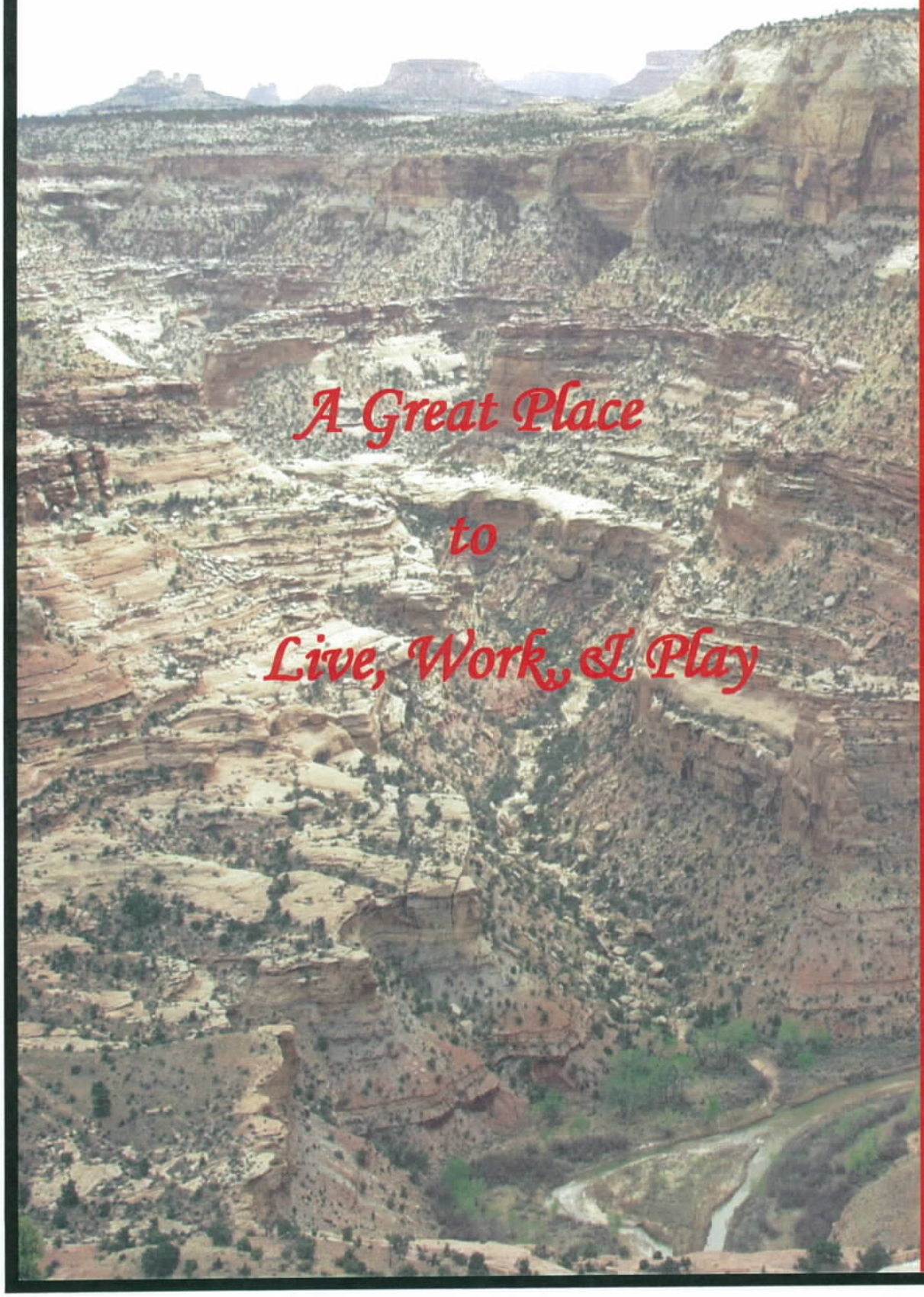
EMERY COUNTY

General Plan



Planning Commission

Adopted Autumn 1996

Revised

1999

2012

Emery County General Plan

County Policies, Objectives, and Action Steps

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TABLE OF CONTENTS

1. Introduction 1
2. Historical Background 1
3. Scope 2
4. General Plan and Purposes 2
5. Using and Amending the Emery County Plan 3
6. Community Vision 3
   6.1 Maintaining Emery County's Rural Character 3
   6.2 Public Lands/Federal and State Agencies 3
7. Human and Community Services 4
   7.1 Education 4
   7.2 Emergency Services/Law Enforcement 4
   7.3 Medical Facilities 4
   7.4 Senior Citizens Services 4
   7.5 Affordable Housing 5
   7.6 Low Income Goals, Objectives, and Policies 5
8. Resource and Asset Management 6
   8.1 Transportation 6
   8.2 Archaeological/Cultural Resources and Facilities 6
   8.3 Preservation of Cultural and Historical Heritage Resources 6
   8.4 Water Resources 7
   8.5 Emery County Policy-Public Lands, Federal and State Agencies 7
   8.6 State Trust Lands 7
   8.7 Mineral and Energy Resource Extractions 8
   8.8 Multiple-Use 8
   8.9 Action/Implementation Steps 9
   8.10 Emery County Policies – Private Land Use and Development 9
   8.11 Open Space/Agricultural Land Preservation 9
   8.12 Industrial Zoning 10
   8.13 Residential Living 10
   8.14 Mining, Grazing and Recreation Zoning 10
   8.15 Economic Development 10
   8.16 Recreation and Tourism 10
   8.17 Business Expansion and Retention 11
   8.18 Small Business Assistance 11
   8.19 Value-Added Agricultures 11
   8.20 Telecommunications 11
   8.21 Recreation and Tourism 12
      8.21.1 Tourism Promotion 12
      8.21.2 Tourism Mitigation 12
9. Public Lands 12
   9.1 Agriculture 12
   9.2 Livestock Grazing 13
   9.3 Air Quality 14
   9.4 Fire Management, Protection and Prevention 15
   9.5 Forestry and Forest Products 16
   9.6 Heritage Resources 17
      9.6.1 Native American Culture 18
   9.7 Invasive Species and Integrated Pest Management 18
   9.8 Mining and Mineral Resources 18

9.9 Biological Resources 19
9.10 Recreation 19
9.10.1 Camping 20
9.10.2 Funding 20
9.10.3 Planning 21
9.10.4 Snowmobiles 21
9.10.5 Other Winter Sports 21
9.11 Special Designation Lands 21
9.11.1 Areas of Critical Environmental Concern (ACEC) 22
9.11.2 National Monuments 23
9.11.3 Wild & Scenic Rivers and Proposed Wild and Scenic Rivers 23
9.11.4 Proposed Wild and Scenic Rivers 23
9.11.5 Wilderness and Wilderness Study Areas 23
9.11.6 Adjacent Private Land and Land Management 24
9.11.7 Cultural and natural Resource Management 24
9.11.8 Equestrian 24
9.11.9 Grazing 25
9.11.10 Hunting, Fishing, and Trapping 25
9.11.11 Mineral Rights and Claims 26
9.11.12 Purity Doctrine 26
9.11.13 Recreation 26
9.11.14 Trails & Transportation. 26
9.11.15 User Amenities 27
9.11.16 Wilderness Study Areas 27
9.12 Transportation and Access 27
9.13 Water Resources 29
9.13.1 Emery County Policy 29
9.13.2 Water Quality and Quantity 30
9.13.3 Water Rights/Allocation 32
Appendix A – Emery County Transportation System 39
Appendix B – Emery County's Position on "Purity Doctrine" 40
Appendix C – Alternative 'E' Areas – 2007 Addendum 41
Appendix D – San Rafael River and Muddy Creek Watersheds Study 233

EMERY COUNTY GENERAL PLAN

1. Introduction

Utah State Statute provides for the development of county level plans under Title 17-27-301. Components which may be addressed within these plans include: land use, transportation, environmental issues, public services and facilities, rehabilitation and redevelopment, economic concerns, recommendations for plan implementation, and "any other elements that the County considers appropriate". In its plan, Emery County has focused on issues identified by County residents during several public work sessions. These issues are addressed in the Plan through County "Value/Goal" Statements. Issues identified as "County priorities" are further developed through "County Policy Statements" and "Action and Implementation Steps".

As part of this planning project, The *Emery County Profile,* has been prepared. This document contains information, data, and maps covering County demographics, economics, land use, history, and public facilities and services. If consistently updated, this document will remain a valuable resource for Emery County officials, County residents, and persons interested in the status of Emery County.

2. Historical Background

Emery County is located "where the desert meets the mountains," at the border of the Colorado Plateau and the High Plateaus. On the western side of the County is the Wasatch Plateau, which is the major water source for the County. The San Rafael Swell dominates the County's center with its rugged reefs, "castles" and gorges. East of the San Rafael Swell is the Green River Desert, an arid district which has been historically important to ranching operations located in the lower San Rafael Valley. The eastern border of the County is formed by the Green River.

Jedediah Smith passed through what is now Emery County in 1826, leaving the oldest written description which characterizes Castle Valley as "very barren and rocky". The Old Spanish Trail reached its northern most point in Emery County, offering one of the few routes through the west until gold rush spurred the development of more direct routes to California which were located to the north and south of present Emery County.

In the mid-1870s ranchers and stockmen began bringing their herds into Emery County from the valleys of the Great Basin and a few settled permanently. The settlement era began in full force in 1877 when Brigham Young issued his last call for settlers in the area. By 1880 enough families had settled in Emery County to justify the establishment of a County government. The name for the area proposed by the settlers was Castle County, but the Territorial Legislature chose instead to name the County after Governor George C. Emery. As originally established, Emery County included areas that later became Grand County (1890) and Carbon County (1894).

Settlers established irrigated farming and ranching operations, but the population remained small until the routing of the railroad reached Emery County and profoundly impacted regional development. Coal production expanded rapidly in the late 1800s but Emery County remained primarily a farming and stock raising area with residents working in the

mines in the off-seasons. Shortly after the turn of the century Emery County reached an economic plateau when all the water had been appropriated and the land had reached its carrying capacity. The City of Green River continued to grow, establishing a strong agricultural base in melon production.

The demand for coal during World War II stimulated the development of several mines in the County. After the war, between 1950 and 1970 was a time of economic stagnation and decline. The uranium boom and missile tracking facility built in Green River gave a temporary lift to the County. With the completion of the Emery County Water Project, Emery County finally had a stable industrial water source which was crucial to Utah Power and Light's decision to build two major generating plants in the County. But recent years have found the County in another economic plateau. Prospects are bright however, with well planned recreational development, and the continuation and expansion of present industries combined with the established agricultural base, Emery County will persist and prosper with its rural spirit in an industrial society.

3. Scope

The area encompassed by this plan is the entire area of Emery County, approximately 2.8 million acres. Approximately ninety-two percent of this area is public land administered by federal and state agencies. The Bureau of Land Management's Price River and San Rafael Resource Areas and the United States Department of Agriculture's Manti-LaSal National Forest are located at least partially within Emery County. State-owned public lands within the County are managed by the State Institutional and Trust Lands Administration, the Division of Forestry, Fire and State Lands, Utah Division of Wildlife Resources, and the Utah Division of State Parks. Due to the County's dependence on public land and the accompanying resources, it is extremely important that County input be considered by federal and state agencies and reflected in the resource management plans that are developed for these lands and resources. It is the intent of Emery County that this Plan clearly and concisely state County policies, issues and objectives and that this document will be used by the County and federal and state public land management agencies during public land planning efforts and decision-making processes.

The incorporated cities and towns within Emery County each have the statutory responsibility to draft, prepare and approve General Plans in accordance with State law. Therefore, this document does not supersede the individual plans of the incorporated communities. Instead, it is the intent of Emery County that the General Plan serve as a catalyst with the individual communities to ensure that proper planning activities are followed throughout the county. It is the desire of Emery County to work with the local communities to develop best planning practices countywide.

4. General Plan Purpose and Process

Under Utah state law, a general plan should address certain social, economical, and environmental issues. The law also requires a minimum level of public participation.

These County Policy Statements, County Objectives, and Action/Implementation Strategies are formally presented to the citizens of Emery County through this Plan. As outlined in Utah State statute, these recommendations have been subject to Planning Commission and County Commission review and adopted through the open public process and hearings.

5. Using and Amending the Emery County General Plan

It is intended that the General Plan serve as a framework for Emery County as it considers future private and public land use decisions. The Plan is also designed to provide a policy foundation for the development of infrastructure, community and human services, as well as the pursuit of economic development opportunities.

6. Community Vision

6.1 Maintaining Emery County's Rural Character

Emery County's rural lifestyle is one of its greatest assets. Residents enjoy the "small town" atmosphere, good moral climate, and community spirit. Local residents also feel a deep appreciation for the County's unique landscape, natural setting and amenities, such as clean air, pure water, and uninterrupted views of the desert and mountains. The County's century-long dependence on the land and its accompanying resources has engendered feelings of appreciation and stewardship. These deep-rooted feelings are manifest today as the County participates in County-impacting natural resource and land use management decisions. These County values and characteristics make Emery County what it is today, "a great place to live and work". Residents feel that all future development decisions made within the County should be consistent with these interests.

Specific elements include:

- protecting/preserving the County's open spaces - preserve a landscape with planned development;
- continue to support and actively develop the energy industry that has served as the economic backbone of the county for over a century;
- maintaining the quality of current public services and facilities through proper planning practices;
- ensuring that development decisions are sensitive to the needs of all parties within the county, including agricultural, commercial, residential and governmental;
- maintaining our public land heritage, historical uses, accessibility, and involvement in planning and management decisions; and
- maintaining zoning ordinances and development regulations that are consistent with the County's General Plan development goals and with State laws and administrative rules.

6.2 Public Lands/Federal and State Agencies

Ninety-two percent of Emery County is comprised of public land managed by federal or state agencies. County industries such as agriculture, mining, tourism, gas and oil development and recreation depend on the continued use and availability of these lands and their accompanying resources for economic growth and stability. Emery County acknowledges the existence of federal laws such as the Endangered Species Act, the National Environmental Policy Act, and the Federal Land Policy and Management Act under which federal land managers/agencies must work. However,

these laws also specifically identify opportunities for local governments to participate in public land management decision-making processes. The County feels that federal and state agencies should consider and address the County's concerns, interests, and objectives as stated in the County's General Plan when fulfilling these regulations and enforcing these policies.

In response to these interests and concerns, the County will:

- actively participate in all relevant public land management decisions by serving as a cooperating agency in land use planning processes;
- support multiple-use management of BLM and USFS in their properly adopted planning processes;
- support continued access to natural resources including but not limited to coal, natural gas, uranium and gypsum;
- support continued access and development of lands managed by the State Institutional Trustlands Administration (SITLA) and other state lands;
- support responsible use of public land resources; and
- work to preserve and maintain public land access routes as adopted in the county travel plan.

7. Human and Community Services

7.1 Education

Emery County schools are recognized statewide for their solid academic curriculum and athletic prowess. Continuing to build on this foundation is a top priority of the County. The County is committed to working with the Emery County School District to improve and maintain the quality of educational facilities, instructional materials, trained personnel, and outreach programs necessary to pursue this agenda.

7.2 Emergency Services/Law Enforcement

We are dedicated to maintaining the professional nature of our emergency services/law enforcement personnel and agencies. We support emergency planning to prepare for any potential disaster.

7.3 Medical Facilities

County residents desire and need to maintain a high level of health care. We support upgrading and expanding County medical facilities and services at all possible locations according to demographic demands and economic feasibility.

7.4 Senior Citizen Services

Emery County acknowledges the need to provide adequate senior citizen care facilities and services. County residents are committed to expanding recreational, educational, and medical services and opportunities targeted for this sector of the population.

7.5 Affordable Housing

Section 17-27a-403 of the Utah State Code establishes the availability of moderate-income housing as a statewide concern, and it requires counties to propose a plan for moderate-income housing as a part of their general plans. "Moderate-income housing" is defined as housing that is affordable for households with gross incomes equal to or less than 80 percent of the median gross income of the county, or in other words, 80 percent of the area median income (AMI). Median incomes are established by the U.S. Department of Housing and Urban Development (HUD) for the county, based on household size.

Guidelines also state that no more than 30 percent of a household's income should be spent on housing costs, including utilities. The purpose of the statute is to ensure that people with moderate incomes who desire to live in Emery County can do so. The County should offer a reasonable opportunity for those with moderate incomes to obtain housing in the county and to fully participate in all aspects of neighborhood and community life during all stages of their lives.

7.6 Low Income Goals, Objectives and Policies

GOAL: Provide a mix of housing types across the full spectrum of income ranges throughout the county

OBJECTIVE 1: Support a mix of quality housing opportunities to support economic development efforts.

POLICIES:

1. Promote and maintain a range of housing types and affordability.
2. Promote upgrading of and reinvestment in existing housing stock and neighborhoods.
3. Encourage multifamily residential and higher-density single-family development to occur within cities when feasible.

OBJECTIVE 2: Encourage and monitor the availability of affordable housing.

POLICIES:

1. Collaborate with municipalities and the Southeastern Utah Association of Governments (SEUAOG) to promote affordable housing.
2. Support the development of viable opportunities for affordable housing and home ownership through alternative housing products.
3. Maximize the utilization of state and federal assistance programs designed to assist low income individuals.
4. Work with local financial institutions to promote low income financing opportunities for construction and acquisition of low income housing.

OBJECTIVE 3: Encourage the development of housing units suitable for people with special needs, such as, but not limited to, the elderly and disabled.

POLICIES:

1. Monitor housing development for the Americans with Disabilities Act (ADA) and Fair Housing Law Compliance through the County's development review process.
2. Work with other jurisdictions (local, state, and federal) as well as the private and nonprofit sector to leverage resources to address special needs countywide.
3. Consistently enact and enforce building codes that keep all residential construction in compliance with current codes.

OBJECTIVE 4: Promote quality residential development in well-designed subdivisions.

POLICIES:

1. Establish criteria for manufactured and modular housing to promote placement in a wider array of zoning districts.
2. Enforce codes and ordinances to ensure maintenance of neighborhood integrity as the housing stock ages.
3. Enforce subdivision designs that protect environmentally sensitive areas or unique property characteristics.

8. Resource and Asset Management

8.1 Transportation

The County feels that roads should be upgraded and improved to allow more convenient routes that are passable in all types of weather.
The County recognizes three primary types of roads or transportation networks. These include federal roads and designated routes, state roads and routes and the Emery County road system.

The County has adopted an airport plan. This document will include recommendations for expanding, upgrading and maintaining the existing facilities. It is anticipated that this document will be updated as required. The complete Emery County Transportation System is defined in Appendix A.

8.2 Archeological/Cultural Resources and Facilities

Emery County has an abundance of prehistoric and archeological resources as well as a strong cultural heritage. Emery County's past, including dinosaurs, Native Americans, early settlers, and the mining industry, is proudly displayed and depicted in numerous museums and points of interest. Emery County will work with state and federal agencies to protect these resources.

8.3 Preservation of Cultural and Historical Heritage Resources

Emery County views the preservation of its heritage and culture and its associated heritage and tourism industries, as a critical part of the planning process. The preservation of their heritage and cultural resources, including access to the sites and settings of local history, has great significance for the citizens of Emery County.

8.4 Water Resources

Adequate water quality and availability is the lifeblood of Emery County and is necessary for future residential, industrial, commercial, agricultural, and recreational development. Emery County will protect this valuable resource by promoting watershed protection measures and supporting the efficient management and use of water resources. The County supports the development, adoption, and implementation of water storage, distribution, and conservation plans by irrigation companies, industrial users, and municipalities. The County will protect private water rights from federal and state encroachment and/or coerced acquisition.

8.5 Emery County Policy - Public Lands, Federal and State Agencies

It is the policy of Emery County to actively participate with federal and state land management agencies in the planning, development and establishment of resource management decisions and plans that will allow the management entities to effectively fulfill their responsibilities to manage our natural resources, while recognizing and addressing local needs and objectives, as stated in the County's General Plan. This will be accomplished through on-going planning processes and forums which provide the opportunity for local participation and partnerships of the County with the various public land management entities.

To ensure greater County involvement in public land management, the County will:

- actively participate in all relevant public land management decisions;
- show continued support for multiple-use management of BLM, USFS, and State lands;
- support responsible use and protection of public land resources; and
- work to preserve and maintain public land access routes, such as those recognized in legitimate land planning processes such as resource management plans;
- support these efforts through the Emery County Public Lands Council and the staff position of a Public Lands Director.

It is the intent and purpose of the Emery County Public Lands Council to aggressively preserve the community heritage of Emery County by vigorously participating in and influencing all public land planning and decision-making processes on behalf of, and under authority of the Emery County Commission.

The Public Lands Council will be a forum for open and positive discussion of natural resource/public land issues. County responses to proposed plans and recommendations for future policy will be well thought-out. Where applicable, conflicts between the County and land management agencies will be resolved at the county level.

8.6 State Trust Lands

Emery County will become actively involved in any effort to influence management of state School and Institutional Trust Lands Administration (SITLA) lands within Emery

County. The County will become involved in any future processes for the exchange of these lands and also to achieve a reasonable and balanced management strategy.

8.7 Mineral and Energy Resource Extraction

Emery County supports development of extraction industries. In practice, this is accomplished through a thoughtful and consistent application of the Conditional Use Permit process. Emery County recognizes the development rights associated with mineral lease and acknowledges the importance of these resources to our State and national economies. Emery County also recognizes the potential impacts on the landscape, subsurface, and overall environment associated with these developments, which may impact traditional uses such as roads, watersheds, livestock grazing, wildlife habitat, view sheds, hunting, and recreational activities, and aquifers. Other concerns include noise pollution, dust control from roads and surface disturbances, the handling of saline water and its disposal, and safety concerns from potential dangers like escaping gases and/or fires and explosions.

Emery County requires cooperation from the industry and the various government entities in minimizing, mitigating, and compensating for the potential impacts of oil and gas development, including exploration, extraction, and transport. Emery County also requires that a high priority be given to the reclamation of all disturbances (both surface and sub-surface) prior to the issuance of any permits and/or authorizations in the form of contractual and bondable guarantees.

8.8 Multiple-Use

Emery County feels that public land should be managed under the "multiple-use and sustained yield" concept. Emery County's definition of multiple-use includes, but is not limited to, traditional consumptive and non-consumptive uses such as grazing, all-season recreation, timber harvest, wilderness, mining, oil/gas exploration and development, agriculture, wildlife, hunting, fishing, camping, historic and prehistoric cultural resources, and watershed.

County industries such as agriculture, timber, grazing, tourism, and mining depend on the continued use and availability of public land and its resources. Because decisions to alter the management and use of these resources directly impact County interests, Emery County will be an active partner in the preservation, protection, and prudent management of our natural resources, including local cultural heritage resources. Emery County recognizes the urgency for properly focused planning and coordination among the various entities during resource management decision-making processes and to address increasing demands on public lands. These resources may be lost if appropriate actions and programs are not implemented. To help accomplish this goal, the County has established a series of Memoranda of Understanding between Emery County and the Bureau of Land Management, the U.S. Forest Service, the Utah School and Institutional and Trust Lands Administration, and the Utah Department of Natural Resources.

All public land agency management plans and proposals will be reviewed according to the County's multiple-use definition. The County will respond in a timely and appropriate manner to these management plans or resource-use decisions. Because the management of public land directly affects the lives and livelihoods of

local citizens, the County asserts that public land management agencies have an obligation to identify and address all environmental and economic impacts that might result from decisions to alter or discontinue traditional resource uses. The County will continue working to ensure that these impacts are fully considered by agencies during the decision-making process.

8.9 Action/Implementation Steps-

The County will actively participate in federal and state land management decisions by fully discussing public land issues/problems and possible solutions with land managers and other stakeholders. To the extent allowed by those agencies, the County will participate as a stake holder and will represent the interests as listed in the General Plan. The County will adhere to the memorandums of understanding that have been established with land management agencies and will follow up with those agencies to ensure they follow the management plans that have been approved.

Emery County recognizes the need to protect and preserve the public lands for present and future generations. It is the stated position and belief of Emery County that there are many land management tools available that provide protection to public land and its resources in Emery County. Emery County desires to explore all available options and tools for public land management and apply those options that best fit the needs of local public lands on a case-by-case, area-by-area basis. By utilizing a broad array of options, and by allowing local involvement in the decision-making processes, Emery County is confident that the natural values of the lands can be protected without endangering the economic and cultural future of our communities.

8.10 Emery County Policies - Private Land Use and Development

Emery County supports developing, adopting and implementing the land use and development regulations necessary to maintain and protect the County's existing rural character and scenic environment. The planning process shall include, but is not limited to:

- watershed protection (addressed in Water Resource section)
- open-space/agricultural land preservation
- adequate industrial and commercial zones
- appropriate residential planning processes
- administration of Conditional Use Permit process for all activities
- consistent application and enforcement of building codes

8.11 Open Space/Agricultural Land Preservation

The County recognizes the value of preserving agricultural land as well as the natural open space that defines the county as a truly unique landscape. As a result, the county will continue to adopt policies and zoning ordinances that reinforce this ethic. This will be balanced with a reasonable growth focused approach that recognizes the value of expanded residential and commercial development in the county.

8.12 Industrial Zoning

The County feels that the existing zoning ordinance should include an appropriate number of industrial zones. The ordinance should clearly identify the purpose of each zone, the permitted and conditional uses allowed, and the appropriate level of county staff or planning commission review necessary for approval.

8.13 Residential Zoning

The County recognizes the need for residential development in the unincorporated portions of the county and that these should compliment the uses within the cities. Residential uses are conditional uses and do not supersede permitted or other conditional uses within the individual zones.

As an example, in the Agricultural zone, the primary, permitted activities are agriculture, grazing and related activities. Residential activities will be permitted so long as the activity does not create conflicts with existing agriculture activities.

8.14 Mining, Grazing and Recreational Zoning

The majority of the private land within Emery County is surrounded by State or Federally managed land. In order to preserve the character of the sensitive private in-holdings, the Mining, Grazing, and Recreation zoning designation will be used to provide a mechanism to facilitate vastly different uses. Within this zone, the primary activity will be mining, mineral extraction, forestry, grazing, and recreation. Other activities may be allowed under established and well defined conditional use process as deemed appropriate. Uses such as permanent residential housing are not primary activities in this zone and will be discouraged. Recreational homes, however, are in keeping with the intent of the plan.

8.15 Economic Development

In addition to maintaining a strong economic base related to mineral extraction, energy, coal mining, gas and oil development and power production, Emery County strives to diversify its economy and build a broad employment and industry profile. The County currently supports expanding businesses through a number of economic development plans and small business assistance programs. The County will continue these efforts. The County desires to expand and support retail businesses within the County. The County supports economic development in all areas of the county and will actively work to promote opportunities.

The County supports all existing and potential natural resources that are abundant within the county. This will be accomplished in accordance with proper planning processes and adequate public input.

The County seeks and supports jobs that are family sustaining and that have positive environmental, social, and public service impacts.

8.16 Recreation and Tourism

Because of its unique and varied landscape, Emery County provides a number of diverse recreational opportunities.

The County will implement promotional and infrastructure practices that mitigate recreational impacts and will consider polices to address impacts as they occur. When evaluating potential recreational developments and investments the County will consider:

- the County's ability to provide essential services (law enforcement, emergency services, water and waste management, search and rescue);
- impacts on traditional recreational uses (example: OHV trail development at the expense of traditional hiking or riding trails.);
- providing opportunities for youth and family-related activities;
- targeting sectors of the tourist population for additional economic benefits; and
- making all appropriate facilities consistent with ADA requirements.

8.17 Business Expansion and Retention

The County supports business through a number of economic development plans and small business assistance programs and will continue these efforts. The County recognizes the value of a regional approach to economic development and will continue to support regional economic development programs that extend beyond Emery County borders when it can be demonstrated that the county can benefit from these initiatives.

8.18 Small Business Assistance

County residents feel that additional economic growth will come from within the County and from the small business sector. County entrepreneurs have several resources available for assistance including the Emery County Economic Development Department and neighboring colleges and universities.

8.19 Value-added Agriculture

County residents feel that local agricultural operations produce high quality agricultural products. The County feels that this agricultural strength should be further developed. The County expresses an interest in pursuing "value added agriculture" options as a subsection of business expansion and retention.

8.20 Telecommunications

Adequate telecommunications technology is vital to the future of Emery County. Technology will increasingly affect numerous aspects of life in rural Utah, including business, employment opportunities, education, health care, banking and finance, government services, and entertainment.

The policy of Emery County is to give first priority to supporting local providers of telecommunications technology and services whenever feasible in order to strengthen local technological capacity as well as to strengthen the local economy.

8.21 Position Statement of the Emery County Travel Bureau

"Tourism development in Emery County must be carefully planned and managed as defined by local government and private industry and supported by state, federal and regional partners. Regional, state and federal coordination is vital"

Tourism efforts in Emery County will focus on each of the following areas:

* Tourism Assessment
* Promotion
* Impact Mitigation
* Industry Development

8.21.1 Tourism Promotion

Emery County seeks to promote developed tourism sites and events throughout the County as well as promotion of undeveloped sites such as the Black Dragon, Green River and the Wedge Overlook. The Emery County Travel Bureau will be responsible for promoting these areas and will work to coordinate its efforts with federal, state and regional agencies involved in promotion.

8.21.2 Tourism Mitigation

Emery County seeks to mitigate the negative impacts of tourism. Mitigation implies management of impacts such as:

* Cost of providing services
* Denigration of natural, cultural and archaeological resources
* Negative impacts on local quality of life.

Emery County realizes that tourism mitigation also implies visitor management and proposes the following actions to manage the activities of people using public lands:

* Direct access (guide people to areas of least impact)
* Designate camping areas

The scenic and recreation attractions contribute to the quality of life in Emery County. Several significant attractions have the potential to attract many visitors, but as visitation increases, there will be unavoidable impacts and conflicts. The County will work to develop plans and polices to minimize these conflicts, while promoting tourism.

9. Public Lands

9.1 Agriculture

Agriculture is important for the environmental, cultural, social and economic benefits it provides. Agriculture successfully balances those benefits and continues to be a valuable source of jobs and income in Emery County.

Agriculture in Emery County provides jobs, local tax base, a variety of environmental benefits, scenic beauty, food and fiber for human consumption and fuels management through controlling the amount and distribution of grasses and removing small diameter live fuels that encourage the spread of fire and increase flame height.

Agriculture practices also provide public benefit, i.e. creating and maintaining habitat for wildlife, visually appealing working landscapes, and water for urban, industrial and agricultural users.

It is the policy of Emery County to actively promote and protect working landscapes-farms, ranches, and actively managed public lands.

The Emery County Public Lands Council finds that:

1. Working landscapes and agriculture in Emery County should be preserved and enhanced on both private and public lands;
2. The customs, culture and heritage associated with agricultural production in Emery County are necessary to the livelihood and well-being of its citizens;
3. The County desires to protect historic uses of agricultural land and promote the continuation and expansion of agricultural pursuits. To achieve these, the County supports active multiple-use management of federally and state-managed lands, continuation of private property rights, reliance on self determination, and upholding open market conditions;
4. Opportunities for agriculture on federal and state lands should be continued at levels consistent with historic customs and culture. Further, those levels should be sufficient to ensure protection against catastrophic fire and to ensure sound resource management practices; and
5. Federal and state governments should not obstruct agricultural opportunities on lands they manage or regulate.

9.2 Livestock Grazing

Livestock grazing on public land should be managed and regulated by state and federal agencies so as to maintain and enhance desired plant communities for the benefit of watershed, wildlife, water quality, recreation, and livestock grazing as required by the applicable land use plans. Such management should be developed specifically and individually for each public land grazing allotment in order to achieve the desired result throughout the County.

A viable rangeland livestock industry must be protected as an essential component of our county's economy, history, culture, customs, traditions, and is vital to the economy of affected communities. Good grazing practices are a necessary part of maintaining rangeland health, and assist in reducing potential fire danger by keeping fuel loading to a minimum.

In order to comply with multiple use concepts no individual resource value should be given priority in vegetation management decisions. The Council requests that federal and state agencies coordinate with the Council (or it's officially designated subcommittees) on matters affecting livestock grazing and farming on all federal and state managed and regulated lands.

The Council also establishes the following policies:

1. Transportation of livestock and equipment necessary for their effective management should be allowed over federal, state and other roads and highways within the County and on public lands.
2. Open range conditions should exist on active cattle allotments behind allotment boundaries in alignment with the historic nature of grazing management on open range. Livestock may be on County roads crossing both public and private property within active livestock management practices.
3. Emery County recognizes historic cattle movement on public lands and the nuisance it may pose to private property owners and the general public within public lands and allotment boundaries, and recognizes the need for private property owners and ranchers to work together to minimize that nuisance. Private property owners adjacent to active cattle allotments and established, historic trail corridors should hold permittees harmless for common grazing behavior and the agencies should not require permittees to restrict cattle movement while on said range i.e. fencing, corraling, etc.
4. Emery County desires to protect the traditional uses, appearance, existence, maintenance, and enhancement of structures and other improvements within active permit allotments due to their critical importance to permittees. Such structures and improvements include but are not limited to cabins, corral facilities, fences, cattle guard, and developed watering facilities (including in Wilderness and other special designation lands). All structures and improvements are essential to the management of grazing land allotments and should be permitted to be maintained in good working order for their ongoing use. Agencies should recognize common maintenance practices may include motorized access to structures and improvements as well as the use of motorized equipment to perform maintenance activities (including in Wilderness and other special designation lands).
5. The County strongly opposes unilaterally imposed or unrealistic increases in Grazing fees since they could seriously affect the ranching community and could hurt businesses that are linked to the ranching industry.
6. Agencies should coordinate with the Lands Council (and any officially identified subcommittee) on matters affecting livestock grazing and farming on all federal and state managed lands and regulated resources.
7. Agencies should consider establishment of grazing advisory boards.

Guidance Documents for Livestock Grazing on Public Lands within Emery County:

- Taylor Grazing Act
- Price Field Office Resource Management Plan, 2008

9.3 Air Quality

Emery County enjoys extremely good air quality and seeks to achieve and maintain all state and federal air quality standards while recognizing economic and environmental impacts and working with the federal and state agencies through the following policies:

1. The County recognizes that one of the threats to the County's air quality is catastrophic wildfire and encourages Agencies to enact programs that allow

prescribed burning, forest improvement techniques such as forest thinning, pruning, and removal of brush and insect-killed trees, and other methods for reducing fire hazard that ultimately protects air quality.

2. Agencies should provide for the continuation of agricultural and prescribed burning as a resource management tool in accordance with air quality regulations.
3. Agencies should establish forest management programs that encourage fuel reduction of forests and wildlands by means other than burning, utilizing all means of fuel reduction including but not limited to: logging, forest thinning, and chipping, brush mastication, livestock grazing, herbicide use, and public firewood utilization.
4. Agencies should provide for an increased air quality monitoring network that encompasses public and private lands to collect accurate real time measurements of pollutants to support prescribed burning activities and assess the public's exposure to ambient air pollutants such as particulate matter and ozone.

9.4 Fire Management, Protection and Prevention

Fire protection services within the County are provided by several agencies, representing federal, state, and local jurisdictions, with the assistance of the County residents serving as volunteer firefighters. Some areas of the County are comprised of forested ecosystems, including Pinion/Juniper stands in the lower elevations up through the pines, fir and aspen at the higher elevations. Drought, dense forest fuels, beetle infestation and inadequate harvesting of timber in these ecosystems have contributed to the creation of the extreme fire hazard conditions. Ladder fuels should be reduced and sound timber management practices followed to avoid catastrophic fires. The County acknowledges the need for action to reduce fire hazard in, and adjacent to, the County and has established the following policies to facilitate such action:

1. The condition of some public lands in the County is dangerously overgrown with fire fuels thereby creating a public nuisance. Agencies must manage these lands in a manner that reduces the fire threat and guards against fire's serious air quality impacts.
2. Agencies should work diligently to reduce the threat of wildfire on public lands to protect the County's water resources.
3. Reducing forest fuels is a cost-effective fire prevention and protection practice that can lessen the necessity to battle catastrophic wildfires. The County supports active forest thinning and increased timber production that preserves wildlife habitat, minimizes erosion, and does not irreparably harm watersheds and streams.
4. Federal and State Agencies are encouraged to participate in, to develop, implement, and update fire protection plans and in public outreach efforts by providing information and education about fire risk.
5. Agencies should provide information to the County on their policies and practices related to fire use and fuels management, including but not limited to fire use designation criteria, favorable and unfavorable prescribed burning parameters, fuel model inputs, fire personnel staffing levels, and public road closures and re-openings.

6. Agencies should coordinate planning, scheduling, implementation, and dissemination of public information concerning prescribed burns with Emery County.
7. Agencies should avoid scheduling prescribed burns on or around major holiday weekends and whenever the region anticipates significant tourist inflows.

9.5 Forestry and Forest Products

It is the policy of Emery County to promote the continuation of a sustainable forest products industry by encouraging the active management of forests on public lands, as provided in the following policies:

1. Emery County encourages federal and state agencies to adopt and maintain scientifically sound forest management policies based on high quality, recently acquired data and to pursue multiple use of public forest resources to provide sustainable and continuous yield of timber, forage, firewood, wildlife, fisheries, recreation and water.
2. Agencies should adopt policies that promote and facilitate local manufacturing of forest products from public lands.
3. Agencies should support a broad range of reforestation and timber stand improvement tools and timber harvesting practices consistent with prudent resource protection practices.
4. Agencies should adopt policies that promote and facilitate early detection and control of insect infestations through the use of biological and chemical agents, including salvage of dead and dying forest stands.
5. Agencies should adopt policies that provide for the prevention of forest fires through thinning stand densities associated with the onset of competition as well as construction and maintenance of strategically located fuel breaks and other vegetation management.
6. Such actions are critically important and necessary to change existing forest surface, ladder, and crown fuel profiles in order to reduce potential wildfire intensity and behavior, and mitigate the consequences of large, and potentially damaging, wildfires on public lands and on private lands contained within and adjacent to Agency managed lands. The achievement of a more sustainable forest condition via implementation of such prevention actions will benefit forest related resources, including improved watershed conditions, improved wildlife habitat and enhanced forest health.
7. The County supports prescribed burns as a fuels reduction management tool for resource enhancement when used in conjunction with forest thinning and post treatment salvage or in areas that physically cannot be mechanically thinned when such burns comply with air quality regulations.
8. Agencies should encourage and provide for the prompt salvage and replanting of forested areas and forest losses due to fire, insect infestation, or other events.
9. The County supports and encourages partnerships between Agencies and the timber industry to implement treatments to maximize environmental benefits of forest ecosystem health, diversity and sustainability, and to maximize social and

economic benefits of industry and community infrastructure, increased employment, and improved tax base.

10. The County encourages Agencies to actively manage the watersheds in forested areas by reducing the threat of wildfire thereby increasing water supply security and quality, providing deeper, more persistent snow packs, longer runoff durations, and increased groundwater storage.

9.6 Heritage Resources

Much of Emery County's past is intertwined with public lands and resources. One reason pioneers and settlers came here is because of the abundance of natural resources. Farmers and ranchers, while grazing their animals on the land throughout the county, discovered coal, uranium, minerals, Native American rock art, and other unique qualities that are the natural treasures of Emery County. As a result, archeological, cultural, historic and prehistoric resources that are found on private and public lands are an integral part of what make up Emery County. The County is proud and protective of these resources which have factored into this community's daily life, from providing a living to recreation and family traditions.

Emery County shares the mission of the Utah State Historical Society, which is to "preserve and share the past for the present and future". The County's Heritage Resource management element in this plan invites citizens to help protect and enhance those aspects that first attracted them or keep them here, including the historic character and unique charm of the County. Taking part in preserving the past builds pride and creates good feelings about the future. These pieces of the past invite visitors to understand our history, appreciate its characters, and learn its lessons. In the end, everyone benefits. For these reasons, efforts directed at identifying, recording and preserving the County's Heritage Resources on public lands – a major part of our tangible links to the past – should be undertaken to preserve our future.
The County is a Certified Local Government, qualified under the National Park Service (NPS) and the State Historic Preservation Office (SHPO). As a Certified Local Government, the County is able to nominate buildings and other structures to the National Historic Register. Federal and state agencies should coordinate with the County to attain consistency with the Heritage Resources element of this plan and other relevant federal and state statutes.

In addition, Emery County finds that:

1. Structures constructed within active and inactive grazing permit allotments should be maintained due to their critical importance to permittees and their historic significance. Such structures and improvements include but are not limited to cabins, corral facilities, fences, and developed watering facilities (including in Wilderness and other special designation lands). Such structures and improvements are essential to the management of grazing land allotments and should be permitted to be maintained and enhanced where desired by permittees in good working order for their ongoing use.
2. It is the policy of Emery County that archeological surveys and cultural resource studies required by the agencies should be:
    - coordinated with the County,

- conducted expeditiously and paid for by the agency requesting or requiring the study, and
- completed in a timely manner.

9.6.1 Native American Culture

The cultural resources associated with Native Americans in Emery County are necessary to the customs, traditions, historic and cultural livelihood and well-being of Native Americans. Therefore it is the policy of Emery County to support and protect their inherent rights in addition to protecting private property rights and multiple uses on federal and state lands. Consistent with federal and state legislation, Emery County finds that Agencies should establish and implement consultation and coordination requirements with all federally recognized tribes with cultural ties to Emery County. Further, Agencies should provide opportunity for joint coordination with the County and Tribes where appropriate.

9.7 Invasive Species and Pest Management

Emery County advocates the control of predatory animals, rodents, noxious weeds, and disease bearing vectors on all lands within the County. A noxious weed is an unwanted plant specified by federal, state, or local laws as being undesirable, troublesome, and difficult to control. It grows and spreads in places where it interferes with the growth and production of native plants or desired crops.

The County acknowledges that noxious weed infestation and growth constitutes a major threat to the public health, natural resource values, and the economic viability of the public lands and should be a high priority of federal and state agency managers, as stated below:

1. The County encourages the Agencies to protect public lands bordering private lands from predatory animals, rodents, noxious weeds and vectors.
2. Agencies should prepare and implement plans for controlling predatory animals, rodents, Insects, and noxious weeds in accordance with the practices advocated by the Utah Department of Food and Agriculture and Department of Wildlife Resources.
3. Agencies should coordinate their pest control regulations and actions with the County.

9.8 Mining and Mineral Resources

Emery County recognizes that the development of its abundant mineral resources is desirable and contributes to the economic well being of the County, State and the nation. Federal and State public land laws as well as land management plans provide for comprehensive and continuous oversight of the administration of a mining system which allows for exploration and production of mineral resources on public lands throughout the country. Accordingly, it is the policy of Emery County to encourage responsible stewardship of the environment in conjunction with mineral exploration and development. The County supports mineral exploration and development on public lands that is:

- conducted subject to permits issued by jurisdictional agencies;
- consistent with County ordinances;
- consistent with local history, customs, traditions and culture;
- free from legally and scientifically invalid and unreasonable barriers;
- is consistent with the 1872 mining law;
- considers resource potential data that is available from industry, Utah Geologic Survey, Department of the Interior and Department of Agriculture; and
- consistent with sound economic and environmental practices.

Emery County requests that all state and federal agencies coordinate agency reclamation plans with the County. Any changes to the current system should reflect consultation with and consideration of the effects on private industry as well.

9.9 Biological Resources

Management of biological resources, including plants, fish, wildlife, and species designated as special status, threatened, endangered, sensitive, candidate or indicator under the federal or state Endangered Species Act, on public lands should be based upon sound scientific evidence and local input. Local input should be provided in developing biological resource management plans in accordance with the following policies:

1. In formulating biological resources management plans, federal and state agencies should identify the potential negative impacts of those plans on the local economy, the environment, private property interests, and customary usage rights of the public land affected by the proposed plan.
2. Agencies should coordinate with the County before eliminating, introducing or reintroducing any species onto public lands and address potential impacts of such an action on private lands, customary use and private property interests in the public land, and the local economy.
3. The County encourages the Agencies to develop biological resources management plans that provide for the enhancement of native fish, game and non-game species, promote fishing and hunting on public lands, and provide a private property compensation program for certain damages created by wildlife.
4. The State of Utah Division of Wildlife Management is the agency responsible for the management of wildlife within Emery County.

9.10 Recreation

Recreational use of land and water resources in Emery County, in times past, typically involved Emery County residents, residents of neighboring counties and a few visitors from locations outside the immediate area. That has changed dramatically in the last couple of decades. Located just a few hours from the Wasatch Front, and the Western Slope of Colorado, the County is a vacation destination for these residents, as well as others from across the nation. Public lands within the County provide residents and visitors alike with opportunities for a wide variety of outdoor experiences. Influxes of tourists and recreational visitors come to enjoy off-road vehicles (OHVs) including

snowmobiles and to ski, snowboard, hike, ride horses and bikes, rock climb, ice climb, rock-hounding, bouldering, fish, hunt, camp, watch birds and wildlife, raft, canoe and kayak rivers, water ski and wake board, and take part in other outdoor sports.

Some recreation areas should be readily accessible with good roads and should be adequately signed to inform the public of regulations, potential conflicting uses, and problems. Agencies should proactively mediate conflict between multiple uses, including non-recreational users. Emery County seeks to protect the existing uses on public land and advocates management which allows for and protects that use. Agencies should enhance recreation opportunities and not place unreasonable and undue hardship and burdens on businesses in the development of NEPA.

Recreational use creates increased demands on law enforcement, waste management, search and rescue, emergency medical services, road maintenance and other natural resources. The Emery County Sheriff's Office and related services are heavily impacted by recreation user groups yet there is almost no economic support of these services generated by recreational use. Agency identification of socioeconomic impacts for proposed recreation-related actions (including management or elimination of recreational facilities such as OHV trails) should consider impacts to the County and provide for economic or other mitigation of such impacts. While Emery County supports and encourages recreational uses, agencies should not encourage or promote activities that are incompatible with existing permitted agricultural uses.

9.10.1 Camping

Dispersed camping is historically, traditionally, and culturally important to Emery County residents and visitors and as such, should remain available for use and accessible via motor vehicle. Roads and trails for access to such areas should remain open and/or if undesignated, should be left open and evaluated for inclusion into the system at the agency's earliest opportunity. In conjunction with dispersed camping, there should be ample opportunity to park off the road. Users should not have to leave their vehicle unprotected on the road and walk into historical campsites. The County supports locating camping areas a reasonable distance from streams to protect water quality. Agency decommissioning of recreational facilities such as campgrounds or elements of campgrounds, dispersed camping sites, restrooms, and other facilities traditionally used for camping and day use should not be accomplished without reasonable notice and coordination with the County. Agencies decommissioning or temporarily closing facilities for urgent or emergency reasons, should apprise the County of those actions at their earliest opportunity. Formal decommissioning should undergo NEPA review and should include detailed and comprehensive socioeconomic analysis and identification and selection of alternatives that achieve the agencies' desired outcomes and result in the fewest negative impacts on the human environment.

9.10.2 Funding

Federal and state budget cuts have placed a heavy burden on land management agencies to maintain current levels of management activities. For this reason, the possible enactment of new or increased user fees is of concern. The County discourages augmenting agencies shrinking budgets by establishing new and increased user fees.

Emery County also encourages agencies to:

1. Allocate sufficient amounts of their budgets to recreation to accommodate increasing demands on recreation facilities and related infrastructure. All indications are that impacts to public lands will increase dramatically in the foreseeable future.
2. Recreation funding should not be reallocated to other activities. Further, forest management and fire protection and prevention funding should not be reallocated to recreation activities.

9.10.3 Planning

When planning for future recreation needs (Forest Plan Revision, SRMA activity level planning for example), the agencies should coordinate with the County through the Public Lands Department to ensure local values and economic interests are preserved. Emery County has Memoranda of Understanding with federal and state agencies which will govern the interaction of County and agencies. Emery County desires Cooperating Agency status in all formal planning processes.

9.10.4 Snowmobiles

Snowmobile use should be allowed on all Forest Service or BLM lands except where specifically restricted or prohibited by statute or land use designation.

9.10.5 Other Winter Sports

Skiing, snowboarding, para skiing, etc. represent established recreation use during the winter months. Areas utilized for these activities provide a unique access portal to public lands during winter months that would otherwise be inaccessible to the public.

9.11 Special Designation Lands

Emery County believes it is possible to protect public lands without impacting our economy. The County also believes that we can develop and expand our local economy without endangering the wilderness values present in some areas of the public lands.

Emery County supports the wise use, conservation and protection of the nation's public lands and the resources associated with these lands, including prudent and appropriate management prescriptions established to achieve wise use. These prescriptions may include designation of wilderness.

Emery County supports multiple uses relative to public and private recreational and cultural opportunities on special designation lands that are compatible with local customs, historic practices, and traditions. Land use in special designation lands should be managed within the constraints of private property rights. Given the significant number of acres within Emery County under public ownership and special designation, Emery County opposes designation of buffer zones between special designation lands, multiple use lands, and private property. Emery County finds that:

1. Proposed designation and conservation actions relative to special designation lands should be coordinated with the County, negative socioeconomic impacts to the County and/or its residents should be fully mitigated, and should be found to be consistent with the County General Plan prior to designation by agencies, Congress or the current administration.
2. The County reserves its right and ability to coordinate in planning and management processes with agencies on the basis of the potential and actual consequences to the tax base and residents' continued interest in historic, traditional, cultural, economic and natural resources.
3. Once under consideration, the lands within the county should undergo timely and expeditious review by the agencies and Congress. Where such lands and resources have been studied for designation but have not been acted upon in Congress within ten years of nomination for special designation, these lands and all buffers will be returned to the land use status they held prior to initiation of the study.
4. The County opposes actual and de facto special use designations via administrative action. It further opposes any special use designations without the specific endorsement of the County. Before designation of any special area, public hearings should be held within Emery County. The appropriate cabinet secretary should fully comply with requirements of NEPA prior to making recommendations to the President and/or Congress for any such designation.
5. Federal agencies should coordinate with the County as early as possible when considering administrative special use designations such as National Parks, Monuments or other designations that affect the use and status of public lands in the County.
6. The County will participate in the planning and decision-making process surrounding the creation of proposed special designation lands (including federal legislation) for the purpose of advocating for County and local economic interests and the incorporation of economic development activities within the management plan of the special designated area, the continuation of grazing, oil and gas activities, mining and mineral rights, access issues and other concerns it deems appropriate.

9.11.1 Areas of Critical Environmental Concern (ACEC)

An ACEC is an area with special resource values that must be designated as an ACEC to receive special management. No such designations should be recommended by agencies where other designations or prescribed management actions provide for adequate management. Emery County finds that ACEC's may not promote the interests of local economies, public safety, private property ownership, and protection of local customs and culture. In addition, they may not readily allow active adaptive management in response to arising environmental issues affecting wildlife, landscapes, or human communities. As a result, agencies advancing any proposal for an ACEC in the County should actively coordinate and seek approval of the County prior to any formal consideration for ACEC status.

9.11.2 National Monuments

Emery County finds that National Monuments may not promote the interests of local economies, public safety, private property ownership, and protection of local customs and culture. In addition, they do not readily allow active adaptive management in response to arising environmental issues affecting wildlife, landscapes, or human communities. As a result, agencies advancing any proposal for a National Monument in the County should actively coordinate and seek approval of the County prior to any formal consideration for National Monument status. No such designation should be recommended by agencies where other designations or prescribed management actions provide for adequate management.

9.11.3 Wild and Scenic Rivers and Proposed Wild and Scenic Rivers

The National Wild and Scenic River Act provides the guidance for identification and designation of individual river segments for study and for recommendation for inclusion in the system in order to provide balance with development and to provide unique representation within the national system. Inaction by Congress on recommendations for designation should be interpreted as a negative response if no action is taken within ten years of the recommendation. Either in that event or in the event Congress acts within ten years to deny designation into the Wild and Scenic River system, agencies should seek release from special designation of the river corridor to allow full multiple use management.

9.11.4 Proposed Wild and Scenic Rivers

In 2008, the Department of the Interior (DOI), Utah Bureau of Land Management (BLM), and Price Field Office adopted a Resource Management Plan (RMP) which provides guidance for management for all natural resources on BLM administrated lands within Emery County. Development of the plan included an inventory of 38 river segments, many of them within Emery County, eligible for inclusion into the National Wild and Scenic River System. Of the eligible segments, 4 segments within Emery County were found suitable for inclusion within the system. All four segments are part of the Green River. Emery County finds that candidate river segments on BLM administrated land have been inventoried as mandated by the Wild and Scenic Rivers Act and that those segments not found suitable will be managed according to the RMP.

Manti-LaSal National Forest began an inventory of rivers within Emery County in 2002. Fifteen river segments were determined to be eligible for Wild and Scenic River designation, but it is anticipated that no river segments will be determined to be suitable for designation and therefore will not be recommended for designation. Emery County finds that candidate river segments on United States Forest Service administrated land have been inventoried as mandated by the Wild and Scenic Rivers Act and that those segments not found suitable will be managed according to the current land use plan.

9.11.5 Wilderness and Wilderness Study Areas

Emery County recognizes the wisdom of Congress to "to secure for the American People the benefits of an enduring resource of Wilderness" (Sec 2a,

P.L. 88-577) which will be "devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use" (Sec 4b, P.L. 88-577). This intent was affirmed in a 1998 court case of Wilderness Watch, et al., v F. Dale Robertson, et al., Cave... No. 92-740, United States District Court for the District of Columbia, 11988 U.S.W. Dist. LEXIS 14457, August 31, 1998, which concludes that the statute clearly directs the Forest Service to administer the Wilderness with an eye not only toward strict conservation, but also to ensure the use and enjoyment of the American people. The County affirms the purpose of the Wilderness Act as defined above; however the County is gravely concerned about the potential degradation and loss of local heritage, customs, traditions, and culture negatively impacted as a result of revisionist interpretations of the Act.

9.11.6 Adjacent Private Lands and Land Management

The County affirms the ability of the County property owners to use and enjoy private lands located adjacent to Wilderness, Wilderness Study Areas, buffer zones, and all other special designation public lands. Condemnation of private property in conjunction with designations of public lands should not be initiated, nor the imposition of involuntary conservation measures and/or easements for any purpose. Public lands should be managed with regard to their unique qualities, designations, and uses, not as interlinking parts of larger wholes or regions.

9.11.7 Cultural and Natural Resource Management

Archeological and historical sites and structures that existed or were in use at the time of Wilderness designation should be permitted to remain in Wilderness and adjacent buffer zones and may be excavated, stabilized, maintained, or improved for interpretation and continued use. Sites or structures that provided support for historic, traditional, cultural, and customary uses are included, as are those which qualify for inclusion on the National Register of Historic Places. Properties which qualify for inclusion on the National Register, whether under current permit or not, should not be removed or demolished and may be maintained by public agencies, private organizations, and individual efforts.

9.11.8 Equestrian

The County supports equestrian and stock use in Wilderness, WSA's and other special designation areas. Any trend of restrictions or increasing restrictions directed towards the use of pack and saddle stock for recreational purposes is unacceptable. Further, utilization of complaints by non-stock users to restrict the use of pack and saddle stock in Wilderness should not justify management restrictions. Restriction of pack and saddle stock is not viewed as protecting the Wilderness character by the County. The County supports Congressional intent of Wilderness designation for a "broad spectrum of Americans" and desires to avoid increasing restrictions directed specifically at recreational opportunities intended in the Wilderness Act, often the result of the complaints of a minority of users who seek to restrict the use of horses and mules in Wilderness and who justify the actions as necessary to protect Wilderness character.

Recreational pack and saddle stock use that is established at the time of Wilderness designation is recognized as an appropriate and historical use of Wilderness equal in importance to other uses including backpacking and hiking. No curtailments of recreational equine use or grazing incidental to that use should be restricted or removed simply because an area has been designated as Wilderness. Values, norms, and preferences of other Wilderness users should not be used as reason to restrict, phase out, or terminate historical or permitted recreation uses.

Restrictions and prohibitions imposed on recreational equine use and incidental grazing should be the exception rather than the rule and should be decided by site specific analysis based on biological and physical criteria rather than subjective social preferences of other Wilderness users.
Public lands should be managed with regard to their individual, unique qualities, designations, and uses, not as interlinking parts of larger wholes or regions.

9.11.9 Grazing

Stock grazing under permit should not be restricted to favor Wilderness visitor management. Further, existing and new permits for livestock grazing should be issued on allotments where grazing was established at the time the Wilderness was designated. Any regulation and/or removal of grazing allotments should be based on the following process:

1. Scientifically valid, peer reviewed studies that demonstrate an irrefutable and direct correlation between the challenged use and the impact, that validate the need for the proposed action, completion of comprehensive NEPA analyses quantifying economic and social costs of the proposed action, and that establish an adaptive management-based monitoring and recovery strategy leading to reactivation of the allotment for grazing use.
2. Livestock numbers or animal unit months (AUMs) should only be limited where such action is validated by scientific, peer reviewed studies that demonstrate a direct correlation between the livestock numbers, AUMs, and an irrefutable adverse impact that validate the need for the proposed action, that conduct a comprehensive NEPA analysis quantifying economic and social costs of the proposed action that establish an adaptive, management-based monitoring and recovery strategy leading to resumption of the allotment for grazing use.

9.11.10 Hunting, Fishing and Trapping

Hunting, fishing and trapping are qualifying uses of Wilderness as allowed by Congress. To regulate and/or remove these uses from Wilderness, scientifically valid, peer reviewed studies should demonstrate an irrefutable and direct correlation between the uses and the impact, validate the need for the proposed action, conduct a comprehensive NEPA analysis that includes economic and social costs of the proposed regulation or removal, and establish an adaptive management-based monitoring and recovery strategy leading to resumption of those uses as established by the criteria above.

Fish-stocking of streams and lakes should be continued and encouraged unless scientifically valid, peer reviewed studies show a direct correlation between fish stocking, predation on Threatened and Endangered species, and increasing user visits that create a negative impact on the Wilderness experience as defined by Congress (above).

9.11.11 Mineral Rights and Claims

Access to mining claims owned by individuals, groups, and businesses should not be restricted. Roads which exist at the time of designation that serve mining claims should not be closed, nor should the agencies unreasonably withhold use permits for access to such roads.

9.11.12 Purity Doctrine

The County opposes the imposition of the Purity Doctrine in County Wilderness areas. (See Appendix B)

9.11.13 Recreation

Recreational and historical uses should be recognized as an appropriate purpose of Wilderness equal in importance to preservation of natural conditions. These uses and activities should not be restricted or *entirely* excluded from Wilderness via utilization of any of the following direct and/or indirect actions by agencies or Wilderness purists:

- removal and obliteration of campsite improvement;
- removal of motorized or mechanized trails designated prior to wilderness designation;
- rerouting of primary transportation away from destination areas;
- regulating use of saddle horses and/or pack stock; and
- removal of other historic or cultural recreation activity which was enjoyed prior to wilderness designation.

9.11.14 Trails & Transportation

Emery County has observed reluctance by the Price Field Office to maintain trails and trail signage within Wilderness Study Areas (WSA's). House Report 95-540 directed the agencies to "maximize efforts to construct, maintain, and improve trails and trail systems in Wilderness areas, so as to facilitate access and recreational use, as well as to increase opportunities for a high quality Wilderness experience for the visiting public." The report also acknowledged that "trails, trail signs, and necessary bridges are all permissible when designed in keeping with the Wilderness concept" and instructed the agency in its maintenance and construction efforts to "include the use of mechanical equipment where appropriate and/or necessary."

Emery County consequently finds that:

1. Trails must be managed to provide for all user types considered appropriate when the area was designated as Wilderness;
2. Federal agencies responsible for Wilderness must consider use of mechanical/motorized equipment for trail maintenance and reconstruction as an appropriate and necessary tool to accomplish trail maintenance;
3. Agencies should consider use of mechanical/motorized equipment for fire management on a case by case basis.
4. Trail signs, and necessary bridges are recognized as appropriate structures within Wilderness necessary to provide Wilderness opportunities for all Americans;
5. Trails should be managed to continue historic, traditional, customary, and cultural uses when the area was designated as Wilderness;
6. RS 2477 trails and roads that existed and may or may not have been shown on agency and/or County maps are required to be part of the official existing and authorized trail and road system. Trails which do not appear on those official maps but can be demonstrated to have historic, traditional, cultural, or customary significance to County residents and other public land users should be evaluated for addition to the official system; and
7. Minimum tool analysis and minimum requirements analysis should consider the mandate of providing for recreation and historic use, comprehensive economic and social analyses of the costs of closing those trails and roads under NEPA, as well as the physical and biological attributes of Wilderness character.

9.11.15 User Amenities

Facilities and/or improvements that existed at the time of Wilderness designation and/or that can be demonstrated to serve an existing permitted use at the time of the Wilderness designation should be retained for historic, cultural, traditional, and customary uses. Improvised camping structures constructed by users should be permitted as temporary shelters erected in response to a weather event and should be dismantled by the users upon the conclusion of the weather event.

9.11.16 Wilderness Study Areas

Wilderness Study Areas that have been so designated for a period of ten years or longer should revert to multiple use lands.
The 2007 Addendum which addresses "Alternative E Areas", "Reinventory Lands" and "Wilderness Characteristics Lands" is incorporated into the General Plan. (See Appendix C)

9.12 Transportation and Access

Transportation is the basic system which provides mobility to sustain social, economic and recreational activities in the County public and private lands. An improperly developed or out of balance transportation system can result in ineffective mobility and cause adverse and undesirable conditions such as safety hazard, delays, unnecessary

energy consumption, economic costs and frustrations for visitors. It is the desire of Emery County to shape and maintain a transportation system which improves the quality of life and residents' ability to move throughout the County's public and private lands. It is the desire of Emery County to develop and maintain a transportation plan in coordination with the agencies that optimizes accessibility across federal and state lands, promotes efficiency and allows for responsible management of public lands.

Access to federal lands is critical so that the full benefits of multiple uses can be realized. Access to federal and state managed land should not entail encumbrances or restrictions on private property rights, including all livestock business operations which must traverse state and federal byways in the course of transporting livestock. Future uses and needs for capacity increases should be a large component and driver of the evaluative process. Roads and trails should be permitted for all proper and lawful purposes subject to compliance with rules and regulations governing the lands and the roads and trails to be used.

Emery County supports agency efforts to maintain and rehabilitate existing authorized and unauthorized public land roads and access points with historic, cultural, and traditional importance to residents and visitors. The County opposes administrative limitation of access to public lands due to road or trail closures, decommissioning, and other limiting policies that are not consistent with agency land use plans or county plans. Continuation of existing uses and patterns should be maintained unless reliable science compels the agency to change those uses.

Revised Statute 2477, 1866 (RS 2477) provides that rights-of-way for the construction of highways over public land not reserved for public uses, is hereby "granted". Miners, ranchers and others developed such rights-of-way in the form of roads and trails, many of which continue to be used today, although their usage is increasingly restricted. The County is in the process of identifying such roads and trails and is opposed to further limitation of public access to state and federally-managed lands; The County recognizes the system of roads and rights-of-way established under RS 2477.

Emery County opposes federal actions that intentionally or unintentionally reduce the scope of rights that are protected by the Federal Land Policy and Management Act (FLPMA), National Forest Management Act (NFMA), and other federal statutes.

Balancing private property interests with the public's need for access, is critical when pursuing and maintaining rights-of-ways. In-holders of private property require rights-of-way to access their property and exercise other activities and other rights associated with private property. Emery County supports the rights of these individuals.

All roads and trails that had been designated open for multiple use travel at the beginning of 2010 should remain open to the applicable forms of motorized travel, unless sufficient environmental or scientifically valid justification exists for the closure of a road or trail.

Coordination with the County is critical for the maintenance of sound travel management plans. Agencies are requested to attain consistency between proposed travel management plans and County transportation positions. The County supports an interconnected transportation system for Off Highway Vehicles using routes

designated in the Emery County OHV Ordinance, BLM designated routes, and routes identified by MLNF.

Further, it is Emery County's position that:

- historic uses, roads and routes will be maintained in specially designated areas (wilderness, roadless, areas of critical environmental concern (ACEC), etc.) to the fullest extent permissible under such land's designation by Congress;
- vehicle access will be provided to all historically used campsites;
- all authorized and unauthorized dispersed and developed campsite access routes will be evaluated for inclusion into the agency road/transportation system;
- light or intermittent use of a trail or route does not justify a change in designation, closure, or its removal from the transportation system;
- roads and trails that have washed out or are otherwise impassable will not necessarily be closed as a result, nor will authorization be denied due to the agency's failure or inability to maintain them;
- MLNF and BLM roads and trails will remain open unless there is a scientifically defensible and significant reason to change the status;
- The agencies will maximize and protect access opportunities for residents and visitors who are physically unable to access dispersed camping areas via non-motorized means; and
- seasonal and wet weather closures will reflect existing conditions, historic, historic, and seasonal uses such as hunting and fishing, permittee needs and requirements for access for herding and cattle removal purposes, and other local interests;
- Seasonal and wet weather closures will be based on current weather and road conditions, not calendar.

9.13 Water Resources

9.13.1 Emery County Policy

Adequate water quality and availability is necessary for significant residential, industrial, commercial, agricultural, and recreational development. The County desires to protect and enhance the quality and quantity of usable water by promoting the efficient management of water resources and the protection of individual water rights. The County supports the development, adoption, and implementation of water storage, distribution and conservation plans by irrigation companies, industrial users, and municipalities.

There are twenty-three federal water agencies and fifteen water-related state agencies with who water users in the County must commonly deal. Those agencies and organization are listed in Appendix G in the *Emery County Profile* Water Resources section. Water related decision-making efforts are very complicated and difficult in the County. Emery County has made efforts to coordinate with all pertinent water agencies and organizations in its water policy making and planning efforts and will continue to work with those agencies.

Emery County is experiencing over-utilization pressures as well as political pressures on its water resources. The streams and tributaries of our present water supply are all over appropriated. Any new use must come from existing water supplies or the creation of additional storage facilities to harness the spring runoff from the melting snow.

Other threats include unfunded political mandates (such as dam safety, endangered or sensitive species, wetland protection, etc.), federal and state in-stream requirements, federal regulations for project water, subsidence due to mining activities, trans-basin movement of water by the mining industry, watershed damage due to invasive species, timber harvesting and mountain home subdivisions, uncontrolled trans-mountain diversions, ground water interference by methane gas developers, the retirement of agriculture production lands to provide water for industry, and the ever dwindling supply of water.

The County demands that these many interests and agencies acquire their rights to use water resources through the Utah State appropriation system. The County will resist any method of "taking without compensation".

9.13.2 Water Quality and Quantity

Emery County desires to protect the quality and quantity of its water resources. The County is concerned with the effects of industry, recreation, and residential development on water quality and will continue existing monitoring activities. It is the County's position that parties causing resource damage is responsible to perform and/or finance adequate and appropriate mitigation measures. Many important County watersheds are located in adjacent counties. The County Commission is encouraged to consult, cooperate, and coordinate with those counties on watershed management and water quality issues.

The following outline will quantify the County's water resources and will declare the County's positions regarding the various pressures and demands on water resources.

Objective: ***The County desires to maintain the current level of water quality...quantity.***

Watershed Protection

In 1905, when record keeping began, the annual flow of the County's four western streams; Muddy, Ferron, Cottonwood, and Huntington was 252,000 Ac-ft. In 1990, the annual flow was 194,000 Ac-ft, a decrease of 58,000 Ac-ft. The reason for this decrease is probably two-fold. First, the amount of precipitation is steadily decreasing. Second, the condition of the watershed is improving, utilizing more of the moisture in consumptive use.

The County protects watershed areas through its existing zoning ordinance. Two "critical environment" zone classifications cover the canyon, mountain, riparian, and watershed areas of the County. The County also imposes slope/grade building standards and requires that all sewer and water systems comply with State Health Department standards.

The County supports land use practices which promote proper ground cover to prevent erosion. The County will promote practices which will decrease the growth of noxious weeds, phreatophytes, and high consumptive vegetation, and will favor practices which increase erosion preventing ground cover.

The County supports domestic livestock grazing on the watersheds. Grazing can be used as a management tool to promote the health of a watershed. Proper grazing will rejuvenate grass growth and trample seeds for increased plant numbers. The County also recognizes the economic dependency that agriculture has on public land use, and the value it has in sustaining the rural lifestyle of the area.

The County recognizes recreation as a prominent factor in our social fabric. However, recreationists must accept the responsibility of maintaining a clean, healthy watershed. Facilities should be provided and maintained to control human waste, and trails and signs should be developed that guide hikers away from delicate riparian zones. The County supports the concept of any motorized vehicle being used only on designated roadways or routes in order to control erosion and other resource impacts.

Mountain homes and campgrounds should be controlled to minimize the effect of septic tanks and waste facilities on groundwater. Coliform shall be the primary measure of water quality. Stream set back requirements for homes and campgrounds shall be sufficient to prevent any contamination to surface or underground water.

Timber harvest, mining, and other surface development shall be controlled to the extent that the exposed ground shall be reseeded with grasses, forbes, and tree seedlings to aid the natural re-growth and protect the watershed. Open pit mining has not occurred on the County's watershed and does not appear eminent in the future. However, any like activities will be consistent with the watershed values stated herein. Any potential contamination of mountain water by sediment, chemicals, or waste, will be mitigated prior to allowing any industrial activity.

It shall be the County's policy to maintain excellent water quality of its streams. The current excellent quality shall be the minimum level.

Objective: *Emery County supports implementing additional watershed protection measures....*

Action/Implementation Steps –

The Emery County Planning Commission will identify watershed areas and the appropriate private or public interests owning or managing these properties.

Working with all interested parties, the Planning Commission shall review the existing watershed protection and subdivision ordinances to determine whether these ordinances provide adequate watershed protection. Accomplishing this objective will include expanding the existing zoning resolution to include soil and slope analysis requirements and stream corridor and floodplain setbacks.

Depending on the Planning Commission's findings and recommendations, an overlay and accompanying regulations will be developed. This information will identify "protection" zones, corresponding levels of development (or non-development) and damage mitigation requirements.

Planning Commission recommendations are to be reviewed by the public and recommended to the County Commission to be adopted as part of the County's land use ordinance and included in the applicable public-land use plans.

9.13.3 Water Rights/Allocation

Objective: ***The County will actively participate in all relevant local, regional, state, and federal water management efforts.***

The County feels that private water rights should be protected from federal and state encroachment and/or coerced acquisition. To ensure that the County's water resource issues and interests are adequately heard and addressed, the County will actively participate in the Colorado River water leasing discussion and all other relevant federal and state water resource planning efforts and decisions. Emery County endorses the Utah State Water Laws of Appropriation as the legal basis of all water use within the County. Under state law, all water in the state, whether above or under the ground, is declared to be the property of the public subject to all existing rights to the use thereof.

Beneficial use is the basis, the measure and the limit of all rights to the use of water in this state. The appropriation of water to acquire use and ownership must be bound based on useful and beneficial purpose. The user who is first in time shall be first in right.

Water Rights which have been appropriated in Emery County are shown on the table below. When these rights exceed the flow in the river, the first in time of the appropriation is first to fill his water right. It shall be the County's policy that these four rivers of Western Emery County are substantially over appropriated and the County will urge the State Engineer to close these rivers to further appropriation.

River	Total Appropriation (cfs)	Average Flow (cfs)	Total Storage Rights (Ac-ft)	Actual Storage (Ac-ft)
Muddy	244	40	7,545	1,839
Ferron	378	70	20,914	18,000
Cottonwood	678	100	218,233	62,500
Huntington	487	100	61,149	54,056
Green River	132	n/a	-0-	-0-
Trans. Mt.	216 (26,700 Ac-ft)	Unknown	-0-	-0-

The Green River water users are being limited to the present water appropriation. Emery County encourages the State Division of Water Rights to

grant an additional permanent water right allocation to these appropriators. Since the rights of appropriation control the amount of the diversion, place of use, nature of use, etc, it is in the best interest of the County water resources, that these rights be adjudicated. The County will encourage the State Engineer to bring this action to fruition.

Objective: ***The County supports a fair allocation of water rights between water uses.***

The County feels that industry and municipalities should not claim or own more water than necessary to cover their anticipated needs and that unused water should be made available for other uses. The County also feels that the protection and recovery plans for endangered species and other "special interests" should be paid for by advocates of those purposes and uses.
The County also feels that the Bureau of Reclamation application process required to increase acreage irrigated is cumbersome and complicated. The County recommends that the acreage threshold triggering the need for re-application be raised.

Objective: ***The County feels benefits from conservation practices should go to those conserving the resource.***

The County feels that the state law requiring that water saved through conservation goes to the next appropriation creates a negative incentive for more efficient water use. The County would like to see the return, be it financial through the sale of the excess water, or physical through the irrigating of additional ground, and be directly reaped by the conserver.

The demand for western Emery County water greatly exceeds the supply. Conservation practices have always been followed. Agriculture has used and reused this resource as it passes through the valleys. Reservoirs have been constructed and regulated to maximize the use of the highly varied flow. Emery County promotes conservation as a way of life. Water so conserved will be used to meet the demands of the County and maximize the use of this valuable resource. The concept of conservation plans are promoted, especially by industrial and municipal users who continually hold excess water rights against peak demands. As water conservation measures become economical, the County encourages the use of these methods.

Objective: ***The County feels that waste water and return use practices and privileges should be maintained and protected.***

Groundwater

The countless mountain springs form the base flow of our water resources. As the winter snows melt and run into our reservoirs and then into our valleys, it also enters the ground and recharges the many aquifers for discharge through springs and seeps later in the summer season. This natural process forms the basis of our water use downstream. It will be the policy of the County that these natural outlets remain uninterrupted.

The County recognizes the necessity of mining as its economic base. However, the interruption of water flowing to these natural spring outlets cannot be tolerated. It is the policy of the County that any water interrupted by mining, subsidence, etc. shall be replaced in quantity, quality, kind, and/or compensation. If studies show a possibility of ground water interruption is eminent, then mitigation of the probable interruption will be necessary prior to mining activities. Any trans-basin transfer of water will be contrary to the policies and interests of the County.

Emery County endorses the water monitoring program being conducted by Emery Water Conservancy District. This provides a base line record of the County water resources. All like information gathered by mining interests, government agencies, and others shall be made available to the conservancy district for its record.

The geology of the County is the source of its physical uniqueness. The Wasatch Plateau rises sharply on the western boundary to elevations of 11,000 ft and provides the mountainous watershed. This mountainous region receives over 40-inches of precipitation per year and is the source of the County's water. The valley floor varies from elevation 6,000 to 4,500 in its deepest canyons and receives less than 7-inches of precipitation per year. The valleys which support farms, industry, and communities sit on a marine shale deposit which is about 3,000 feet thick. This formation is called the Mancos Shale. Located deep below this shale layer are two thick sandstone aquifers ranging from 500 to 1,000 feet and are found at about 6,000 to 7,000 feet. These aquifers turn up and surface about 10 - 15 miles east of the communities and the surrounding agriculture lands. These aquifers have never been tapped because of their depth and the expense of their development. However, these water bearing zones are part of the water resources of the County. The County policy will be to insure that the quality of these aquifers are not degraded by injection wells, or any other activity.

Water Storage

The semi-arid climate in which we live necessitates the wise use of our water resources. Storage which catches the melting winter snow from the mountain ranges and holds the water for year-round use is vital to the existence of the County's communities, industry, and agriculture. Most of these storage reservoirs are located high in the watersheds. A list of existing reservoirs is located in the *Emery County Profile* section III page 7.

Numerous other man made reservoirs belong to the Division of Wildlife Resources. These reservoirs are used for recreation and do not contribute to water storage potential. However, they contribute greatly to the enjoyment and quality of life of the County citizens. The County encourages the continuing maintenance of these facilities.

The Emery County Project was completed by the U.S. Bureau of Reclamation in 1965. This project constructed the Joe's Valley Dam as its major feature. Water is stored in Joe's Valley Reservoir and used for agriculture, industry, and municipal needs on Cottonwood Creek and Huntington Creek. As with all

federally funded facilities, numerous generic rules and regulations apply to the use of these facilities. Some of these rules are contrary to wise use, conservation, and sometimes contrary to good sense.

Emery County appreciates the fact that these facilities were provided and endorses management practices which utilize these facilities to the fullest extent in the storage and conveyance of all waters.

The County also endorses the lifting of acreage restrictions which diminish the availability of the supplemental water to the agriculture interests of the County. The County urges a cooperative effort with the Bureau of Reclamation to use their existing systems in a wise and efficient manner.

Objective: ***Increase the number of storage reservoirs within the County.***

The County feels that additional storage facilities are needed for the County to fully utilize its water resources. The County supports downstream and off-stream storage and would like to develop an adequate system of storage facilities that would allow the excess spring runoff to be captured and utilized later in the growing season. Specific examples include the Muddy Creek. As an alternative to additional water storage facilities, the County supports improved coordination between water users and existing storage facilities.

Objective: ***More efficient use of existing facilities and excess capacity....***
Conveyance Systems

Associated inherently with the storage facilities is the system of canals, ditches and pipelines which supply the water to its place of use. These conveyance systems transport the water from the natural streams to irrigate thirsty ground, operate power plants, and provide water to the communities. The resulting network runs for hundreds of miles throughout the County. The County recognizes this system as necessary to our way of life. The County supports any effort which will improve these systems, decrease seepage losses, and promote better management practices. The County acknowledges that the major canals have an inherent right-of-way that was established when the area was settled. This right-of-way is recognized as fifty feet on either side of the canals. The right-of-way is for access, maintenance, distribution, and improvement.

In-stream Flow

Traditional water management has focused on improving the resource to meet the needs of the users. Recently, the concept of water resource development has been enlarged to include recreational and environmental uses. In 1986, the Utah State Legislature included in-stream flows as a beneficial use, subject to the laws of appropriation. In 1995, the State included parks and recreation as a beneficial use. This change of philosophy comes largely on the heels of the water development period which occurred prior to 1980. Many streams in the State have been controlled with storage reservoirs and diversion structures. Prior to these control structures, the natural stream flows were unpredictable and destructive. Without reservoirs, the mountain snows melted in the spring

and came roaring down our canyons, gutting the channels, carrying rock, soil, and canal diversions downstream. The runoff would last about four to eight weeks and then the streams would revert to base flow. Diversions were precarious. Flows to farms and municipalities were unpredictable. The large flows were destructive both to man and the environment. Once the streams were controlled, diversions became predictable, channels filled in with vegetation, riparian zones were healed, and people began to believe that this was the way nature intended things to be. The basic problem, rising from the change of economic focus to include recreation and environmental uses, is that these "new" uses did not finance initial water development. They were a favorable byproduct of development financed by agriculture, municipalities, and industry. Further, the general populace no longer sees the large runoff flows going unused downstream. They see placid lakes, meandering streams, and water in their faucets.

It is with this basis of understanding that Emery County recognizes its dependency on the man-made structures that control water resources and make possible a rural lifestyle. The County recognizes the need for recreation and environmental uses. However, at present, the rivers are fully appropriated and no new water is available for these uses. To commit water to in-stream flows would prevent users within the County from fully utilizing their water rights and preclude the valleys from having an adequate water supply for culinary, industrial, and agricultural purposes. It is impractical for the County to establish a policy that favors leaving flows in our streams at the expense of providing basic water supply services to existing users.

Emery County recognizes in-stream flows as beneficial use. These uses may receive an appropriation with priority dates at the time of application. Any development of water resource for in-stream use must be financed solely by in-stream users or those groups which promote such use. The County further declares as its policy, that water which is conserved through more efficient conveyance or use will be committed to fulfilling present needs of existing water users, and the conserved water will be committed to downstream use, only upon the state laws of appropriation; first in time, first in right.

"Wilderness", "Wild and Scenic River", and "Endangered Species" designations are federally legislated. These designations could adversely affect all rivers and streams in Emery County. The intent of this legislation is contrary to existing state water laws and to the well-being of the County. The County's position will be to oppose any taking of existing water rights, both diversion and storage.

The County declares that any water dedicated to federal use must be appropriated under state law. The date of that appropriation will be set in accordance with state law. The County further declares that existing users have the right to fully develop their existing diversion and storage rights.

Wetlands

The preservation of wetlands is federally mandated. The definition of wetlands is subject to federal wetlands designation definitions and judgment. Some wetlands occur naturally. Some wetlands have been created artificially by off-

stream diversions. The geology of Emery County precludes the natural occurrence of wetlands outside of the riparian zone along the streams and rivers which run through the valleys. All other wetland areas have been created artificially by irrigation practices.

The County recognizes that conservation practices are important and have endorsed these practices within this plan. The County further recognizes that some wetland areas may be negatively impacted by water conservation practices. Where choices are to be made, the County's position will favor conservation practices over wetland preservation. The County declares it impracticable to weigh artificial wet zones against insuring that the needs of the water users of our County are met. The County further declares that any water rights which are designated for wetland use must be obtained in compliance with the state water laws of appropriation.

Salinity

The rivers of western Emery County emerge from the mountainous canyons and run for miles across the marine deposit known as the Mancos Shale. This marine deposit is saturated with lenses of calcium sulfate (CaS04). These lenses are water soluble and when exposed by stream erosion both within the natural river channels and the myriad of drainage channels, salts are absorbed by the streams. The amount of salts being transported by our streams are measured as Total Dissolved Solids (TDS) and the units are milligrams per liter (mg/L) or parts per million (ppm). The TDS of our streams entering the valley are about 300 mg/L. The TDS of our streams leaving the Mancos Shale formation varies from 2000 mg/L to 5000 mg/L. This condition is consistent with the entire upper Colorado River drainage basin.

Federal agreements and law encourage the decrease of salinity in the Colorado River. Studies have been completed which outline ways that this amount of dissolved solids can be decreased. For the most part, these methods consist of conservation measures. Conveyance losses and on farm efficiencies contribute to the salinity of the return flows. These same losses also contribute to the artificial wetlands of the County. The two desirables are in conflict. One cannot be controlled without affecting the other. The County's position will be to continue to endorse practicable conservation measures that ensure the needs of the County water users are met, now and in the future. The County reiterates its position that water conserved will be used within the framework of present state laws and for purposes that are defined within the adjudication of existing water rights.

Weather Modification

Emery County water users have, for many years, participated financially in a cloud seeding program. The County encourages further participation and investigation of ways and measures of modifying our natural weather patterns for the benefit of the County.

Education

As the focus of water management practices and projected needs change from traditional concerns to meet environmental concerns, the need for water

education becomes paramount. It is important that our citizens understand the necessity of the control structures which manage our water resources. It is equally as important that they understand that the state appropriation laws that protect our water rights from being superseded by federal mandates and designations. It is important that we remember the conditions which existed prior to the development of our water resources and appreciate the reasons for the system of management that exists on the rivers of the County. Education is necessary to understand where our water resource comes from, how it is managed, and how it can be conserved. The County supports and encourages educational efforts in our schools and in our local media by Emery Water Conservancy District and the Castle Valley Special Service District.

APPENDIX A

EMERY COUNTY TRANSPORTATION SYSTEM

The Emery County Transportation System:

1) Federal Interstate System Freeways;
2) Utah Department of Transportation Highways;
3) Bureau of Land Management (BLM) system roads;
4) BLM designated motorized routes as identified in the Price Field Office Resource Management Plan (RMP) of 2008;
5) Manti-LaSal National Forest (MLNF) forest roads;
6) Manti-LaSal National Forest (MLNF) motorized trails;
7) City and county Class A, B and D roads;
8) Emery County Motorized trails;
9) Federal, State and County designated non-motorized trails;
10) Roads and routes which provide access to dispersed camp sites;
11) Huntington Airport, Green River Airport, Cedar Mountain Backcountry Airstrip, Hidden Splendor Backcountry Airstrip, Mexican Mountain Backcountry Airstrip;
12) The Green River

Emery County will participate with the Bureau of Land Management Price Field Office in a NEPA process to designate open routes in the formerly 'open' area east of SR-24. This process will include an exhaustive inventory of routes by BLM. Emery County will participate as a cooperating agency.

APPENDIX B

EMERY COUNTY'S POSITION ON "PURITY DOCTRINE"

The efforts of the managing agencies *of moving Wilderness as a whole towards a more pristine condition is outside the statute and should not be adhered to. More pristine is the result* of a preservation/purity bias that has been prevalent since before the Act was passed. The purity doctrine was addressed by Congress during the 1970's in two pieces of legislation. The first was a statute adding numerous areas of forests in the eastern states to the Wilderness system. The second was the Endangered American Wilderness Act of 1978. The House Report on the Endangered American Wilderness Bill (Report 95-540, July 27, 1977) specifically directed the managing agencies to abandon the purity approach.

Congress clearly expected that Wilderness would accommodate a wide spectrum of Americans who desired wilderness-type recreation experiences of a nature that were established at the time the law was passed. The intent of Congress (emphasized throughout the Congressional Record) was to preserve existing conditions while providing for existing and future use.

No where does the Wilderness Act or Congressional Record require restoring Wilderness to a condition more pristine than that which existed prior to designation, and no where does it define 'special' categories of users that will be favored through implementation of the law. As a result of a perceived need by some to provide 'stock free' opportunities, zones are being created on Wilderness lands in the US to accommodate a 'wilder elite' who prefers not to see horses and mules (or signs of their presence), aircraft, motorized or mechanized trails, or other evidence of use by people. In doing so, customary and historical users may be excluded from areas commonly and historically frequented by such users.

APPENDIX C

ALTERNATIVE 'E' AREAS
2007 ADDENDUM

TABLE OF CONTENTS

1. Addendum 42
2. Social Aspects and Traditional Land Use 42
3. Regions 44
   - 3.1 Cedar Mountain 44
   - 3.2 Desolation Canyon 50
   - 3.3 Devil's Canyon 60
   - 3.4 Eagle Canyon 66
   - 3.5 Flat Tops 74
   - 3.6 Hondu Country 81
   - 3.7 Labyrinth Canyon 88
   - 3.8 Limestone Cliffs 96
   - 3.9 Lost Springs Wash 103
   - 3.10 Mexican Mountain 111
   - 3.11 Molen Reef 120
   - 3.12 Muddy Creek/Crack Canyon 128
   - 3.13 Mussentuchit Badlands 137
   - 3.14 Never Sweat Wash 144
   - 3.15 Price River Area 151
   - 3.16 Rock Canyon 159
   - 3.17 San Rafael Knob 166
   - 3.18 San Rafael Reef 173
   - 3.19 San Rafael River 179
   - 3.20 South Horn Mountain 187
   - 3.21 Sweet Water Reef 194
   - 3.22 Turtle Canyon 201
   - 3.23 Upper Muddy Creek 209
   - 3.24 Wildcat Knolls Extension Unit B 217
   - 3.25 Wild Horse Mesa 224

ALTERNATIVE 'E'

1. Addendum

In May of 2007, Emery County finds itself in the midst of a land use planning process. The Price Field Office (PFO) of the Bureau of Land Management (BLM) has recently added a fifth alternative (Alternative E) to its Draft Resource Management Plan (RMP). Alternative E is an extreme conservation/minimum development alternative.

Alternative E has been included as a result of two processes which in essence proffer the concept that there are a number of geographic areas within the PFO, and within Emery County that either have or are likely to have, wilderness characteristics. While Emery County refuses to recognize that these characteristics exist to the extent they are represented in Alternative E, we are placed in an unenviable position of disproving these proposals.

Emery County has been deeply involved in the development of the Draft RMP as a cooperating agency and will continue to be active in the process until the Final RMP is implemented. For this reason, this addendum to the Emery County General Plan has been developed with the specific intent to eliminate as much as possible, the inclusion of any portion of Alternative E in the Proposed Plan. What follows in this document is first of all the social and economic realities which are of major significance to Emery County and the State of Utah and secondarily, a list of very definite positions which Emery County holds concerning each of the regions represented in Alternative E.

2. Social Aspects and Traditional Land Use

Within the areas of concern in Alternative E are many notable and important Western American history sites. The Spanish Trail was created following the 1776 journey of Fathers Escalante and Dominguez. This route was a significant trading resource, particularly in the early 1800's when the route was used as a frontier route for early explorers like John C. Fremont and John W. Gunnison in the 1850's. Famous Indian leaders like Chief Walker also used the route during the early history of the area. During the "Utah War" of 1857 and 1858, U.S. Army troops traveled the area on their way to the Sevier valley.

Between 1881 and 1883, a railroad project was undertaken from the present location of Green River, west to the San Rafael Swell, across the Buckhorn Flat and south towards the town of Salina. Although the project was never finished, the Denver & Rio Grande Western Railway (D&RGW) grade is still visible for nearly 40 miles in affected area and dozens of rock structures and workers names carved on rock faces bring visitors on a regular basis.

Livestock grazing attracted the first Anglo-American people into the San Rafael and Green River Desert areas in the mid 1800's. Areas such as Sinbad Country in the San Rafael Knob area, Desolation Canyon and Price River were especially attractive with tall grass and along with development of water sources, cattle, horses and sheep did well on the newly discovered forage sources.

The cattle industry continues to be a vital economic force within Emery County. Furthermore, as families and other residents recognized the inherent value of the wide open, natural conditions, recreational activities developed which continue at present. Trail riding on the cattle trails developed by the early cowboys has become more popular. What

has become "dispersed camping" to BLM recreation planners is the remnant activity of making camp in the shade of the nearest tree at the side of the trail or near the only water source for miles.

"Eastering" has more to do with enjoying the first outing following winter than recognizing the Christian event, and is socially and geographically unique. This one activity brings as many as 7,500 people out onto the lands managed by the Price Field Office of the BLM on a single weekend.

Local residents have utilized many types of machines over the years to traverse the sometimes inhospitable terrain of the area. Trucks of various makes were utilized for cattle operations as soon as routes were developed that would get them to the cattle camps. Bulldozers were soon put to work making nearly all to the area accessible for oil and mineral exploration and many of those routes and roadbeds serve as county and BLM system roads today. During the 1950's and 1960's, the "Uranium Boom" led to the development of hundreds of miles of bulldozed routes throughout the region.

Other roads were created to develop other minerals that are available in the area. Significant sand and gravel beds are disbursed throughout the areas. Gypsum, traditionally used for plaster, was developed in a number of locations. Even metals such as copper and silver had active mining operations, particularly in the 1930's. Each of these activities created roads and trails to develop the resources.

As these routes proliferated during this time, the addition of these routes led to the development of new activities in the area. Recreational use of these lands became a regionally significant activity. Tote-goats, trail bikes, dune buggies, 4X4's of every type were employed and over the years became an industry of their own. It quickly became apparent that motorized travel was an enjoyable means of exploring these roads/trails or wash bottoms or just the open country between here and there. Technological advances in the motorized travel industry have led to more and more use over the decades.

It should be pointed out that until the Wilderness Study Areas were created in the mid 1980's, there were no limitations on motorized vehicle travel in the areas. Furthermore, with a few exceptions, until the San Rafael Route Designation Plan of 2003, open, cross country travel has been a legitimate and legal option for all motorized use. Open cross country travel is still legal and recognized as a legitimate use in the northern half of Emery County.

Notwithstanding this, Emery County has undertaken to provide management of motorized vehicle use by adopting a County Travel Plan and a related OHV ordinance. Furthermore, most of the incorporated communities have created plans of their own.

In recent years new recreation opportunities began to appear within the affected areas. Hiking, Rock Climbing, Rappelling and Bouldering have become significant and important recreational opportunities. On the Green River, rafting and kayaking have transitioned from small scale recreational opportunities to significant businesses. On the San Rafael, Muddy and Price Rivers, high seasonal flows enable rafting, tubing and kayaking opportunities. For more than 40 years, the County has participated in the "Friendship Cruise". A multiple day event held each May between Green River and Moab.

Mountain Biking is a relatively new activity that is exploding in scope. For 20 years, local biking enthusiasts have hosted a spring mountain biking festival and in the past five years, a fall festival has been created. Other mountain biking activities center on the world famous

biking area of Moab. Since much of the "San Rafael Swell" is relatively close to Moab, overflow traffic is increasing by leaps and bounds.

Local residents of the area have utilized the living natural resources of the area since prehistoric times. Hunting and fishing opportunities abound and are recognized even in early prehistoric petroglyphs throughout the region. Today, the area is known for its significant Deer, Antelope and Bighorn Sheep (both Rocky Mountain and Desert varieties) populations. Upland game, particularly Chukar Partridge, and small game hunting opportunities are also important to local residents.

3. Regions

3.1 Cedar Mountain

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "CEDAR MOUNTAIN REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Cedar Mountain region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE CEDAR MOUNTAIN REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

T24S R7E - Sections 28, 29, and 33

T25S R6E - Sections 24 and 25

T25S R7E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T26S R7E Sections 1, 3, 4, 9, 10, and 11

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T24S R7E - Sections 28, 29, 32, and 33

T25S R6E - Sections 24 and 25

T25S R7E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T26S R7E - Sections 1, 2, 3, 4, 9, 10, and 11

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Cedar Mountain Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Cedar Mountain Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Cedar Mountain Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources in the Cedar Mountain Region at the Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Cedar Mountain Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid, and gaseous mineral resources in the Cedar Mountain Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Cedar Mountain Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Cedar Mountain Region that are no longer necessary or effective should be modified, waived, or removed.

- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Cedar Mountain Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Cedar Mountain Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Cedar Mountain Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Cedar Mountain Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Cedar Mountain Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Cedar Mountain Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Cedar Mountain Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Cedar Mountain Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Cedar Mountain Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Cedar Mountain Region to restore, maintain and

maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Cedar Mountain Region.

- Emery County's strategy and plan for protecting the Cedar Mountain Region watershed is to deter unauthorized cross-country OHV use in the Cedar Mountain Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Cedar Mountain Region on which to legitimately operate their OHVs. Closing the Cedar Mountain Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Cedar Mountain Region watershed.
- Accordingly, all motorized trails in the Cedar Mountain Region which have been designated open to OHV use by the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available In The Cedar Mountain Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Cedar Mountain Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Cedar Mountain Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Cedar Mountain Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Cedar Mountain Region.
- Any segment of society, for that matter, who want to recreate in the Cedar Mountain Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Cedar Mountain Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Cedar Mountain Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Cedar Mountain Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Cedar Mountain Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Cedar Mountain Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued

ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Cedar Mountain Region that have been designated open to OHV use by the 2003 San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation –motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Cedar Mountain Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Cedar Mountain Region is considered to be part of Emery County's plan specifically applicable to the Cedar Mountain Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Cedar Mountain Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Cedar Mountain Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Cedar Mountain Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Cedar Mountain Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Cedar Mountain Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Cedar Mountain Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Cedar Mountain Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There are no private lands within or adjacent to the Cedar Mountain Region

SECTION 10- Manage the Cedar Mountain Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Cedar Mountain Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Cedar Mountain Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Cedar Mountain Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Cedar Mountain Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Cedar Mountain Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Cedar Mountain Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Cedar Mountain Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Cedar Mountain Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;

- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- NA

SECTION 13- NA

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Cedar Mountain Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Cedar Mountain Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Cedar Mountain Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Cedar Mountain Region.
- Emery County's foregoing plan clarification for the Cedar Mountain Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.2 Desolation Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "DESOLATION CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Desolation Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONGOING PLAN FOR MANAGING CERTAIN LANDS IN THE DESOLATION CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:
Desolation Canyon located in:

T16S R14E - Sections 14, 15, 22, 23, 24, 25, 26, 35, and 36

T16S R15E - Section 31

T16S R16E - Sections 5, 6, and 32

T17S R14E - Sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 33, 34, 35, and 36

T17S R15E - Sections 6, 7, 16, 25, 26, 35, and 36

T17S R16E - Sections 3, 4, 10, 15, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T18S R14E - Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, 26, 27, 34, 35, and 36

T18S R15E - Sections 1, 2, 6, 7, 17, 18, 19, 20, 30, and 31

T18S R16E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, and 27

T19S R14E - Sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 34, 35, and 36

T19S R15E - Sections 18, 19, 29, 30, 31, 32, and 33

T20S R14E - Sections 1, 2, 11, 12, 13, 14, 23, 24, and 24

T20S R15E - Sections 1, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, and 30

T20S R16E - Sections 7, 18, and 19

This plan clarification also applies to all other areas of land located in any townships and ranges of Desolation Canyon Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Desolation Canyon located in parts of:

T16S R14E - Sections 14, 15, 22, 23, 24, 25, 26, and 35

T16S R15E - Section 31

T16S R16E - Sections 5 and 6

T17S R14E - Sections 1, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 33, 34, and 35

T17S R15E - Sections 6, 7, 21, 25, 26, and 35

T17S R16E - Sections 3, 4, 10, 27, 28, 29, 30, 31, 33, 34, and 35

T18S R14E - Sections 1, 3, 4, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, 26, 27, 34, and 35

T18S R15E - Sections 1, 6, 7, 17, 18, 19, 20, 30, and 31

T18S R16E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 20, 21, 22, 23, 24, 25, 26, and 27

T18S R17E - Sections 18 and 19

T19S R14E - Sections 1, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 34, and 35

T19S R15E - Sections 18, 19, 29, 30, and 31

T20S R14E - Sections 1, 11, 12, 13, 14, 23, 24, and 25

T20S R15E - Sections 1, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 33, 34, and 35

T20S R16E - Sections 7, 18, 19, and 30

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Desolation Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Desolation Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Desolation Canyon Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Desolation Canyon Region At The Highest Reasonably Sustainable levels

- Development of the solid, fluid and gaseous mineral resources in the Desolation Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Desolation Canyon Region should be seriously considered for development.

- Lands shown to have reasonable mineral potential in the Desolation Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Desolation Canyon Region that are no longer necessary or effective should be modified, waived, or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Desolation Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Desolation Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Desolation Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Desolation Canyon Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Desolation Canyon Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Desolation Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Desolation Canyon Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Desolation Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.

- Any grazing animal unit months that may have been reduced in the Desolation Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Desolation Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Desolation Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Desolation Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Desolation Canyon Region.
- Where water resources in the Desolation Canyon Region have diminished because once existing grasses or other species have succeeded to tamarisk, Russian Olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Desolation Canyon Region watershed is to deter unauthorized cross-country OHV use in the Desolation Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Desolation Canyon Region on which to legitimately operate their OHVs. Closing the Desolation Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Desolation Canyon Region watershed.
- Accordingly, all trails in the Desolation Canyon Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Desolation Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Desolation Canyon Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.

- Public land outdoor recreational access in the Desolation Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Desolation Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Desolation Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Desolation Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Desolation Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Desolation Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Desolation Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Desolation Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Desolation Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Desolation Canyon Region that have been designated open to OHV use in Alternative D - Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation - motorized and non-motorized - should continue.

SECTION 7- Maintain and Keep Open All Roads in the Desolation Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Desolation Canyon Region is considered to be part of Emery County's plan specifically applicable to the Desolation Canyon Region. All such public roads are shown in the attached official map.

- Emery County plans to keep all such roads in the Desolation Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Desolation Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Desolation Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Desolation Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Desolation Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Desolation Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Desolation Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Desolation Canyon Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the Desolation Canyon Region.
- Land management policies and standards on BLM land in the Desolation Canyon Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the Desolation Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Desolation Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Desolation Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Desolation Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Desolation Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Desolation Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Desolation Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Desolation Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Desolation Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references

or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Any of The Area of Critical Environmental Concern ("ACEC") Designation Alternatives Currently Under Consideration in the Price Resource Management Plan Revision Process, Would Contradict Emery County's Plan For Managing The Desolation Canyon Region

- It is Emery County's policy that no part of the Desolation Canyon Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management. C The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of April 15, 2007, none of the ACEC alternatives being considered in the Price Resource Management Plan ("RMP") revision process meets Emery County's above stated ACEC planning criteria.

SECTION 13- Including Any River Segment in the Desolation Canyon Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Desolation Canyon Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
  - The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
  - It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
  - It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.
- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Desolation Canyon Region that meets the above criteria. Hence, no river segment in the Desolation Canyon Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Desolation Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Desolation Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Desolation Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Desolation Canyon Region.
- Emery County's foregoing plan clarification for the Desolation Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.3 Devil's Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "DEVIL'S CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Devil's Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE DEVIL'S CANYON REGION OF THE COUNTY

SECTION 1- Subject Lands

This plan clarification applies to those certain areas of land in South Central Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

Devil's Canyon, located in:

T23S R7E - Sections 12, 13, and 24

T23S R8E - Sections 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 22, 23, 24, and 25

T23S R9E - Sections 13, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 28, 29, and 30

This plan clarification also applies to all other areas of land located in any townships and ranges of South Central Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Devil's Canyon, located in parts of:

T23S R7E - Sections 12, 13, 24, and 25

T23S R8E - Sections 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 23, 24, 25, 29, and 30

T23S R9E - Sections 13, 15, 17, 18, 19, 20, 21, 22, 24, 25, 28, 29, and 30

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Devil's Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Devil's Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Devil's Canyon Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Devil's Canyon Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Devil's Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Devil's Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Devil's Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Devil's Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.

- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Devil's Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Devil's Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Devil's Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Devil's Canyon Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Devil's Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Devil's Canyon Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Devil's Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Devil's Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Devil's Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Devil's Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Devil's Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Devil's Canyon Region.
- Where water resources in the Devil's Canyon Region have diminished because once existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be

applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.

- Emery County's strategy and plan for protecting the Devil's Canyon Region watershed is to deter unauthorized cross-country OHV use in the Devil's Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Devil's Canyon Region on which to legitimately operate their OHVs. Closing the Devil's Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Devil's Canyon Region watershed.
- Accordingly, all trails in the Devil's Canyon Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Devil's Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Devil's Canyon Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Devil's Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Devil's Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred

  form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Devil's Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Devil's Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Devil's Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Devil's Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Devil's Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Devil's Canyon Region for a so-called "solitude wilderness experience" or the like.

- Accordingly, all roads in the Devil's Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Devil's Canyon Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation –motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Devil's Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Devil's Canyon Region is considered to be part of Emery County's plan specifically applicable to the Devil's Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Devil's Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Devil's Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Devil's Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Devil's Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Devil's Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Devil's Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Devil's Canyon

Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Devil's Canyon Region

SECTION 10- Manage the Devil's Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Devil's Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Devil's Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Devil's Canyon Region For So- Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Devil's Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Devil's Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Devil's Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Devil's Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Devil's Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;

- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- NA. There are no proposed ACEC's in Alternative E within the Devil's Canyon Region

SECTION 13- NA. There are no river segments within Devil's Canyon Region that have been nominated for Wild and Scenic River designation

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Devil's Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Devil's Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Devil's Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Devil's Canyon Region.
- Emery County's foregoing plan clarification for the Devil's Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.4 Eagle Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "EAGLE CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify longstanding policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Eagle Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE EAGLE CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to areas of land located in any townships and ranges of East Central Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Eagle Canyon, located in parts of:

T20S R8E - Sections 26, 27, 33, 34, and 35

T20S R9E - Sections 31 and 33

T21S R8E - Sections 1, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T21S R9E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 22, 28, 29, 30, 31, and 33

T22S R8E - Sections 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, and 24

T22S R9E - Sections 4, 5, 6, 7, 8, 17, 18, 19, 20, and 21

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Eagle Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Eagle Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Eagle Canyon

Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Eagle Canyon Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Eagle Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Eagle Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Eagle Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Eagle Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Eagle Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Eagle Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Eagle Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Eagle Canyon Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Eagle Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Eagle Canyon Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.

- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Eagle Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Eagle Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Eagle Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Eagle Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Eagle Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Eagle Canyon Region.
- Where water resources in the Eagle Canyon Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Eagle Canyon Region watershed is to deter unauthorized cross-country OHV use in the Eagle Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Eagle Canyon Region on which to legitimately operate their OHVs. Closing the Eagle Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Eagle Canyon Region watershed.
- Accordingly, all trails in the Eagle Canyon Region which have been designated open to OHV use in the BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Eagle Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Eagle Canyon Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Eagle Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Eagle Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Eagle Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Eagle Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Eagle Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Eagle Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Eagle Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Eagle Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Eagle Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Eagle Canyon Region that have been designated open to OHV use by the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation, motorized and non-motorized should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Eagle Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Eagle Canyon Region is considered to be part of Emery County's plan specifically applicable to the Eagle Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Eagle Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Eagle Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Eagle Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Eagle Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Eagle Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Eagle Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Eagle Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Eagle Canyon Region

SECTION 10- Manage the Eagle Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Eagle Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.

- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Eagle Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Eagle Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Eagle Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Eagle Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so called "wilderness characteristics" management standard for the Eagle Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Eagle Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Eagle Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Any of The Expanded Areas of Critical Environmental Concern ("ACEC") Proposed in Alternative E Would Contradict Emery County's Plan For Managing The Eagle Canyon Region

- It is Emery County's policy that no part of the Eagle Canyon Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
  - The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- Including Any River Segment in the Eagle Canyon Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Eagle Canyon Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.

- It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Eagle Canyon Region that meets the above criteria. Hence, no river segment in the Eagle Canyon Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Eagle Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Eagle Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Eagle Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Eagle Canyon Region.
- Emery County's foregoing plan clarification for the Eagle Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.5 Flat Tops

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "FLAT TOPS REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Flat Tops region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE FLAT TOPS REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Canyonlands Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Canyonlands Region portion of the said UWC internet web site:

T26S R13E - Sections 14, 15, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, 35, and 36

T26S R14E - Sections 19, 30, and 31

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Flat Tops Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Flat Tops Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Flat Tops Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Flat Tops Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Flat Tops Region is an important part of the economy of Emery County.

- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Flat Tops Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Flat Tops Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Flat Tops Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Flat Tops Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Flat Tops Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Flat Tops Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Flat Tops Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Flat Tops Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Flat Tops Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Flat Tops Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Flat Tops Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Flat Tops Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Flat Tops Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Flat Tops Region.
- Emery County's strategy and plan for protecting the Flat Tops Region watershed is to deter unauthorized cross-country OHV use in the Flat Tops Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Flat Tops Region on which to legitimately operate their OHVs. Closing the Flat Tops Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Flat Tops Region watershed.
- Accordingly, all trails in the Flat Tops Region which historically have been open to OHV use should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Flat Tops Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Flat Tops Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Flat Tops Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Flat Tops Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Flat Tops Region.
- Any segment of society, for that matter, who want to recreate in the Flat Tops Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Flat Tops Region if they do not want to or are physically unable or cannot afford such an activity.

- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Flat Tops Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Flat Tops Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Flat Tops Region for a so called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Flat Tops Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Flat Tops Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan, should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation - motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Flat Tops Region That appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Flat Tops Region is considered to be part of Emery County's plan specifically applicable to the Flat Tops Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Flat Tops Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Flat Tops Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Flat Tops Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Flat Tops Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Flat Tops Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Flat Tops Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Flat Tops Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Flat Tops Region

SECTION 10- Manage the Flat Tops Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Flat Tops Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Flat Tops Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Flat Tops Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Flat Tops Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Flat Tops Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Flat Tops Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Flat Tops Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.

- A so-called "wilderness characteristics" management standard for the Flat Tops Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts' any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Temple/Cottonwood/Dugout Area of Critical Environmental Concern ("ACEC") Would Contradict Emery County's Plan For Managing The Flat Tops Region

- It is Emery County's policy that no part of the Flat Tops Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- However, Emery County is supportive of an Big Flat Tops ACEC in the Flat Tops area, that it is consistent with Big Flat Tops ACEC as described in Alternative D, Final Resource Management Plan. Any other ACEC alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Flat Tops Region.

SECTION 13- NA. There are no river segments within the Flat Tops Region nominated for designation as Wild and Scenic Rivers

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Flat Tops Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Flat Tops Region.

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Flat Tops Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Flat Tops Region.
- Emery County's foregoing plan clarification for the Flat Tops Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.6 Hondu Country

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION IF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "HONDOO COUNTRY REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Hondu Country region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE

FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE HONDU COUNTRY REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in south central Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

Hondu Country located in:

T23S R9E - Sections 33, 34, 35, and 36

T24S R8E - Sections 24, 25, and 36

T24S R9E - Sections 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35

T24S R10E - Sections 4, 5, 6, 7, 8, 17, 18, and 19

T25S R9E - Sections 2, 3, and 4

This plan clarification also applies to all other areas of land located in any townships and ranges of South central Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Hondu Country located in parts of:

T23S R9E - Sections 33, 34, and 35

T24S R8E - Sections 25 and 36

T24S R9E - Sections 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T24S R10E - Sections 4, 5, 6, 7, 8, 17, 18, and 19

T25S R9E - Sections 3 and 4

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Hondu Country Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Hondu Country Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Hondu Country Region. These policies are intended to supplement the general plan policies

that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Hondu Country Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Hondu Country Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Hondu Country Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Hondu Country Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Hondu Country Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Hondu Country Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Hondu Country Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Hondu Country Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Hondu Country Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Hondu Country Region as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Hondu Country Region not be relinquished or retired in favor of conservation, wildlife and other uses.

- Emery County recognizes that from time to time a bona fide livestock permittee in the Hondu Country Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Hondu Country Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Hondu Country Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Hondu Country Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Hondu Country Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain, and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Hondu Country Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Hondu Country Region.
- Where water resources in the Hondu Country Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Hondu Country Region watershed is to deter unauthorized cross-country OHV use in the Hondu Country Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Hondu Country Region on which to legitimately operate their OHVs. Closing the Hondu Country Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Hondu Country Region watershed.

- Accordingly, all trails in the Hondu Country Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Hondu Country Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Hondu Country Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Hondu Country Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Hondu Country Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Hondu Country Region.
- Any segment of society, for that matter, who want to recreate in the Hondu Country Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Hondu Country Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Hondu Country Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Hondu Country Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Hondu Country Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Hondu Country Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Hondu Country Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Hondu Country Region That Appear On Emery County's Most Recent Transportation Map,

and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Hondu Country Region is considered to be part of Emery County's plan specifically applicable to the Hondu Country Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Hondu Country Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Hondu Country Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Hondu Country Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Hondu Country Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Hondu Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Hondu Country Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Hondu Country Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within of adjacent to the Hondu Country Region

SECTION 10- Manage the Hondu Country Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Hondu Country Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Hondu Country Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Hondu Country Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Hondu Country Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Hondu Country Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Hondu Country Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Hondu Country Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Hondu Country Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references

or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- NA. There are no ACEC's within the Hondu Country Region that are exclusive to Alternative E.

SECTION 13- There are no river segments which have been nominated for Wild and Scenic River designation within the Hondu Country Region

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Hondu Country Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Hondu Country Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Hondu Country Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Hondu Country Region.
- Emery County's foregoing plan clarification for the Hondu Country Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.7 Labyrinth Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION IF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "LABYRINTH CANYON REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Labyrinth Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE LABYRINTH CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southeastern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

T23S R16E - Section 36

T23S R17E - Section 31

T24S R16E - Sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36

T24S R17E - Sections 6, 19, 30, and 31

T25S R16E - Sections 1, 2, 3, 4, 5, 8, and 9

T25S R17E - Sections 5, 6, 7, 8, 9, 16, 20, 21, 22, 23, 26, 27, 28, 29, 32, 33, 34, and 35

T26S R16E - Sections 2, 3, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 26, 27, 28, 29, 31, 32, 33, 34, and 36

T26S R17E - Sections 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35

This plan clarification also applies to all other areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Canyonlands Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Canyonlands Region portion of the said UWC internet web site:

T24S R16E - Sections 1, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36

T24S R17E - Sections 6, 19, 30, and 31

T25S R16E - Sections 1, 3, 4, 5, 8, and 9

T25S R17E - Sections 6 and 7

T26S R16E - Sections 3, 10, 11, 12, 13, 14, 15, 21, 22, 23, 26, 27, 28, 29, 31, 33, and 34

T26S R17E - Sections 2, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Labyrinth Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Labyrinth Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Labyrinth Canyon Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Labyrinth Canyon Region At The Highest Reasonably Sustainable Levels.

- Development of the solid, fluid and gaseous mineral resources in the Labyrinth Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Labyrinth Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Labyrinth Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Labyrinth Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Labyrinth Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Labyrinth Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Labyrinth Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Labyrinth Canyon Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Labyrinth Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.

- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Labyrinth Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Labyrinth Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Labyrinth Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Labyrinth Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Labyrinth Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Labyrinth Canyon Region.
- Where water resources in the Labyrinth Canyon Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Labyrinth Canyon Region watershed is to deter unauthorized cross-country OHV use in the Labyrinth Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Labyrinth Canyon Region on which to legitimately operate their OHVs. Closing the Labyrinth Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Labyrinth Canyon Region watershed.
- Accordingly, all trails in the Labyrinth Canyon Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Labyrinth Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Labyrinth Canyon Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Labyrinth Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Labyrinth Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Labyrinth Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Labyrinth Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Labyrinth Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Labyrinth Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Labyrinth Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Labyrinth Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Labyrinth Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Labyrinth Canyon Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Labyrinth Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.

- That portion of Emery County's official transportation map which shows all County B and D roads in the Labyrinth Canyon Region is considered to be part of Emery County's plan specifically applicable to the Labyrinth Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Labyrinth Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Labyrinth Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Labyrinth Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Labyrinth Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Labyrinth Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Labyrinth Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Labyrinth Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Labyrinth Canyon Region

SECTION 10- Manage the Labyrinth Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Labyrinth Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as

mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.

- Land management policies and standards on BLM land in the Labyrinth Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Labyrinth Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Labyrinth Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Labyrinth Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Labyrinth Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Labyrinth Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Labyrinth Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandates in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing The Lower Green Area of Critical Environmental Concern ("ACEC") Designation Would Contradict Emery County's Plan For Managing The Labyrinth Canyon Region

- It is Emery County's policy that no part of the Labyrinth Canyon Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of May 4, 2007, none of the ACEC alternatives exclusive to Alternative E in the Price Resource Management Plan ("RMP") revision process meets Emery County's above-stated ACEC planning criteria

SECTION 13- Including Any River Segment in the Labyrinth Canyon Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Labyrinth Canyon Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.

- It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Labyrinth Canyon Region that meets the above criteria. Hence, no river segment in the Labyrinth Canyon Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Labyrinth Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Labyrinth Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Labyrinth Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Labyrinth Canyon Region.
- Emery County's foregoing plan clarification for the Labyrinth Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.8 Limestone Cliffs

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "LIMESTONE CLIFFS REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Limestone Cliffs region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE LIMESTONE CLIFFS REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

Limestone Cliffs located in:

T24S R6E - Sections 18, 19, 30, and 31

T25S R6E - Section 6

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Limestone Cliffs located in parts of:

T24S R6E - Sections 18, 19, 30, and 31

T25S R6E - Section 6

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Limestone Cliffs Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Limestone Cliffs Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Limestone

Cliffs Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Limestone Cliffs Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Limestone Cliffs Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Limestone Cliffs Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Limestone Cliffs Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Limestone Cliffs Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Limestone Cliffs Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Limestone Cliffs Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Limestone Cliffs Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Limestone Cliffs Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Limestone Cliffs Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Limestone Cliffs Region, acting in good faith and not to circumvent the intent of

the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.

- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Limestone Cliffs Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Limestone Cliffs Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Limestone Cliffs Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Limestone Cliffs Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Limestone Cliffs Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Limestone Cliffs Region.
- Where water resources in the Limestone Cliffs Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Limestone Cliffs Region watershed is to deter unauthorized cross-country OHV use in the Limestone Cliffs Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Limestone Cliffs Region on which to legitimately operate their OHVs. Closing the Limestone Cliffs Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Limestone Cliffs Region watershed.
- Accordingly, all trails in the Limestone Cliffs Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Limestone Cliffs Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Limestone Cliffs Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Limestone Cliffs Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Limestone Cliffs Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Limestone Cliffs Region.
- Any segment of society, for that matter, who want to recreate in the Limestone Cliffs Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Limestone Cliffs Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Limestone Cliffs Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Limestone Cliffs Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Limestone Cliffs Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Limestone Cliffs Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Limestone Cliffs Region that have been designated open to OHV use by the 2003 BLM Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Limestone Cliffs Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Limestone Cliffs Region is considered to be part of Emery County's plan specifically applicable to the Limestone Cliffs Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Limestone Cliffs Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Limestone Cliffs Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Limestone Cliffs Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Limestone Cliffs Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Limestone Cliffs Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Limestone Cliffs Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Limestone Cliffs Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Limestone Cliffs Region

SECTION 10- Manage the Limestone Cliffs Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Limestone Cliffs Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.

- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Limestone Cliffs Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Limestone Cliffs Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Limestone Cliffs Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Limestone Cliffs Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Limestone Cliffs Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Limestone Cliffs Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Limestone Cliffs Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- NA. There are no ACEC's proposed within the Limestone Cliffs Region

SECTION 13- There are no river segments nominated for Wild and Scenic River designation within the Limestone Cliffs Region

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Limestone Cliffs Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Limestone Cliffs Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Limestone Cliffs Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Limestone Cliffs Region.
- Emery County's foregoing plan clarification for the Limestone Cliffs Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.9 Lost Springs Wash

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "LOST SPRINGS WASH REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Never Sweat Wash region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE LOST SPRINGS WASH REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Lost Springs Wash Region

T19S R13E - Sections 1, 8, 12, 13, 14, 15, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, and 35.

T19S R14E - Sections 5, 6, 7, 8, 9, 17, 18, 19, 20, 21, 28, 29, 30, 31, 33, and 34

T20S R13E - Sections 1, 3, 10, 11, 12, 13, 14, 23, 24, and 25

T20S R14E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 33, and 34

T21S R14E - Section 3

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Lost Springs Wash Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Lost Springs Wash Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Lost Springs Wash Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Lost Springs Wash Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Lost Springs Wash Region is an important part of the economy of Emery County.
- There are current, active solid, fluid and gaseous mineral leases and claims in the Lost Springs Wash Region that are in different phases of development. Emery County recognizes these existing claims and leases and will utilize the existing planning and zoning clearance process on these sites to ensure the needs of all county residents are met.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Lost Springs Wash Region should be seriously considered for development.

- Lands shown to have reasonable mineral potential in the Lost Springs Wash Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Lost Springs Wash Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Lost Springs Wash Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Lost Springs Wash Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Lost Springs Wash Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Lost Springs Wash Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Lost Springs Wash Region as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Lost Springs Wash Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Lost Springs Wash Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Lost Springs Wash Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Lost Springs Wash Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Lost Springs Wash Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Lost Springs Wash Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain, and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Lost Springs Wash Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Lost Springs Wash Region.
- Where water resources in the Lost Springs Wash Region have diminished because once-existing grasses or other species have succeeded to Tamarisk, Russian Olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Lost Springs Wash Region watershed is to deter unauthorized cross-country OHV use in the Lost Springs Wash Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Lost Springs Wash Region on which to legitimately operate their OHVs. Closing the Lost Springs Wash Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Lost Springs Wash Region watershed.
- Accordingly, all trails in the Lost Springs Wash Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Lost Springs Wash Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Lost Springs Wash Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Lost Springs Wash Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Lost Springs Wash Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not

be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Lost Springs Wash Region.

- Any segment of society, for that matter, who want to recreate in the Lost Springs Wash Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Lost Springs Wash Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Lost Springs Wash Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Lost Springs Wash Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Lost Springs Wash Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Lost Springs Wash Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Lost Springs Wash Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Lost Springs Wash Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Lost Springs Wash Region is considered to be part of Emery County's plan specifically applicable to the Lost Springs Wash Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Lost Springs Wash Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.

- Additional roads and trails may be needed in the Lost Springs Wash Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Lost Springs Wash Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Lost Springs Wash Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Lost Springs Wash Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Lost Springs Wash Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Lost Springs Wash Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Private Property Rights - N/A There is no private property within or adjacent to the Lost Springs Wash Region

SECTION 10- Manage the Lost Springs Wash Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Lost Springs Wash Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Lost Springs Wash Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Lost Springs Wash Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Lost Springs Wash Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Lost Springs Wash Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Lost Springs Wash Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Lost Springs Wash Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Lost Springs Wash Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing "Big Hole", "Cottonwood Creek" and "Smith Cabin" Areas of Critical Environmental Concern ("ACEC") Designation Must Be Consistent With Emery County's Plan For Managing The Lost Springs Wash Region

- It is Emery County's policy that no part of the Lost Springs Wash Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to

specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.

- The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
- The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

However, Emery County is supportive of ACEC's in the Lost Springs Wash Region, provided that the above conditions are met. Any other ACEC alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Lost Springs Wash Region.

SECTION 13- Including Any River Segment in the Lost Springs Wash Region, Specifically the Segment Known as Cottonwood Wash, in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Lost Springs Wash Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.

- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Lost Springs Wash Region that meets the above criteria, including Cottonwood Wash. Hence, no river segment in the Lost Springs Wash Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Lost Springs Wash Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Lost Springs Wash Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Lost Springs Wash Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Lost Springs Wash Region.
- Emery County's foregoing plan clarification for the Lost Springs Wash Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.10 Mexican Mountain

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "MEXICAN MOUNTAIN REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Mexican Mountain region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE MEXICAN MOUNTAIN REGION OF THE COUNTY
SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in ---------Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

Mexican Mountain located in:

T19S R11E - Sections 25, 26, 28, 29, 33, 34, 35, and 36

T19S R12E - Sections 19, 30, 31, 32, 33, 34, 35, and 36

T19S R13E - Sections 29, 30, 31, 32, and 33

T20S R11E - Sections 2, 3, 4, 10, 11, 13, 14, 24, 33, and 36

T20S R12E - Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 29, and 30

T20S R13E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 23, 24, 25, 26, and 36

T20S R14E - Section 31

T21S R11E - Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, and 26

T21S R12E - Sections 4, 5, 8, 9, 10, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, and 36

T21S R13E - Sections 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 32, 33, 34, 35, and 36

T21S R14E - Sections 20 and 31

T22S R12E - Sections 1, 2, 3, 4, 10, 11, and 12

This plan clarification also applies to all other areas of land located in any townships and ranges of Mexican Mountain Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Mexican Mountain located in parts of:

T19S R11E - Sections 28, 29, and 33

T19S R13E - Sections 29, 30, 31, and 33

T20S R11E - Sections 3, 4, 10, 11, 13, 14, 15, 23, 24, 25, and 33

T20S R12E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 29, 30, and 31

T20S R13E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 23, 25, and 26

T20S R14E - Section 31

T21S R11E - Sections 1, 3, 4, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, and 26

T21S R12E - Sections 4, 5, 8, 9, 10, 13, 14, 15, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, and 35

T21S R13E - Sections 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 32, 33, 34, 35, and 36

T21S R14E - Sections 5 and 31

T22S R12E - Sections 1, 3, 4, 10, and 11

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Mexican Mountain Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Mexican Mountain Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Mexican Mountain Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Mexican Mountain Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Mexican Mountain Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Mexican Mountain Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Mexican Mountain Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Mexican Mountain Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.

- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Mexican Mountain Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Mexican Mountain Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Mexican Mountain Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Mexican Mountain Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Mexican Mountain Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Mexican Mountain Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Mexican Mountain Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Mexican Mountain Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Mexican Mountain Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Mexican Mountain Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Mexican Mountain Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River

drainage area is changing, it is important now more than ever that management practices be employed in the Mexican Mountain Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Mexican Mountain Region.

- Where water resources in the Mexican Mountain Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Mexican Mountain Region watershed is to deter unauthorized cross-country OHV use in the Mexican Mountain Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Mexican Mountain Region on which to legitimately operate their OHVs. Closing the Mexican Mountain Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Mexican Mountain Region watershed.
- Accordingly, all trails in the Mexican Mountain Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Mexican Mountain Region.

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Mexican Mountain Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Mexican Mountain Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Mexican Mountain Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Mexican Mountain Region.
- Any segment of society, for that matter, who want to recreate in the Mexican Mountain Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They

should not have to hike into the outdoor recreational destinations in the Mexican Mountain Region if they do not want to or are physically unable or cannot afford such an activity.

- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Mexican Mountain Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Mexican Mountain Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Mexican Mountain Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Mexican Mountain Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Mexican Mountain Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Mexican Mountain Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Mexican Mountain Region is considered to be part of Emery County's plan specifically applicable to the Mexican Mountain Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Mexican Mountain Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Mexican Mountain Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Mexican Mountain Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Mexican Mountain Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Mexican Mountain Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Mexican Mountain Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Mexican Mountain Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Mexican Mountain Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the Mexican Mountain Region.
- Land management policies and standards on BLM land in the Mexican Mountain Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10 - Manage the Mexican Mountain Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Mexican Mountain Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Mexican Mountain Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Mexican Mountain Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Mexican Mountain Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Mexican Mountain Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Mexican Mountain Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Mexican Mountain Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Mexican Mountain Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Any of The Area of Critical Environmental Concern ("ACEC") Designation Alternatives Currently Under Consideration in the Price Resource Management Plan Revision Process, Would Contradict Emery County's Plan For Managing The Mexican Mountain Region

- It is Emery County's policy that no part of the Mexican Mountain Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to

specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.

- The proposed ACEC is limited only to areas that are already developed or used.
- The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of April 15, 2007, none of the ACEC alternatives being considered in the Price Resource Management Plan ("RMP") revision process meets Emery County's above-stated ACEC planning criteria.

However, Emery County is supportive of an ACEC in the Mexican Mountain area, known as the San Rafael Canyon Lower ACEC, provided that the ACEC designation and future management are limited in scope to the specific resources that are identified in the ACEC designation. Furthermore, Emery County opposes any effort to use ACEC designation to manage lands as "de-facto wilderness". Any other ACEC alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Mexican Mountain Region.

SECTION 13- Including Any River Segment in the Mexican Mountain Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Mexican Mountain Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.

- It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Mexican Mountain Region that meets the above criteria. Hence, no river segment in the Mexican Mountain Region should be included in the National Wild and Scenic River System.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Mexican Mountain Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Mexican Mountain Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Mexican Mountain Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Mexican Mountain Region.
- Emery County's foregoing plan clarification for the Mexican Mountain Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.11 Molen Reef

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "MOLEN REEF REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Molen Reef region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE MOLEN REEF REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Molen Reef located in parts of:

T21S R7E - Sections 33, 34, and 35

T22S R6E - Sections 12, 13, 23, 24, 25, 26, and 35

T22S R7E - Sections 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T22S R8E - Sections 6, 7, 8, 9, 15, 17, 18, 19, 20, 21, 22, 28, 29, 30, and 31

T23S R6E - Sections 1, 12, and 13

T23S R7E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 17

T23S R8E - Sections 5 and 6

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Molen Reef Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Molen Reef Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Molen Reef

Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Molen Reef Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Molen Reef Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Molen Reef Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Molen Reef Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Molen Reef Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Molen Reef Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Molen Reef Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Molen Reef Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Molen Reef Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Molen Reef Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Molen Reef Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.

- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Molen Reef Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Molen Reef Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Molen Reef Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Molen Reef Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Molen Reef Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Molen Reef Region.
- Where water resources in the Molen Reef Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Molen Reef Region watershed is to deter unauthorized cross-country OHV use in the Molen Reef Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Molen Reef Region on which to legitimately operate their OHVs. Closing the Molen Reef Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Molen Reef Region watershed.
- Accordingly, all trails in the Molen Reef Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Molen Reef Region.

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Molen Reef Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Molen Reef Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Molen Reef Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Molen Reef Region.
- Any segment of society, for that matter, who want to recreate in the Molen Reef Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Molen Reef Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Molen Reef Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Molen Reef Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Molen Reef Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Molen Reef Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Molen Reef Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Molen Reef Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Molen Reef Region is considered to be part of Emery

County's plan specifically applicable to the Molen Reef Region. All such public roads are shown in the attached official map.

- Emery County plans to keep all such roads in the Molen Reef Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Molen Reef Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Molen Reef Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Molen Reef Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Molen Reef Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Molen Reef Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Molen Reef Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Molen Reef Region So As to Not Interfere With The Property Rights of Private Landowners Located Adjacent to That Region

- There are parcels of private fee land located adjacent to the Molen Reef Region.
- Land management policies and standards on BLM land in the Molen Reef Region should not interfere with the property rights of private landowners adjacent to the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the Molen Reef Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Molen Reef Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Molen Reef Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Molen Reef Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Molen Reef Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Molen Reef Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Molen Reef Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Molen Reef Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Molen Reef Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references

or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing The Expanded Areas of Critical Environmental Concern ("ACEC") in Alternative E Would Contradict Emery County's Plan For Managing The Molen Reef Region

- It is Emery County's policy that no part of the Molen Reef Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- NA. There are no river segments within the Molen Reef Region which have been nominated for Wild and Scenic River Designation.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Molen Reef Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Molen Reef Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Molen Reef Region.

- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Molen Reef Region.
- Emery County's foregoing plan clarification for the Molen Reef Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.12 Muddy Creek/Crack Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "MUDDY CREEK/CRACK CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Muddy Creek/Crack Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE MUDDY CREEK/CRACK CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

T23S R7E - Sections 25, 26, 34, 35, and 36

T23S R8E - Sections 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, and 36

T23S R9E - Sections 25, 31, and 36

T24S R7E - Sections 1, 2, 3, 11, 12, 13, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36

T24S R8E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24, 25, 26, 30, 31, 32, 35, and 36

T24S R9E - Sections 5, 6, 7, 8, 18, 19, 31, 32, 33, and 36

T24S R10E - Sections 1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T24S R11E - Sections 7, 17, 18, 19, 30, 31, 32, and 33

T25S R7E - Sections 1, 2, 3, 12, 13, 14, 23, 24, and 25

T25S R8E - Sections 1, 2, 5, 6, 7, 8, 13, 16, 17, 18, 19, 20, 26, 27, 29, 30, 31, 32, 33, 34, 35, and 36

T25S R9E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, 35, and 36

T25S R10E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 28, 29, 30, 31, 32, and 36

T25S R11E - Sections 2, 3, 4, 5, 6, 7, 8, 9, 14, 15, 22, 23, 26, 27, 28, 29, 32, and 33

T26S R6E - Sections 21, 22, 23, 24, 25, 26, 27, 35, and 36

T26S R7E - Sections 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T26S R8E - Sections 1, 2, 3, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T26S R9E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, and 34

T26S R10E - Sections 1, 2, 3, 4, 5, 8, 9, 10, and 16

T26S R11E - Sections 5 and 6

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T23S R7E - Sections 25, 26, 34, and 35

T23S R8E - Sections 22, 23, 25, 26, 27, 30, 31, 33, 34, and 35

T23S R9E - Sections 25 and 31

T24S R7E - Sections 1, 3, 11, 12, 13, 22, 23, 24, 25, 26, 27, 28, 34, and 35

T24S R8E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25, 26, 30, 31, and 35

T24S R9E - Sections 5, 6, 7, 8, 18, 19, 24, 25, 26, 31, and 35

T24S R10E - Sections 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T24S R11E - Sections 7, 17, 18, 19, 20, 29, 30, and 31

T25S R7E - Sections 1, 3, 13, 14, 23, 24, and 25

T25S R8E - Sections 1, 5, 6, 7, 8, 13, 17, 18, 19, 20, 26, 27, 29, 30, 31, 33, 34, and 35

T25S R9E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, and 35

T25S R10E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 28, 29, 30, 31, and 35

T25S R11E - Sections 3, 4, 5, 6, 7, 8, 9, 14, 15, 18, 22, 23, 27, 28, 29, 32, and 33

T26S R6E - Sections 21, 22, 23, 24, 25, 26, 27, and 35

T26S R7E - Sections 3, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

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T26S R9E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, and 34

T26S R10E - Sections 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, and 19

T26S R11E - Sections 5, 6, 7, 8, and 18

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Muddy Creek/Crack Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Muddy Creek/Crack Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Muddy Creek/Crack Canyon Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Muddy Creek/Crack Canyon Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Muddy Creek/Crack Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Muddy Creek/Crack Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Muddy Creek/Crack Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.

- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Muddy Creek/Crack Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Muddy Creek/Crack Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Muddy Creek/Crack Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Muddy Creek/Crack Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Muddy Creek/Crack Canyon Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Muddy Creek/Crack Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Muddy Creek/Crack Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Muddy Creek/Crack Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Muddy Creek/Crack Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Muddy Creek/Crack Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.

- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Muddy Creek/Crack Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Muddy Creek/Crack Canyon Region.
- Where water resources in the Muddy Creek/Crack Canyon Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Muddy Creek/Crack Canyon Region watershed is to deter unauthorized cross-country OHV use in the Muddy Creek/Crack Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Muddy Creek/Crack Canyon Region on which to legitimately operate their OHVs. Closing the Muddy Creek/Crack Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Muddy Creek/Crack Canyon Region watershed.
- Accordingly, all trails in the Muddy Creek/Crack Canyon Region which have been designated open to OHV use in 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Muddy Creek/Crack Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Muddy Creek/Crack Canyon Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Muddy Creek/Crack Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Muddy Creek/Crack Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Muddy Creek/Crack Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Muddy Creek/Crack Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they

desire it. They should not have to hike into the outdoor recreational destinations in the Muddy Creek/Crack Canyon Region if they do not want to or are physically unable or cannot afford such an activity.

- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Muddy Creek/Crack Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Muddy Creek/Crack Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Muddy Creek/Crack Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Muddy Creek/Crack Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All motorized trails in the Muddy Creek/Crack Canyon Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Muddy Creek/Crack Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Muddy Creek/Crack Canyon Region is considered to be part of Emery County's plan specifically applicable to the Muddy Creek/Crack Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Muddy Creek/Crack Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Muddy Creek/Crack Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Muddy Creek/Crack Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Muddy Creek/Crack Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Muddy Creek/Crack Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Muddy Creek/Crack Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Muddy Creek/Crack Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA There is no private land within or adjacent to the Muddy Creek/Crack Canyon Region

SECTION 10- Manage the Muddy Creek/Crack Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Muddy Creek/Crack Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Muddy Creek/Crack Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Muddy Creek/Crack Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Muddy Creek/Crack Canyon Region.

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Muddy Creek/Crack Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public

lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Muddy Creek/Crack Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Muddy Creek/Crack Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.

- A so-called "wilderness characteristics" management standard for the Muddy Creek/Crack Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Mussentuchit Badlands Area of Critical Environmental Concern ("ACEC") Designation, Would Contradict Emery County's Plan For Managing The Muddy Creek/Crack Canyon Region

- It is Emery County's policy that no part of the Muddy Creek/Crack Canyon Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping

operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.

- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as --------- County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of (month) (date), 2007, none of the ACEC alternatives being considered in the Vernal Resource Management Plan ("RMP") revision process meets --------- County's above-stated ACEC planning criteria.

SECTION 13- Including Any River Segment in the Muddy Creek/Crack Canyon Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Muddy Creek/Crack Canyon Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
  - The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
  - It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
  - It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Muddy Creek/Crack Canyon Region that meets the above criteria. Hence, no river segment in the Muddy Creek/Crack Canyon Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Muddy Creek/Crack Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Muddy Creek/Crack Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Muddy Creek/Crack Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Muddy Creek/Crack Canyon Region.
- Emery County's foregoing plan clarification for the Muddy Creek/Crack Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.13 Mussentuchit Badlands

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "MUSSENTUCHIT BADLANDS REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Mussentuchit Badlands region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE MUSSENTUCHIT BADLANDS REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

T24S R6E - Sections 13, 14, 15, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T24S R7E - Sections 17, 18, 19, 20, 29, 30, 31, and 32

T25S R6E - Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, and 27

T25S R7E - Sections 5, 6, 7, 18, and 19

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T24S R6E - Sections 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T24S R7E - Sections 17, 18, 19, 29, 30, and 31

T25S R6E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 20, 21, 22, 23, 24, 25, 26, and 27

T25S R7E - Sections 5, 6, 7, 18, and 19

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Mussentuchit Badlands Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Mussentuchit Badlands Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Mussentuchit Badlands Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Mussentuchit Badlands Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Mussentuchit Badlands Region is an important part of the economy of Emery County.

- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Mussentuchit Badlands Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Mussentuchit Badlands Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Mussentuchit Badlands Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Mussentuchit Badlands Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Mussentuchit Badlands Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Mussentuchit Badlands Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Mussentuchit Badlands Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Mussentuchit Badlands Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Mussentuchit Badlands Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Mussentuchit Badlands Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Mussentuchit Badlands Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Mussentuchit Badlands Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Mussentuchit Badlands Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Mussentuchit Badlands Region.
- Emery County's strategy and plan for protecting the Mussentuchit Badlands Region watershed is to deter unauthorized cross-country OHV use in the Mussentuchit Badlands Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Mussentuchit Badlands Region on which to legitimately operate their OHVs. Closing the Mussentuchit Badlands Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Mussentuchit Badlands Region watershed.
- Accordingly, all trails in the Mussentuchit Badlands Region which have been designated open to OHV use by the 2003 BLM San Rafael Designated Route Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Mussentuchit Badlands Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Mussentuchit Badlands Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Mussentuchit Badlands Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Mussentuchit Badlands Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Mussentuchit Badlands Region.

- Any segment of society, for that matter, who want to recreate in the Mussentuchit Badlands Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Mussentuchit Badlands Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Mussentuchit Badlands Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Mussentuchit Badlands Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Mussentuchit Badlands Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Mussentuchit Badlands Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Mussentuchit Badlands Region that have been designated open to OHV use by the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the _____Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Mussentuchit Badlands Region is considered to be part of Emery County's plan specifically applicable to the Mussentuchit Badlands Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Mussentuchit Badlands Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Mussentuchit Badlands Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Mussentuchit Badlands Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Mussentuchit Badlands Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Mussentuchit Badlands Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Mussentuchit Badlands Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Mussentuchit Badlands Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA

SECTION 10- Manage the Mussentuchit Badlands Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Mussentuchit Badlands Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
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- As Utah Code § 63-38d-401(6)(b) indicates, managing the Mussentuchit Badlands Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Mussentuchit Badlands

Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Mussentuchit Badlands Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.

- A so-called "wilderness characteristics" management standard for the Mussentuchit Badlands Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

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  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.

- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- NA

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Mussentuchit Badlands Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Mussentuchit Badlands Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Mussentuchit Badlands Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Mussentuchit Badlands Region.
- Emery County's foregoing plan clarification for the Mussentuchit Badlands Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.14 Never Sweat Wash

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "NEVER SWEAT WASH REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Never Sweat Wash region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;
NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES

THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE NEVER SWEAT WASH REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Never Sweat Wash, located in parts of:

T17S R13E - Sections 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T18S R13E - Sections 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T18S R14E - Sections 7, 8, 15, 17, 18, 19, 20, 21, 22, 28, 29, 30, 31, and 33

T19S R13E - Sections 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, and 15

T19S R14E - Sections 5, 6, and 7

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Never Sweat Wash Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Never Sweat Wash Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Never Sweat Wash Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Never Sweat Wash Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Never Sweat Wash Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Never Sweat Wash Region should be seriously considered for development.

- Lands shown to have reasonable mineral potential in the Never Sweat Wash Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Never Sweat Wash Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Never Sweat Wash Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Never Sweat Wash Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Never Sweat Wash Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Never Sweat Wash Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Never Sweat Wash Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Never Sweat Wash Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Never Sweat Wash Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Never Sweat Wash Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Never Sweat Wash Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Never Sweat Wash Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Never Sweat Wash Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Never Sweat Wash Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Never Sweat Wash Region.
- Where water resources in the Lost Springs Wash Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian Olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses..
- Emery County's strategy and plan for protecting the Never Sweat Wash Region watershed is to deter unauthorized cross-country OHV use in the Never Sweat Wash Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Never Sweat Wash Region on which to legitimately operate their OHVs. Closing the Never Sweat Wash Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Never Sweat Wash Region watershed.
- Accordingly, all trails in the Never Sweat Wash Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Never Sweat Wash Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Never Sweat Wash Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Never Sweat Wash Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Never Sweat Wash Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and

under privileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Never Sweat Wash Region.

- Any segment of society, for that matter, who want to recreate in the Never Sweat Wash Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Never Sweat Wash Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Never Sweat Wash Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Never Sweat Wash Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Never Sweat Wash Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Never Sweat Wash Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Never Sweat Wash Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Never Sweat Wash Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Never Sweat Wash Region is considered to be part of Emery County's plan specifically applicable to the Never Sweat Wash Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Never Sweat Wash Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Never Sweat Wash Region from time to time to facilitate reasonable access to a broad range of resources and

opportunities throughout the Never Sweat Wash Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Never Sweat Wash Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Never Sweat Wash Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Never Sweat Wash Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Never Sweat Wash Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Never Sweat Wash Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the Never Sweat Wash Region.
- Land management policies and standards on BLM land in the Never Sweat Wash Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the Never Sweat Wash Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Never Sweat Wash Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.

- Land management policies and standards on BLM land in the Never Sweat Wash Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Never Sweat Wash Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Never Sweat Wash Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Never Sweat Wash Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Never Sweat Wash Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Never Sweat Wash Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Never Sweat Wash Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- ACEC Designation

- There are no ACEC designations that affect the Never Sweat Wash Region

SECTION 13- National Wild and Scenic River System

- There are no National Wild and Scenic River System proposals that affect the Never Sweat Wash Region.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Never Sweat Wash Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Never Sweat Wash Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Never Sweat Wash Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Never Sweat Wash Region.
- Emery County's foregoing plan clarification for the Never Sweat Wash Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.15 Price River Area

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "PRICE RIVER REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Price River region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Lands Department;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE PRICE RIVER REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Northern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T16S R11E - Sections 11, 12, 13, 14, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, and 35

T16S R12E - Sections 6, 7, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T16S R13E - Sections 18, 19, 20, 28, 29, 30, 31, 33, and 34

T17S R11E - Sections 1, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 22, 23, 24, 25, 26, 28, 29, 33, and 34

T17S R12E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T17S R13E - Sections 3, 4, 5, 6, 7, 8, 9, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, and 31

T18S R11E - Sections 1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 23, 24, 25, and 26

T18S R12E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 33, 34, and 35

T18S R13E - Sections 5, 6, 7, and 8

T19S R12E - Sections 4 and 5

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Price River Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Price River Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Price River Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Price River Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Price River Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.

- All available solid, fluid and gaseous mineral resources in the Price River Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Price River Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Price River Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Price River Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Price River Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Price River Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Price River Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Price River Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Price River Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Price River Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Price River Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Price River Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain, and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Price River Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Price River Region.
- Where water resources in the Price River Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Price River Region watershed is to deter unauthorized cross-country OHV use in the Price River Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Price River Region on which to legitimately operate their OHVs. Closing the Price River Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Price River Region watershed.
- Accordingly, all trails in the Price River Region which historically have been open to OHV use should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Price River Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Price River Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Price River Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Price River Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Price River Region.
- Any segment of society, for that matter, who want to recreate in the Price River Region are entitled to motorized access to that recreation if they desire it, and are

entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Price River Region if they do not want to or are physically unable or cannot afford such an activity.

- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Price River Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Price River Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Price River Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Price River Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Price River Region that have been open to OHV use should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Price River Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Price River Region is considered to be part of Emery County's plan specifically applicable to the Price River Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Price River Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Price River Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Price River Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Price River Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Price River Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Price River Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Price River Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Price River Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the Price River Region.
- Land management policies and standards on BLM land in the Price River Region should not interfere with the property rights of private landowners in, or adjacent to, the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the Price River Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Price River Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Priced River Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Price River Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Price River Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Price River Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Price River Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Price River Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Price River Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Any of The Area of Critical Environmental Concern ("ACEC") Designation Alternatives Currently Under Consideration in the Price Resource Management Plan Revision Process, Would Contradict -------- County's Plan For Managing The ---------- Region

- It is Emery County's policy that no part of the Price River Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.

- The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of (month) (date), 2007, none of the ACEC alternatives being considered in the Vernal Resource Management Plan ("RMP") revision process meets --------- County's above-stated ACEC planning criteria.
- **[OPTIONAL: However, --------- County is supportive of an ACEC in the --------- -------- area, located in Sections ---, ---, ---, --, Township -- South, Range -- East, provided that ---------- . Any other ACEC alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of --------- County for managing the ---------- Region.]**

SECTION 13- Including Any River Segment in the Price River Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Price River Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rational and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
  - The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.

- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Price River Region that meets the above criteria. Hence, no river segment in the Price River Region should be included in the National Wild and Scenic River system.
- As of May 1, 2007, the terms prescribed in any of the alternatives being considered in the proposed revised Vernal RMP for managing proposed wild and scenic river segments in Nine Mile Creek or any other segment in the ---------- Region ---------- Region, constitute de facto wilderness management by another name. They are incompatible with and would therefore frustrate and defeat the foregoing plans of --------- County for managing Nine Mile Creek or any other segment in the ---------- Region.
- **[OPTIONAL: --------- County is supportive of a Wild and Scenic River designation for the ------- ------- [creek / river] located in Sections ---, ---, ---, ---, Township -- South, Range -- East, provided that ---------- . Any other Wild and Scenic River alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of --------- County for managing the ---------- Region.]**

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Price River Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Price River Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Price River Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Price River Region.
- Emery County's foregoing plan clarification for the Price River Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.16 Rock Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "ROCK CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Rock Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE ROCK CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T23S R6E - Sections 14, 15, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 33, 34, and 35

T24S R6E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, and 21

T24S R7E - Sections 7, 17, and 18

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Rock Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Rock Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Rock Canyon Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Rock Canyon Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Rock Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Rock Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Rock Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Rock Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Rock Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Rock Canyon Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Rock Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Rock Canyon Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the ---------- Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Rock Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Rock Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Rock Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Rock Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Rock Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Rock Canyon Region.
- Where water resources in the Rock Canyon Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Rock Canyon Region watershed is to deter unauthorized cross-country OHV use in the Rock Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Rock Canyon Region on which to legitimately operate their OHVs. Closing the Rock Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Rock Canyon Region watershed.
- Accordingly, all trails in the Rock Canyon Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Rock Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Rock Canyon Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Rock Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Rock Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred

form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Rock Canyon Region.

- Any segment of society, for that matter, who want to recreate in the Rock Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Rock Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Rock Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Rock Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Rock Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Rock Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Rock Canyon Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Rock Canyon Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Rock Canyon Region is considered to be part of Emery County's plan specifically applicable to the Rock Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Rock Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Rock Canyon Region from time to time to facilitate reasonable access to a broad range of resources and

opportunities throughout the Rock Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Rock Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Rock Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Rock Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Rock Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There is no private property within or adjacent to the Rock Canyon Region

SECTION 10- Manage the Rock Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Rock Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Rock Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Rock Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The

State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Rock Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Rock Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Rock Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Rock Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Rock Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Mussentuchit Badlands Area of Critical Environmental Concern ("ACEC") Designation Would Contradict Emery County's Plan For Managing The Rock Canyon Region

- It is Emery County's policy that no part of the Rock Canyon Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.

- The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
- The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- NA

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Rock Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Rock Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the Rock Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Rock Canyon Region.
- Emery County's foregoing plan clarification for the Rock Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.17 <u>San Rafael Knob</u>

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "SAN RAFAEL KNOB REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the San Rafael Knob region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE SAN RAFAEL KNOB REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to areas of land located in any townships and ranges of South Central Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

San Rafael Knob, located in parts of:

T22S R10E - Section 31

T23S R9E - Sections 1, 3, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 34, and 35

T23S R10E -Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 30, and 31

T24S R9E - Sections 1, 3, 4, and 5

T24S R10E - Sections 5 and 6

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "San Rafael Knob Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "San Rafael Knob Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the San Rafael Knob Region. These policies are intended to supplement the general plan policies that apply county-wide.

Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The San Rafael Knob Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the San Rafael Knob Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the San Rafael Knob Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the San Rafael Knob Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the San Rafael Knob Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the San Rafael Knob Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The San Rafael Knob Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the San Rafael Knob Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the San Rafael Knob Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the San Rafael Knob Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the San Rafael Knob Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the San Rafael Knob Region should be temporary and scientifically based on rangeland conditions.

- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the San Rafael Knob Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The San Rafael Knob Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the San Rafael Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the San Rafael Knob Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the San Rafael Knob Region.
- Where water resources in the San Rafael Knob Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the San Rafael Knob Region watershed is to deter unauthorized cross-country OHV use in the San Rafael Knob Region. The best way to achieve this is to give OHV users a reasonable system of trails in the San Rafael Knob Region on which to legitimately operate their OHVs. Closing the San Rafael Knob Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the San Rafael Knob Region watershed.
- Accordingly, all trails in the San Rafael Knob Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The San Rafael Knob Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the San Rafael Knob Region, such as hunting, hiking, family

and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.

- Public land outdoor recreational access in the San Rafael Knob Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the San Rafael Knob Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the San Rafael Knob Region.
- Any segment of society, for that matter, who want to recreate in the San Rafael Knob Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the San Rafael Knob Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the San Rafael Knob Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the San Rafael Knob Region to just one form – available for those who have enough time, money and athletic ability to hike into the destinations of the San Rafael Knob Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the San Rafael Knob Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the San Rafael Knob Region that have been open to OHV use should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the San Rafael Knob Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the San Rafael Knob Region is considered to be part of Emery County's plan specifically applicable to the San Rafael Knob Region. All such public roads are shown in the attached official map.

- Emery County plans to keep all such roads in the San Rafael Knob Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the San Rafael Knob Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the San Rafael Knob Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the San Rafael Knob Region to accomplish the purposes of those lands.

SECTION 8 - Manage the San Rafael Knob Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the San Rafael Knob Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the San Rafael Knob Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA There is no private property within of adjacent to the San Rafael Knob Region.

SECTION 10- Manage the San Rafael Knob Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the San Rafael Knob Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the San Rafael Knob Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.

- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The San Rafael Knob Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The San Rafael Knob Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the San Rafael Knob Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the San Rafael Knob Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the San Rafael Knob Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the San Rafael Knob Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12

- Emery County is supportive of the Swasey's Cabin ACEC in the San Rafael Knob Region. Any other ACEC alternative would be incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the San Rafael Knob Region.

SECTION 13- NA There are no river segments within the San Rafael Knob Region nominated for Wild and Scenic River designation.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the San Rafael Knob Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the San Rafael Knob Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael Knob Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael Knob Region.
- Emery County's foregoing plan clarification for the San Rafael Knob Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.18 San Rafael Reef

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "SAN RAFAEL REEF REGION"

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the San Rafael Reef region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE SAN RAFAEL REEF REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of south central Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region,

according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T22S R11E - Sections 23, 24, 25, 26, 27, 28, 33, 34, and 35

T22S R12E - Sections 13, 14, 15, 16, 20, 21, 22, 23, 24, 26, 27, 28, 29, 33, 34, and 35

T22S R13E - Sections 3, 7, 8, 9, 10, 11, 17, 18, 19, 20, 23, 24, 25, 26, 30, 31, and 35

T22S R14E - Sections 30 and 31

T23S R10E - Section 25

T23S R11E - Sections 1, 3, 4, 11, 12, 13, 14, 15, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T23S R12E - Sections 4, 5, 8, 9, 17, 20, 21, 28, 29, and 33

T23S R13E - Sections 1, 5, 6, 11, 12, 13, and 14

T23S R14E - Sections 6, 7, and 18

T24S R10E - Sections 1 and 12

T24S R11E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 25, 26, and 27

T24S R12E - Sections 4, 5, 6, 7, 8, 9, 17, 18, 19, 20, 21, 29, and 30

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "San Rafael Reef Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "San Rafael Reef Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the San Rafael Reef Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The San Rafael Reef Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the San Rafael Reef Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the San Rafael Reef Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the San Rafael Reef Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant

resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.

- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the San Rafael Reef Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the San Rafael Reef Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The San Rafael Reef Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the San Rafael Reef Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the San Rafael Reef Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the ---------- Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the San Rafael Reef Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the San Rafael Reef Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The San Rafael Reef Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the San Rafael Reef Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.

- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the San Rafael Reef Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the San Rafael Reef Region.
- Where water resources in the San Rafael Reef Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the San Rafael Reef Region watershed is to deter unauthorized cross-country OHV use in the San Rafael Reef Region. The best way to achieve this is to give OHV users a reasonable system of trails in the San Rafael Reef Region on which to legitimately operate their OHVs. Closing the San Rafael Reef Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the San Rafael Reef Region watershed.
- Accordingly, all trails in the San Rafael Reef Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The San Rafael Reef Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the San Rafael Reef Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the San Rafael Reef Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the San Rafael Reef Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the San Rafael Reef Region.
- Any segment of society, for that matter, who want to recreate in the San Rafael Reef Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They

should not have to hike into the outdoor recreational destinations in the San Rafael Reef Region if they do not want to or are physically unable or cannot afford such an activity.

- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the San Rafael Reef Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the San Rafael Reef Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the San Rafael Reef Region for a so-called "solitude wilderness experience" or the like.

Accordingly, all roads in the San Rafael Reef Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the San Rafael Reef Region that have been designated open to OHV use in Alternative D Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation - motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the San Rafael Reef Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the San Rafael Reef Region is considered to be part of Emery County's plan specifically applicable to the San Rafael Reef Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the San Rafael Reef Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the San Rafael Reef Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the San Rafael Reef Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the San Rafael Reef Region to accomplish the purposes of those lands.

SECTION 8 - Manage the San Rafael Reef Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and

Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the San Rafael Reef Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the San Rafael Reef Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA There is no private property within or adjacent to the San Rafael Reef area

SECTION 10-

SECTION 11- Managing Part or All of The San Rafael Reef Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The San Rafael Reef Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the San Rafael Reef Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the San Rafael Reef Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the San Rafael Reef Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specify that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the San Rafael Reef Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;

- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- NA. There are no proposed ACEC's within San Rafael Reef Region in Alternative E

SECTION 13- NA. There are no river segments within the San Rafael Reef Region that have been nominated for Wild and Scenic River designation

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the San Rafael Reef Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the San Rafael Reef Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael Reef Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael Reef Region.
- Emery County's foregoing plan clarification for the San Rafael Reef Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.19 San Rafael River

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "SAN RAFAEL RIVER REGION".

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the San Rafael River region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE SAN RAFAEL RIVER REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Canyonlands Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Canyonlands Region portion of the said UWC internet web site:

T23S R13E - Sections 24 and 25

T23S R14E - Sections 8, 9, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T23S R15E - Sections 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T23S R16E - Sections 19, 20, 29, 30, 31, 33, and 34

T24S R13E - Sections 1, 11, 12, 13, 31, 33, 34, and 35

T24S R14E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 34, and 35

T24S R15E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T24S R16E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, and 33

T25S R12E - Sections 1, 11, 12, and 13

T25S R13E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 34, and 35

T25S R14E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 17, 18, 19, 20, 21, 22, 28, 29, 30, and 31

T25S R15E - Sections 1, 3, 4, 5, 6, 9, 10, 11, 12, and 15

T25S R16E - Sections 4, 5, 6, and 7

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "San Rafael River Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "San Rafael River Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the San Rafael River Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The San Rafael River Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the San Rafael River Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the San Rafael River Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the San Rafael River Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the San Rafael River Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the San Rafael River Region should be carefully evaluated for removal.

SECTION 4- Achieve and Maintain Livestock Grazing in The San Rafael River Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the San Rafael River Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the San Rafael River Region, based on an on-the-ground and scientific analysis.

- It is Emery County's plan that animal unit months in the San Rafael River Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the San Rafael River Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the San Rafael River Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The San Rafael River Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the San Rafael River Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain, and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the San Rafael River Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the San Rafael River Region.
- Where water resources in the San Rafael River Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the San Rafael River Region watershed is to deter unauthorized cross-country OHV use in the San Rafael River Region. The best way to achieve this is to give OHV users a reasonable system of trails in the San Rafael River Region on which to legitimately operate their OHVs. Closing the San Rafael River Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the San Rafael River Region watershed.
- Accordingly, all trails in the San Rafael River Region which designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The San Rafael River Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the San Rafael River Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the San Rafael River Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the San Rafael River Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the San Rafael River Region.
- Any segment of society, for that matter, who want to recreate in the San Rafael River Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the San Rafael River Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the San Rafael River Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the San Rafael River Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the San Rafael River Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the San Rafael River Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the San Rafael River Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the San Rafael River Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the San Rafael River Region is considered to be part of Emery County's plan specifically applicable to the San Rafael River Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the San Rafael River Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the San Rafael River Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the San Rafael River Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the San Rafael River Region to accomplish the purposes of those lands.

SECTION 8 - Manage the San Rafael River Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the San Rafael River Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the San Rafael River Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the San Rafael River Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the San Rafael River Region.
- Land management policies and standards on BLM land in the San Rafael River Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the San Rafael River Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the San Rafael River Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the San Rafael River Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The San Rafael River Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The San Rafael River Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the San Rafael River Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the San Rafael River Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the San Rafael River Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the San Rafael River Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;

- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Temple/Cottonwood/Dugout Area of Critical Environmental Concern ("ACEC") Would Contradict Emery County's Plan For Managing San Rafael River Region

- It is Emery County's policy that no part of the San Rafael River Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.
- As of May 4, 2007, none of the ACEC alternatives exclusive to Alternative E in the Price Resource Management Plan ("RMP") revision process meets Emery County's above-stated ACEC planning criteria

SECTION 13- Including Any River Segment in the San Rafael River Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The San Rafael River Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:

- Water is present and flowing at all times.
- The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
- BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
- It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.

There is no river segment in the San Rafael River Region that meets the above criteria. Hence, no river segment in the San Rafael River Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the San Rafael River Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the San Rafael River Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael River Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with Emery County's foregoing plan clarification for the San Rafael River Region.
- Emery County's foregoing plan clarification for the San Rafael River Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.20 South Horn Mountain Unit B

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING

POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "SOUTH HORN MOUNTAIN UNIT B REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the South Horn Mountain Unit B region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE SOUTH HORN MOUNTAIN UNIT B REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

South Horn Mountain Unit B, located in parts of:

T19S R7E - Sections 17, 20, 21, 22, 26, 27, 28, 29, 33, 34, and 35

T20S R6E - Section 1

T20S R7E - Sections 4, 5, 6, and 7

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "South Horn Mountain Unit B Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "South Horn Mountain Unit B Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the South Horn Mountain Unit B Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The South Horn Mountain Unit B Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the South Horn Mountain Unit B Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the South Horn Mountain Unit B Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the South Horn Mountain Unit B Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the South Horn Mountain Unit B Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the South Horn Mountain Unit B Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The South Horn Mountain Unit B Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the South Horn Mountain Unit B Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the South Horn Mountain Unit B Region, based on an on-the-ground and scientific analysis.

- Emery County regards the land which comprises the grazing districts and allotments in the South Horn Mountain Unit B Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the South Horn Mountain Unit B Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the South Horn Mountain Unit B Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the South Horn Mountain Unit B Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the South Horn Mountain Unit B Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve not converted to wildlife use.

SECTION 5 - Manage the Watershed in The South Horn Mountain Unit B Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the South Horn Mountain Unit B Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the South Horn Mountain Unit B Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the South Horn Mountain Unit B Region.
- Where water resources in the Lost Springs Wash Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses..
- Emery County's strategy and plan for protecting the South Horn Mountain Unit B Region watershed is to deter unauthorized cross-country OHV use in the South Horn Mountain Unit B Region. The best way to achieve this is to give OHV users a

reasonable system of trails in the South Horn Mountain Unit B Region on which to legitimately operate their OHVs. Closing the South Horn Mountain Unit B Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the South Horn Mountain Unit B Region watershed.

- Accordingly, all trails in the South Horn Mountain Unit B Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The South Horn Mountain Unit B Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the South Horn Mountain Unit B Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the South Horn Mountain Unit B Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the South Horn Mountain Unit B Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the South Horn Mountain Unit B Region.
- Any segment of society, for that matter, who want to recreate in the South Horn Mountain Unit B Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the South Horn Mountain Unit B Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the South Horn Mountain Unit B Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the South Horn Mountain Unit B Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the South Horn Mountain Unit B Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the South Horn Mountain Unit B Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the South Horn Mountain Unit B Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping,

group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the South Horn Mountain Unit B Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the South Horn Mountain Unit B Region is considered to be part of Emery County's plan specifically applicable to the South Horn Mountain Unit B Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the South Horn Mountain Unit B Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the South Horn Mountain Unit B Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the South Horn Mountain Unit B Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the South Horn Mountain Unit B Region to accomplish the purposes of those lands.

SECTION 8 - Manage the South Horn Mountain Unit B Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the South Horn Mountain Unit B Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the South Horn Mountain Unit B Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the South Horn Mountain Unit B Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the South Horn Mountain Unit B Region.
- Land management policies and standards on BLM land in the South Horn Mountain Unit B Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.
- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the South Horn Mountain Unit B Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the South Horn Mountain Unit B Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the South Horn Mountain Unit B Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The South Horn Mountain Unit B Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The South Horn Mountain Unit B Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the South Horn Mountain Unit B Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the South Horn Mountain Unit B Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the South Horn Mountain Unit B Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.

- A so-called "wilderness characteristics" management standard for the South Horn Mountain Unit B Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- ACEC Designation

- There are no ACEC designations that affect the South Horn Mountain Unit B Region

SECTION 13- National Wild and Scenic River System

- There are no National Wild and Scenic River System proposals that affect the South Horn Mountain Unit B Region

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the South Horn Mountain Unit B Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the South Horn Mountain Unit B Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the South Horn Mountain Unit B Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the South Horn Mountain Unit B Region.
- Emery County's foregoing plan clarification for the South Horn Mountain Unit B Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.21 Sweetwater Reef

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING

POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "SWEETWATER REEF REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Sweetwater Reef region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE SWEETWATER REEF REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Canyonlands Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Canyonlands Region portion of the said UWC internet web site:

T25S R14E - Sections 22, 23, 25, 26, 27, 28, 29, 31, 33, 34, and 35

T25S R15E - Sections 13, 14, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 33, 34, and 35

T25S R16E - Sections 5, 6, 7, 8, 9, 17, 18, 19, 20, 21, 28, 29, 30, 31, and 33

T26S R13E - Sections 13 and 24

T26S R14E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T26S R15E - Sections 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, and 35

T26S R16E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 29, 30, and 31

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Sweetwater Reef Region," and are illustrated more fully in

the official map attached hereto. Any reference hereafter to the term "Sweetwater Reef Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Sweetwater Reef Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The SWEETWATER REEF Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Sweetwater Reef Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Sweetwater Reef Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Sweetwater Reef Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Sweetwater Reef Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Sweetwater Reef Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Sweetwater Reef Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Sweetwater Reef Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Sweetwater Reef Region, based on an on-the-ground and scientific analysis.

- It is Emery County's plan that animal unit months in the Sweetwater Reef Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Sweetwater Reef Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Sweetwater Reef Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Sweetwater Reef Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Sweetwater Reef Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Sweetwater Reef Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Sweetwater Reef Region.
- Emery County's strategy and plan for protecting the Sweetwater Reef Region watershed is to deter unauthorized cross-country OHV use in the Sweetwater Reef Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Sweetwater Reef Region on which to legitimately operate their OHVs. Closing the Sweetwater Reef Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Sweetwater Reef Region watershed.
- Accordingly, all trails in the Sweetwater Reef Region which historically have been open to OHV use should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Sweetwater Reef Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Sweetwater Reef Region, such as hunting, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.

- Public land outdoor recreational access in the Sweetwater Reef Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Sweetwater Reef Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Sweetwater Reef Region.
- Any segment of society, for that matter, who want to recreate in the Sweetwater Reef Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Sweetwater Reef Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Sweetwater Reef Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Sweetwater Reef Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Sweetwater Reef Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Sweetwater Reef Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Sweetwater Reef Region that have been open to OHV use should continue to remain open. Traditional levels of wildlife hunting should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the _____Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Sweetwater Reef Region is considered to be part of Emery County's plan specifically applicable to the Sweetwater Reef Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Sweetwater Reef Region open and reasonably maintained and in good repair. Emery County will consult with the

BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.

- Additional roads and trails may be needed in the Sweetwater Reef Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Sweetwater Reef Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Sweetwater Reef Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Sweetwater Reef Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Sweetwater Reef Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Sweetwater Reef Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - There is no private property within or adjacent to Sweetwater Reef Region.

SECTION 10- Manage the Sweetwater Reef Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region.

- Scattered throughout the Sweetwater Reef Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Sweetwater Reef Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.

- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Sweetwater Reef Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Sweetwater Reef Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Sweetwater Reef Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Sweetwater Reef Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Sweetwater Reef Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Sweetwater Reef Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Temple/Cottonwood/Dugout Area of Critical Environmental Concern ("ACEC") Would Contradict Emery County's Plan For Managing The Sweetwater Reef Region

- It is Emery County's policy that no part of the Sweetwater Reef Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).

- The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
- The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
- The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
- The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
- The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.

- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- NA. There are no river segment within this region which were nominated for Wild and Scenic River consideration.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Sweetwater Reef Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Sweetwater Reef Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Sweetwater Reef Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Sweetwater Reef Region.
- Emery County's foregoing plan clarification for the Sweetwater Reef.
- Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.22 Turtle Canyon

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "TURTLE CANYON REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Turtle Canyon region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE TURTLE CANYON REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Turtle Canyon, located in parts of:

Turtle Canyon Region

T16S R14E - Sections 11, 12, 13, 14, 23, 24, and 25

T16S R15E - Sections 7, 18, 19, 30, and 31

T17S R15E - Sections 5, 6, 7, 8, 17, and 18

T17S R16E - Section 15

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Turtle Canyon Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Turtle Canyon Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Turtle Canyon

Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Turtle Canyon Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Turtle Canyon Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Turtle Canyon Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Turtle Canyon Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Turtle Canyon Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Turtle Canyon Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Turtle Canyon Region At The Highest Reasonably Sustainable Levels.

- Domestic livestock forage in the Turtle Canyon Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Turtle Canyon Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Turtle Canyon Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Turtle Canyon Region not be relinquished or retired in favor of conservation, wildlife and other uses.

- Emery County recognizes that from time to time a bona fide livestock permittee in the Turtle Canyon Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Turtle Canyon Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Turtle Canyon Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Turtle Canyon Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Turtle Canyon Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Turtle Canyon Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Turtle Canyon Region.
- Where water resources in the Turtle Canyon Region have diminished because once-existing grasses or other species have succeeded to Tamarisk, Russian Olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Turtle Canyon Region watershed is to deter unauthorized cross-country OHV use in the Turtle Canyon Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Turtle Canyon Region on which to legitimately operate their OHVs. Closing the Turtle Canyon Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Turtle Canyon Region watershed.

- Accordingly, all trails in the Turtle Canyon Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Turtle Canyon Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Turtle Canyon Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Turtle Canyon Region should not discriminate in favor of one particular mode of recreation to the exclusion of others.

  Traditionally, outdoor recreational opportunities in the Turtle Canyon Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Turtle Canyon Region.
- Any segment of society, for that matter, who want to recreate in the Turtle Canyon Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Turtle Canyon Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Turtle Canyon Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Turtle Canyon Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Turtle Canyon Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Turtle Canyon Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Turtle Canyon Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Turtle Canyon Region That Appear On Emery County's Most Recent Transportation Map,

and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time.

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Turtle Canyon Region is considered to be part of Emery County's plan specifically applicable to the Turtle Canyon Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Turtle Canyon Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Turtle Canyon Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Turtle Canyon Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Turtle Canyon Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Turtle Canyon Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Turtle Canyon Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Turtle Canyon Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Manage the Turtle Canyon Region So As to Not Interfere With The Property Rights of Private Landowners Located in That Region

- There are parcels of private fee land located in, or adjacent to, the Turtle Canyon Region.
- Land management policies and standards on BLM land in the Turtle Canyon Region should not interfere with the property rights of private landowners in the region to enjoy and engage in traditional uses and activities on their private property, consistent with controlling County zoning and land use laws.

- Nor should those landowners and their guests be denied the right of motorized access to their private property consistent with past uses of those private land parcels.

SECTION 10- Manage the Turtle Canyon Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Turtle Canyon Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as

  mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Turtle Canyon Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Turtle Canyon Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Turtle Canyon Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Turtle Canyon Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Turtle Canyon Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Turtle Canyon Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Turtle Canyon Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;

- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- ACEC Designation

- There are no ACEC designations that affect the Turtle Canyon Region

SECTION 13- Including Any River Segment in the Turtle Canyon Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Turtle Canyon Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
  - The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
  - It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
  - It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Turtle Canyon Region that meets the above criteria. Hence, no river segment in the Turtle Canyon Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Turtle Canyon Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Turtle Canyon Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Turtle Canyon Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Turtle Canyon Region.
- Emery County's foregoing plan clarification for the Turtle Canyon Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.23 Upper Muddy Creek

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "UPPER MUDDY CREEK REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Upper Muddy Creek region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE UPPER MUDDY CREEK REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

Upper Muddy Creek, located in:

T23S R6E - Sections 13, 14, 23, 24, 25, 26, 35, and 36

T23S R7E - Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, and 34

T23S R8E - Sections 6 and 7

T24S R6E - Sections 1, 2, 11, and 12

T24S R7E - Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, and 18

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Upper Muddy Creek, located in parts of:

T23S R6E - Sections 13, 14, 23, 24, 25, 26, and 35

T23S R7E - Sections 1, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, and 34

T23S R8E - Sections 6 and 7

T24S R6E - Sections 1, 11, and 12

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Upper Muddy Creek Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Upper Muddy Creek Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Upper Muddy Creek Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Upper Muddy Creek Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Upper Muddy Creek Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Upper Muddy Creek Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Upper Muddy Creek Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Upper Muddy Creek Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Upper Muddy Creek Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Upper Muddy Creek Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Upper Muddy Creek Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Upper Muddy Creek Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Upper Muddy Creek Region as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Upper Muddy Creek Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Upper Muddy Creek Region, acting in good faith and not to circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Upper Muddy Creek Region should be temporary and scientifically based on rangeland conditions.

- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Upper Muddy Creek Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Upper Muddy Creek Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Upper Muddy Creek Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Upper Muddy Creek Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Upper Muddy Creek Region.
- Where water resources in the Upper Muddy Creek Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses. Management of Pinion and Juniper species should use the best possible science, but as a rule, mechanical treatments are acceptable as a means of improving the watershed and grazing opportunities.
- Emery County's strategy and plan for protecting the Upper Muddy Creek Region watershed is to deter unauthorized cross-country OHV use in the Upper Muddy Creek Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Upper Muddy Creek Region on which to legitimately operate their OHVs. Closing the Upper Muddy Creek Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Upper Muddy Creek Region watershed.
- Accordingly, all trails in the Upper Muddy Creek Region which have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Upper Muddy Creek Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Upper Muddy Creek Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Upper Muddy Creek Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Upper Muddy Creek Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Upper Muddy Creek Region.
- Any segment of society, for that matter, who want to recreate in the Upper Muddy Creek Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Upper Muddy Creek Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Upper Muddy Creek Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Upper Muddy Creek Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Upper Muddy Creek Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Upper Muddy Creek Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Upper Muddy Creek Region that have been designated open to OHV use in the 2003 BLM San Rafael Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Upper Muddy Creek Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.

- That portion of Emery County's official transportation map which shows all County B and D roads in the Upper Muddy Creek Region is considered to be part of Emery County's plan specifically applicable to the Upper Muddy Creek Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Upper Muddy Creek Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Upper Muddy Creek Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Upper Muddy Creek Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Upper Muddy Creek Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Upper Muddy Creek Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Upper Muddy Creek Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Upper Muddy Creek Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA. There are no private lands within or adjacent to the Upper Muddy Creek Region.

SECTION 10- Manage the Upper Muddy Creek Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region

- Scattered throughout the Upper Muddy Creek Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as

mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.

- Land management policies and standards on BLM land in the Upper Muddy Creek Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Upper Muddy Creek Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Upper Muddy Creek Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Upper Muddy Creek Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Upper Muddy Creek Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Upper Muddy Creek Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Upper Muddy Creek Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- Imposing Any of The Muddy Creek Area of Critical Environmental Concern ("ACEC") Would Contradict Emery County's Plan For Managing The Upper Muddy Creek Region

- It is Emery County's policy that no part of the Upper Muddy Creek Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- Including Any River Segment in the Upper Muddy Creek Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Upper Muddy Creek Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state

as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.

- The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
- It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
- It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.

- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Upper Muddy Creek Region that meets the above criteria. Hence, no river segment in the Upper Muddy Creek Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Upper Muddy Creek Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Upper Muddy Creek Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Upper Muddy Creek Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Upper Muddy Creek Region.
- Emery County's foregoing plan clarification for the Upper Muddy Creek Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.24 Wildcat Knolls Extension Unit B

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "WILDCAT KNOLLS EXTENSION UNIT B REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Wildcat Knolls Extension Unit B region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE WILDCAT KNOLLS EXTENSION UNIT B REGION OF THE COUNTY

SECTION 1 - Subject Lands

This plan clarification applies to all areas of land located in any townships and ranges of Southeastern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called Book Cliffs Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the Book Cliffs Region portion of the said UWC internet web site:

Wildcat Knolls Extension Unit B, located in parts of:

Wildcat Knolls Extension Unit B Region

T22S R6E - Sections 6 and 7

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Wildcat Knolls Extension Unit B Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Wildcat Knolls Extension Unit B Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Wildcat Knolls Extension Unit B Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Wildcat Knolls Extension Unit B Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Wildcat Knolls Extension Unit B Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Wildcat Knolls Extension Unit B Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Wildcat Knolls Extension Unit B Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Wildcat Knolls Extension Unit B Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary, where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.
- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Wildcat Knolls Extension Unit B Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Wildcat Knolls Extension Unit B Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Wildcat Knolls Extension Unit B Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Wildcat Knolls Extension Unit B Region, based on an on-the-ground and scientific analysis.
- Emery County regards the land which comprises the grazing districts and allotments in the Wildcat Knolls Extension Unit B Region, as still more valuable for grazing than for any other use which excludes livestock grazing, such as conversion of AUM's to wildlife or wilderness values. Accordingly, it is Emery County's plan that animal unit months in the Wildcat Knolls Extension Unit B Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- Emery County recognizes that from time to time a bona fide livestock permittee in the Wildcat Knolls Extension Unit B Region, acting in good faith and not to

circumvent the intent of the BLM's grazing regulations, may temporarily cease grazing operations without losing his or her permitted AUM's.

- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Wildcat Knolls Extension Unit B Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Wildcat Knolls Extension Unit B Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Wildcat Knolls Extension Unit B Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Wildcat Knolls Extension Unit B Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Wildcat Knolls Extension Unit B Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Wildcat Knolls Extension Unit B Region.
- Where water resources in the Lost Springs Wash Region have diminished because once-existing grasses or other species have succeeded to tamarisk, Russian olive or other invasive species, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses..
- Emery County's strategy and plan for protecting the Wildcat Knolls Extension Unit B Region watershed is to deter unauthorized cross-country OHV use in the Wildcat Knolls Extension Unit B Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Wildcat Knolls Extension Unit B Region on which to legitimately operate their OHVs. Closing the Wildcat Knolls Extension Unit B Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Wildcat Knolls Extension Unit B Region watershed.
- Accordingly, all trails in the Wildcat Knolls Extension Unit B Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Wildcat Knolls Extension Unit B Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Wildcat Knolls Extension Unit B Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Wildcat Knolls Extension Unit B Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Wildcat Knolls Extension Unit B Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Wildcat Knolls Extension Unit B Region.
- Any segment of society, for that matter, who want to recreate in the Wildcat Knolls Extension Unit B Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Wildcat Knolls Extension Unit B Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Wildcat Knolls Extension Unit B Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Wildcat Knolls Extension Unit B Region to just one form - available for those who have enough time, money and athletic ability to hike into the destinations of the Wildcat Knolls Extension Unit B Region for a so-called "solitude wilderness experience" or the like.
- Accordingly, all roads in the Wildcat Knolls Extension Unit B Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Wildcat Knolls Extension Unit B Region that have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should continue to remain open. Traditional levels of wildlife hunting and fishing should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation - motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Wildcat Knolls Extension Unit B Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Wildcat Knolls Extension Unit B Region is considered to be part of Emery County's plan specifically applicable to the Wildcat Knolls Extension Unit B Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Wildcat Knolls Extension Unit B Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Wildcat Knolls Extension Unit B Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Wildcat Knolls Extension Unit B Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Wildcat Knolls Extension Unit B Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Wildcat Knolls Extension Unit B Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Wildcat Knolls Extension Unit B Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.
- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Wildcat Knolls Extension Unit B Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - Property Rights of Private Landowners

- There are no parcels of private fee land located in, or adjacent to, the Wildcat Knolls Extension Unit B Region.

SECTION 10- State School and Institutional Trust Lands Administration ("SITLA") Lands

- There are no parcels of SITLA land located in, or adjacent to, the Wildcat Knolls Extension Unit B Region.

SECTION 11- Managing Part or All of The Wildcat Knolls Extension Unit B Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Wildcat Knolls Extension Unit B Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Wildcat Knolls Extension Unit B Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Wildcat Knolls Extension Unit B Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Wildcat Knolls Extension Unit B Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Wildcat Knolls Extension Unit B Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.
- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello, and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12- ACEC Designation

- There are no ACEC designations that affect the Wildcat Knolls Extension Unit B Region

SECTION 13- National Wild and Scenic River System

- There are no National Wild and Scenic River System proposals that affect the Wildcat Knolls Extension Unit B Region

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Wildcat Knolls Extension Unit B Region Would Contradict the

State's Public Land Policy and Contradict Emery County's Plan For Managing the Wildcat Knolls Extension Unit B Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Wildcat Knolls Extension Unit B Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Wildcat Knolls Extension Unit B Region.
- Emery County's foregoing plan clarification for the Wildcat Knolls Extension Unit B Region is generally consistent with either Class III or Class IV, depending on the precise area.

3.25 Wild Horse Mesa

A RECOMMENDED PROPOSAL FOR AMENDING THE PUBLIC LANDS SECTION OF THE EMERY COUNTY GENERAL PLAN TO CLARIFY LONGSTANDING POLICIES FOR THAT GEOGRAPHIC REGION OF EMERY COUNTY DESCRIBED BELOW AND HEREINAFTER REFERRED TO AS THE "WILD HORSE MESA REGION."

WHEREAS, Emery County has a general plan adopted pursuant to Utah Code containing policies for the appropriate use of private and public land within the county; and

WHEREAS, Emery County desires to supplement its general plan to clarify long-standing policies specific to certain geographic regions of the county as the need arises; and

WHEREAS, the Emery County Public Lands Department has recommended certain amendments associated with lands in the Wild Horse Mesa region of the county; and

WHEREAS, the Emery County Planning Commission has reviewed and concurs with the recommendation of the Public Land Use Committee;

NOW, THEREFORE, THE EMERY COUNTY PLANNING COMMISSION PROPOSES THAT THE EMERY COUNTY GENERAL PLAN BE AMENDED BY INSERTING THE FOLLOWING AT THE END OF THE PUBLIC LANDS SECTION OF THAT PLAN:

CLARIFICATION OF EMERY COUNTY'S ONOING PLAN FOR MANAGING CERTAIN LANDS IN THE WILD HORSE MESA REGION OF THE COUNTY
SECTION 1 - Subject Lands

This plan clarification applies to those certain areas of land in Southwestern Emery County which the United States Bureau of Land Management ("BLM") in its so-called 1999 Wilderness Inventory Report purported to label as follows:

T26S R9E - Sections 23, 24, 25, 26, 34, 35, and 36

T26S R10E - Sections 1, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36

T26S R11E - Sections 5, 7, 8, 9, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, and 34

This plan clarification also applies to all other areas of land located in any townships and ranges of Southwestern Emery County, which an organization by the name of the Utah Wilderness Coalition ("UWC") has purported to include in its so-called "Citizen's Proposal for Wilderness in Utah" for their so-called San Rafael Swell Region, according to the map thereof set forth in the UWC internet web site, address http://www.protectwildutah.org/proposal/index, as it exists on April 15, 2007, including the following areas labeled as follows in the San Rafael Swell Region portion of the said UWC internet web site:

T26S R11E - Sections 1, 11, 12, 13, 14, 23, 24, 25, 26, 34, and 35

T26S R12E - Sections 7, 8, 17, 18, 19, 20, 29, 30, and 31

For purposes of this plan clarification, all of the above-described lands are collectively referred to herein as the "Wild Horse Mesa Region," and are illustrated more fully in the official map attached hereto. Any reference hereafter to the term "Wild Horse Mesa Region" shall refer to any and all of the above-described land areas.

SECTION 2 - Clarification of Ongoing Plan

It is Emery County's intent and purpose to clarify the public land use policies within the Emery County General Plan to include this supplement pertaining to the Wild Horse Mesa Region. These policies are intended to supplement the general plan policies that apply county-wide. Emery County declares its plan for the subject region to be as follows:

SECTION 3 - Achieve and Maintain A Continuing Yield of Mineral Resources In The Wild Horse Mesa Region At The Highest Reasonably Sustainable Levels

- Development of the solid, fluid and gaseous mineral resources in the Wild Horse Mesa Region is an important part of the economy of Emery County.
- Emery County recognizes that it is technically feasible to access mineral and energy resources while preserving non-mineral and non-energy resources.
- All available solid, fluid and gaseous mineral resources in the Wild Horse Mesa Region should be seriously considered for development.
- Lands shown to have reasonable mineral potential in the Wild Horse Mesa Region should be open to oil and gas leasing with stipulations and conditions that will protect the lands against unreasonable and irreparable damage to other significant resource values. This should include reasonable and effective mitigation and reclamation measures and bonding for such where necessary.
- The waste of fluid and gaseous minerals should be prohibited.
- Any previous lease restrictions in the Wild Horse Mesa Region that are no longer necessary or effective should be modified, waived or removed.
- Restrictions against surface occupancy should be modified, waived or if necessary removed where it is shown that directional drilling is not ecologically necessary,

where directional drilling is not feasible from an economic or engineering standpoint, or where it is shown that directional drilling will in effect sterilize the mineral and energy resources beneath the area.

- Applications for permission to drill that meet standard qualifications, including reasonable and effective mitigation and reclamation requirements, should be expeditiously processed and granted.
- Any moratorium that may exist against the issuance of additional mining patents and oil and gas leases in the Wild Horse Mesa Region should be carefully evaluated for removal.

SECTION 4 - Achieve and Maintain Livestock Grazing in The Wild Horse Mesa Region At The Highest Reasonably Sustainable Levels

- Domestic livestock forage in the Wild Horse Mesa Region, expressed in animal unit months, for permitted active use as well as the wildlife forage included in that amount, should be no less than the maximum number of animal unit months sustainable by range conditions in grazing districts and allotments in the Wild Horse Mesa Region, based on an on-the-ground and scientific analysis.
- It is Emery County's plan that animal unit months in the Wild Horse Mesa Region not be relinquished or retired in favor of conservation, wildlife and other uses.
- BLM imposed suspensions of use or other reductions in domestic livestock animal unit months in the Wild Horse Mesa Region should be temporary and scientifically based on rangeland conditions.
- The transfer of grazing animal unit months ("AUMs") to wildlife for supposed reasons of rangeland health is opposed by Emery County as illogical. There is already imputed in each AUM a reasonable amount of forage for the wildlife component.
- Any grazing animal unit months that may have been reduced in the Wild Horse Mesa Region due to rangeland health concerns should be restored to livestock when rangeland conditions improve, not converted to wildlife use.

SECTION 5 - Manage the Watershed in The Wild Horse Mesa Region to Achieve and Maintain Water Resources At The Highest Reasonably Sustainable Levels

- All water resources that derive in the Wild Horse Mesa Region are the property of the State of Utah. They are owned exclusively by the State in trust for its citizens.
- As a political subdivision of the State, Emery County has a legitimate interest in seeing that all reasonable steps are taken to preserve, maintain and where reasonable develop those water resources.
- With increased demands on water resources brought on by population increases in the Colorado River drainage area, and with recent drier precipitation trends which call into question in the minds of some whether the climate of the Colorado River drainage area is changing, it is important now more than ever that management practices be employed in the Wild Horse Mesa Region to restore, maintain and maximize water resources there. This includes restoration, maintenance and enhancement of the watershed in the Wild Horse Mesa Region.

- Where water resources in the Wild Horse Mesa Region have diminished because once-existing grasses have succeeded to pinion, juniper and other woody vegetation and associated biomass, a vigorous program of mechanical treatments should be applied to promptly remove this woody vegetation and biomass, stimulate the return of the grasses to historic levels, and thereby provide a watershed that maximizes water yield and water quality for livestock, wildlife, and human uses.
- Emery County's strategy and plan for protecting the Wild Horse Mesa Region watershed is to deter unauthorized cross-country OHV use in the Wild Horse Mesa Region. The best way to achieve this is to give OHV users a reasonable system of trails in the Wild Horse Mesa Region on which to legitimately operate their OHVs. Closing the Wild Horse Mesa Region to all OHV use will only spur increased unauthorized cross-country OHV use to the detriment of the Wild Horse Mesa Region watershed.
- Accordingly, all trails in the Wild Horse Mesa Region which have been designated open to OHV use in Alternative D, Final Price Resource Management Plan should remain open.

SECTION 6 - Achieve and Maintain Traditional Access to Outdoor Recreational Opportunities Available in The Wild Horse Mesa Region

- Traditionally, citizens of Emery County and visitors have enjoyed many forms of outdoor recreation in the Wild Horse Mesa Region, such as hunting, fishing, hiking, family and group parties, family and group campouts and campfires, rock hounding, OHV travel, geological exploring, pioneering, parking their RV, or sightseeing in their personal vehicles.
- Public land outdoor recreational access in the Wild Horse Mesa Region should not discriminate in favor of one particular mode of recreation to the exclusion of others. Traditionally, outdoor recreational opportunities in the Wild Horse Mesa Region have been open and accessible to working class families, to families with small children, to the sick and persons with disabilities, to the middle aged and elderly, to persons of different cultures for whom a "primitive solitary hike" may not be the preferred form of recreating, and to the economically disadvantaged and underprivileged who lack the money and ability to take the time off work necessary to get outfitted for a multi-day "primitive hike" to reach those destinations. All of society should not be forced to participate in a "solitude experience" or a "primitive experience" as the one and only mode of outdoor recreation in the Wild Horse Mesa Region.
- Any segment of society, for that matter, who want to recreate in the Wild Horse Mesa Region are entitled to motorized access to that recreation if they desire it, and are entitled to all traditional forms of outdoor recreation if they desire it. They should not have to hike into the outdoor recreational destinations in the Wild Horse Mesa Region if they do not want to or are physically unable or cannot afford such an activity.
- Hence Emery County's plan calls for continued public motorized access to all traditional outdoor recreational destinations in all areas of the Wild Horse Mesa Region for all such segments of the public. Emery County specifically opposes restricting outdoor recreation in the Wild Horse Mesa Region to just one form –

available for those who have enough time, money and athletic ability to hike into the destinations of the Wild Horse Mesa Region for a so-called "solitude wilderness experience" or the like.

- Accordingly, all roads in the Wild Horse Mesa Region that are part of Emery County's duly adopted transportation plan should remain open to motorized travel. None of them should be closed, and Emery County should have the continued ability to maintain and repair those roads, and where reasonably necessary make improvements thereon. All trails in the Wild Horse Mesa Region that have been designated open to OHV use in BLM's 2003 Route Designation Plan should continue to remain open. Traditional levels of wildlife hunting should continue. Traditional levels of group camping, group day use and all other traditional forms of outdoor recreation -motorized and non-motorized - should continue.

SECTION 7 - Maintain and Keep Open All Roads in the Wild Horse Mesa Region That Appear On Emery County's Most Recent Transportation Map, and Provide For Such Additional Roads and Trails As May Be Necessary From Time to Time

- Emery County's transportation plan includes an official county-wide transportation map, available to the public for viewing and copying, showing all County B and D roads.
- That portion of Emery County's official transportation map which shows all County B and D roads in the Wild Horse Mesa Region is considered to be part of Emery County's plan specifically applicable to the Wild Horse Mesa Region. All such public roads are shown in the attached official map.
- Emery County plans to keep all such roads in the Wild Horse Mesa Region open and reasonably maintained and in good repair. Emery County will consult with the BLM about any required improvements to such roads, reserving the right to request court intervention and relief in the event Emery County and BLM cannot reach an agreement on such proposed improvements after reasonable efforts at consultation.
- Additional roads and trails may be needed in the Wild Horse Mesa Region from time to time to facilitate reasonable access to a broad range of resources and opportunities throughout the Wild Horse Mesa Region, including livestock operations and improvements, solid, fluid and gaseous mineral operations, recreational opportunities and operations, search and rescue needs, other public safety needs, access to public lands for people with disabilities and the elderly, and access to Utah school and institutional trust lands in the Wild Horse Mesa Region to accomplish the purposes of those lands.

SECTION 8 - Manage the Wild Horse Mesa Region So As to Protect Prehistoric Rock Art, Three Dimensional Structures and Other Artifacts and Sites Recognized as Culturally Important and Significant By the State Historic Preservation Officer

- Reasonable mineral development in the Wild Horse Mesa Region can occur while at the same time protecting prehistoric rock art, three- dimensional structures and other artifacts and sites recognized as culturally important and significant by the state historic preservation officer.

- Reasonable and effective stipulations and conditions to protect against damage to the above-described cultural resources should accompany decisions to issue mineral leases, permit drilling or permit seismic activities in the Wild Horse Mesa Region. Such drilling and seismic activities should not be disallowed merely because they are in the immediate vicinity of the above-described cultural resources if it is shown that such activities will not damage those resources.

SECTION 9 - NA There is no private land within or adjacent to the Wild Horse Mesa Region.

SECTION 10- Manage the Wild Horse Mesa Region So As to Not Interfere With The Fiduciary Responsibility of the State School and Institutional Trust Lands Administration ("SITLA") With Respect to Trust Lands Located in That Region.

- Scattered throughout the Wild Horse Mesa Region are sections of school and institutional trust land owned by the State of Utah and administered by SITLA in trust for the benefit of public schools and other institutions ("school trust lands"), as mandated in Utah's Enabling Act and State Constitution.
- As trustee, SITLA has a fiduciary responsibility to manage those school trust lands to generate maximum revenue therefrom, by making them available for sale and private development, and for other multiple use consumptive activities such as mineral development, grazing, recreation, timber, agriculture and the like, all for the financial benefit of Utah's public schools and other institutional beneficiaries.
- Land management policies and standards on BLM land in the Wild Horse Mesa Region should not interfere with SITLA's ability to carry out its fiduciary responsibilities.
- Nor should SITLA be denied the right of motorized access to those school trust sections to enable SITLA to put those sections to use in order to carry out SITLA's fiduciary responsibilities.

SECTION 11- Managing Part or All of The Wild Horse Mesa Region For So-Called Wilderness Characteristics Would Violate FLPMA, Contradict The State's Public Land Policy and Contradict The Foregoing Plans of Emery County For Managing The Wild Horse Mesa Region

- As Utah Code § 63-38d-401(6)(b) indicates, managing the Wild Horse Mesa Region under a "wilderness characteristics" management standard is not the State of Utah's policy for multiple use-sustained yield management on public lands that are not wilderness or wilderness study areas. Nor is it Emery County's. A so-called "wilderness characteristics" management standard for the Wild Horse Mesa Region is de facto wilderness management by another name. It is incompatible with and would therefore frustrate and defeat the foregoing plans of Emery County for managing the Wild Horse Mesa Region. The Public Lands Section of Emery County General Plan, as well as written communications by Emery County to BLM, specifies that additional wilderness designation shall be opposed.
- A so-called "wilderness characteristics" management standard for the Wild Horse Mesa Region also violates FLPMA and the 2003 Settlement Agreement between Utah and Department of Interior.

- Managing Post-603 Lands[1] pursuant to the Interim Management Policy of 1979 ("IMP") is inconsistent with BLM authority. Agreement p. 6 & 13.a;
- Managing Post-603 Lands to preserve their alleged wilderness character strays from the multiple use mandate in a manner inconsistent with FLPMA § Section 603 limited delegation of authority. Agreement p. 9 & 17;
- The 1999 Utah Wilderness Reinventory shall not be used to manage public lands "as if" they are or may become WSA's. Agreement p. 13 & 4;
- DOI/BLM will not establish, manage "*or otherwise treat*" Post-603 Lands as WSA's or as wilderness pursuant to the Section 202 process absent congressional authorization. Agreement p. 14 & 7;
- DOI/BLM will remove from the proposed revised resource management plans in the Vernal, Price, Richfield, Monticello and Moab Districts, any and all references or plans to classify or manage Post-603 BLM lands "*as if*" they are or may become WSA's. Agreement p. 14 & 7

[1] As that term is defined in the *Utah v. Norton* Settlement agreement of April 11, 2003.

SECTION 12 - Imposing Lower Muddy Creek Area of Critical Environmental Concern ("ACEC") Would Contradict Emery County's Plan For Managing The Wild Horse Mesa Region

- It is Emery County's policy that no part of the Wild Horse Mesa Region should be designated an ("ACEC") unless it is clearly demonstrated to the satisfaction of the Emery County Commission that:
  - The proposed ACEC satisfies all the definitional requirements of the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1702(a).
  - The proposed ACEC is limited in geographic size and that the proposed management prescriptions are limited in scope to the minimum necessary to specifically protect and prevent *irreparable* damage to values that are objectively shown to be relevant and important or to protect human life or ensure safety from natural hazards.
  - The proposed ACEC is limited only to areas that are already developed or used or to areas where no development is required.
  - The proposed ACEC designation and protection is necessary to protect not just a change in ground conditions or visual resources that can be reclaimed or reversed eventually (like reclaiming a natural gas well site after pumping operations are complete). Rather, the damage must be shown in all respects to be truly *irreparable* and justified on short term and long term horizons.
  - The proposed ACEC designation and protection will not be applied redundantly over existing protections available under FLPMA multiple use sustained yield management.
  - The proposed ACEC designation is not a substitute for a wilderness suitability determination, nor is it offered as a means to manage a non WSA for so-called wilderness characteristics.
- The foregoing summarizes the ACEC criteria of the State of Utah as well as Emery County. See Utah Code § 63-38d-401(8)(c). And the foregoing summarizes the criteria of FLPMA.

SECTION 13- Including Any River Segment in the Wild Horse Mesa Region in the National Wild and Scenic River System Would Violate the National Wild and Scenic Rivers Act and Related Regulations, Contradict the State's Public Land Policy, and Contradict the Foregoing Plans of Emery County For Managing The Wild Horse Mesa Region

- It is Emery County's policy that no river segment should be included in the National Wild and Scenic River System unless:
  - Water is present and flowing at all times.
  - The water-related value is considered outstandingly remarkable within a region of comparison consisting of one of three physiographic provinces of the state, and that the rationale and justification for the conclusion are disclosed.
  - BLM fully disclaims in writing any interest in water rights with respect to the subject segment.
  - It is clearly demonstrated that including the segment in the NWSR system will not prevent, reduce, impair, or otherwise interfere with the state and its citizen's enjoyment of complete and exclusive water rights in and to rivers of the state as determined by the laws of the state, nor interfere with or impair local, state, regional, or interstate water compacts to which the State or Emery County is a party.
  - The rationale and justification for the proposed addition, including a comparison with protections offered by other management tools, is clearly analyzed within the multiple-use mandate, and the results disclosed.
  - It is clearly demonstrated that BLM does not intend to use such a designation to improperly impose Class I or II Visual Resource Management prescriptions.
  - It is clearly demonstrated that the proposed addition will not adversely impact the local economy agricultural and industrial operations, outdoor recreation, water rights, water quality, water resource planning, and access to and across river corridors in both upstream and downstream directions from the proposed river segment.
- The foregoing also summarizes the wild and scenic river criteria of the State of Utah, Utah Code § 63-38d-401(8)(a), as well as the criteria of Emery County.
- There is no river segment in the Wild Horse Mesa Region that meets the above criteria. Hence, no river segment in the Wild Horse Mesa Region should be included in the National Wild and Scenic River system.

SECTION 14- A Visual Resource Management Class I or II Rating for Any Part of the Wild Horse Mesa Region Would Contradict the State's Public Land Policy and Contradict Emery County's Plan For Managing the Wild Horse Mesa Region

- The objective of BLM Class I Visual Resource Management is not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Wild Horse Mesa Region.
- The objective of BLM Class II Visual Resource Management is generally not compatible with, and would therefore frustrate and interfere with, Emery County's foregoing plan clarification for the Wild Horse Mesa Region.

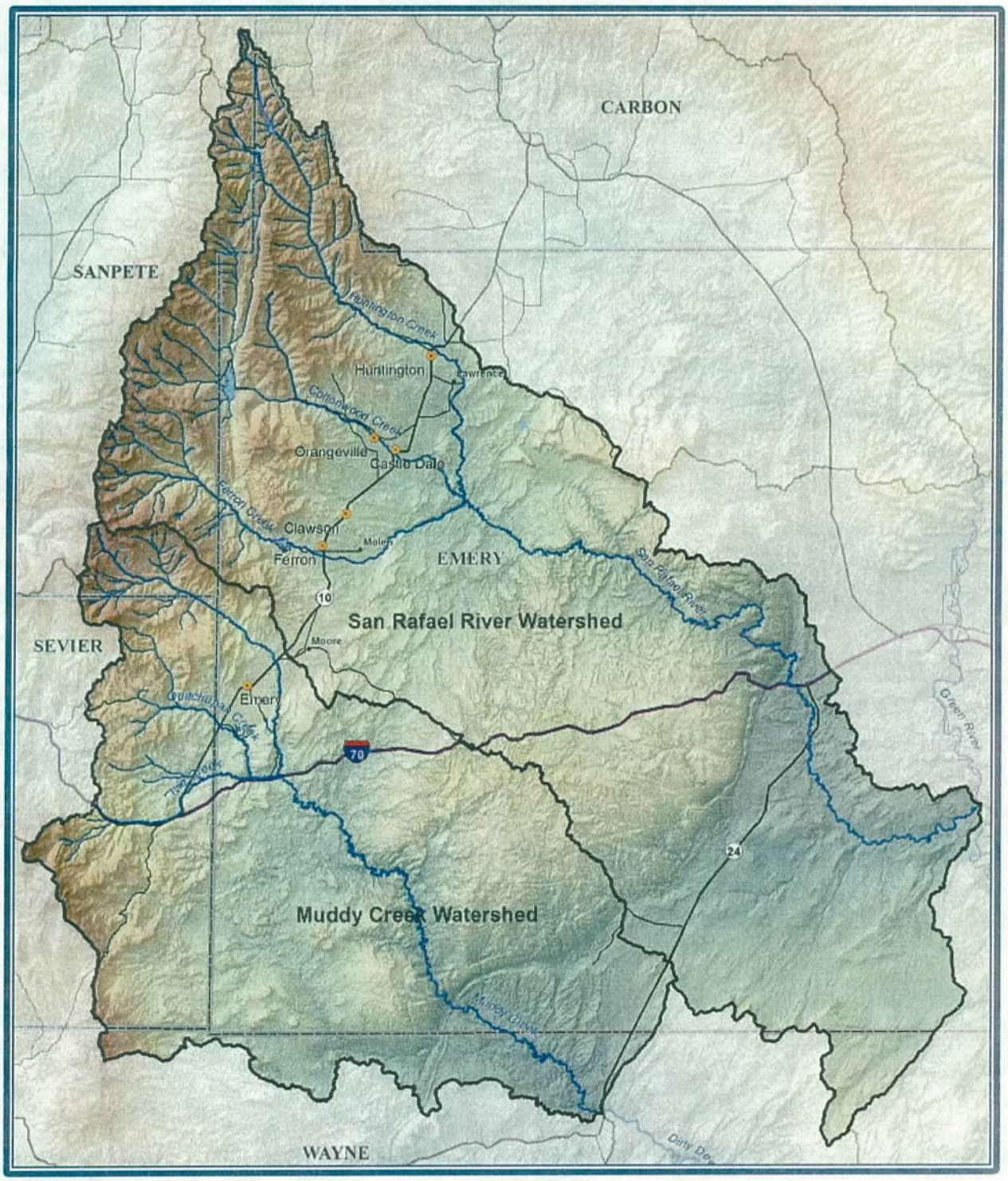
- Emery County's foregoing plan clarification for the Wild Horse Mesa Region is generally consistent with either Class III or Class IV, depending on the precise area.

Within the borders of Emery County are some of the most outstanding archeological sites in the western United States. Some estimates place the peak primitive American Indian population as high as 50,000 people at 1100 A.D. Notable archeology sites include Rochester Panel, Range Creek and the Buckhorn Panel. However, thousands of smaller, less known archeological sites are known and visited by local residents on a regular basis.

Paleontology (Dinosaur) resources in the area are world renowned and local residents have participated in the identification and recovery of these resources for more than 50 years. Active, permitted quarry's exist in several of the affected areas and are important sources of scientific information.

The unique archeology, paleontology and early history in the area has led to the creation of a number of active amateur study groups and has facilitated the creation of 4 museums located in the Carbon and Emery county area.

Other opportunities that have proven to be important social activities within the study area include "rock hounding", prospecting, and firewood gathering. Photographers and landscape artists from around the world have recognized the region as a "hidden gem". New activities, such as geo-caching are being developed each year and as technology improves, new activities will certainly be created.



San Rafael River and Muddy Creek Watersheds Study

Utah Division of Water Resources
December 2012

San Rafael River and Muddy Creek Watersheds Study

Prepared by:

Utah Division of Water Resources

Salt Lake City, Utah

December 2012

In cooperation with:

Natural Resources Conservation Service

Emery County Public Lands Council, Water Resources Subcommittee

Emery Water Conservancy District

Utah Division of Wildlife Resources

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Table of Contents

Acknowledgements iii
List of Figures & Tables ix
Executive Summary xi

Section — Page

1 – Introduction 1-1
1.1 Background 1-1
1.2 Emery County General Plan 1-3
1.2.1 Water Quality and Watershed Health 1-4
1.2.2 Additional Water Storage 1-5
1.2.3 Water Conservation and Wetlands 1-5
1.2.4 Environmental Water Uses and Water Rights 1-5
1.3 Project Area 1-6
1.3.1 Watershed Features 1-6
1.3.2 Land Ownership 1-8
1.4 Purpose of Study 1-8
1.5 Project Participants 1-10
1.5.1 Natural Resources Conservation Service 1-10
1.5.2 Utah Division of Water Resources 1-11
1.5.3 Emery County Public Lands Council, Water Resources Subcommittee 1-11
1.5.4 Emery Water Conservancy District 1-12
1.5.5 Utah Division of Wildlife Resources 1-13
1.5.6 San Rafael Conservation District 1-13

2 – Water Budgets and Hydrologic Models 2-1
2.1 Water Budget 2-1
2.1.1 Precipitation 2-1
2.1.2 Surface Water 2-3
2.1.3 Groundwater 2-7
2.1.4 Water Uses 2-7
2.1.5 Water Budget Summary 2-8
2.1.5.1 San Rafael River 2-8
2.1.5.1 Muddy Creek 2-9
2.2 Hydrologic Models 2-10
2.2.1 San Rafael River Watershed 2-10
2.2.2 Muddy Creek Watershed 2-13
2.2.3 Stream Flow Data and Correlations 2-14
2.2.4 Irrigation Diversions 2-14
2.2.4.1 Huntington-Cleveland Irrigation Company (HCIC) 2-15
2.2.4.2 Cottonwood Creek Consolidated Irrigation Co. (CCCIC) 2-16
2.2.4.3 Ferron Canal and Reservoir Company (FCRC) 2-18
2.2.4.4 Muddy Creek Irrigation Company (MCIC) 2-18
2.2.5 Power Plant Diversions 2-19

2.2.5.1 Huntington Plant 2-19
2.2.5.2 Hunter Plant 2-20
2.2.6 Water Rights and Operational Practices 2-20
2.2.6.1 Huntington Creek 2-21
2.2.6.2 Cottonwood Creek 2-21
2.2.6.3 Ferron Creek 2-23
2.2.7 Trans-basin Diversions 2-23
2.2.8 Summary of Base Model Output 2-23
2.2.8.1 San Rafael River – Summary of Existing Conditions 2-24
2.2.8.2 Muddy Creek – Summary of Existing Conditions 2-26
2.2.9 Scenario Analysis 2-28
2.2.9.1 Enlarging Rolfson Reservoir 2-30
2.2.9.2 Enlarging Miller Flat Reservoir 2-32
2.2.9.3 New Off-stream Reservoir on Rock Canyon Creek 2-34
2.2.9.4 Enlarging Spinners Reservoir 2-36
2.2.9.5 New On-stream Lower Emery Reservoir 2-38

3 – Current and Projected Water Demands 3-1
3.1 Current Water Use 3-1
3.1.1 Municipal & Industrial Water Use 3-1
3.1.1.1 Public Community Systems 3-2
3.1.1.2 Self-supplied Industries 3-3
3.1.2 Agricultural Water Use 3-5
3.1.3 Environmental 3-9
3.2 Projected Future Water Demands 3-10
3.2.1 Municipal & Industrial Water Demands 3-10
3.2.1.1 Public Community Systems 3-10
3.2.1.2 Self Supplied Industries 3-12
3.2.1.3 Summary 3-14
3.2.2 Agricultural Water Demands 3-14
3.2.3 Environmental 3-15

4 – Innovative Water Management Strategies 4-1
4.1 System Automation 4-1
4.2 Cooperative Arrangements 4-2
4.2.1 Emery Water Conservancy District 4-2
4.2.1.1 Ferron Canal and Reservoir Company and Ferron City 4-3
4.2.1.2 Flood Control Using Irrigation Canals 4-4
4.2.2 Future Cooperation 4-4
4.3 Aquifer Storage and Recovery 4-4
4.3.1 Hydrogeologic Assessment of Study Area 4-5
4.3.1.1 Description of Study Area 4-5
4.3.1.2 Aquifer Characteristics 4-6
4.3.2 Possible ASR in the Town of Emery 4-9
4.3.2.1 Background 4-10
4.3.2.2 Successful ASR Projects in Utah Utilizing Injection Wells 4-10
4.3.2.3 Pertinent Details of Emery Town's Wells 4-11
4.3.2.4 Implications for Injection and Aquifer Response 4-14
4.3.2.5 Regulatory Permits 4-15
4.3.2.6 Summary 4-15

4.4 Water Reuse & Recycling 4-16
4.4.1 Current Water Recycling at Power Plants 4-16
4.4.2 Estimated Municipal Wastewater Discharges 4-17
4.4.3 Regulatory Permits 4-18

5 – Opportunities for Additional Surface Water Storage 5-1
5.1 Background and Purpose 5-1
5.2 Methodology, Process, and Final Site Selection 5-1
5.2.1 Site Identification 5-2
5.2.2 Preferred Site Selection 5-5
5.2.3 Preliminary Screening 5-5
5.2.4 Water Supply and Cursory Cost Estimate 5-8
5.2.5 Final Site Selection 5-11
5.3 Water Rights Considerations 5-11

6 – Water Quality Assessment and Improvement Plan 6-1
6.1 Background 6-1
6.2 Goals and Objectives 6-2
6.3 Required EPA Watershed Plan Elements 6-2
6.3.1 Causes of Impairment and Pollution Sources 6-3
6.3.1.1 Causes of Impairment 6-3
6.3.1.2 Pollution Sources 6-6
6.3.2 Estimate of Load Reductions Expected 6-8
6.3.2.1 Watershed Plan Projects 6-8
6.3.2.2 Colorado River Basin Salinity Control Program 6-8
6.3.3 Proposed Nonpoint Source Management Measures 6-10
6.3.3.1 Animal Feeding Operation Improvement 6-10
6.3.3.2 Gully Plugs, Sediment Control 6-12
6.3.3.3 Rangeland Improvement 6-13
6.3.3.4 Sprinkler Irrigation and Salinity Control 6-14
6.3.3.5 Stream Restoration 6-15
6.3.3.6 Wetland Restoration and Enhancement 6-17
6.3.4 Required Technical and Financial Assistance 6-18
6.3.5 Information and Education Plan 6-20
6.3.6 Implementation Schedule 6-22
6.3.7 Milestones 6-25
6.3.8 Load Reduction Criteria 6-26
6.3.9 Monitoring 6-28

7 – Managing Aquatic Wildlife to Avoid Future Conflict 7-1
7.1 Background 7-1
7.2 Goals and Objectives 7-2
7.3 Endangered Species Use of the San Rafael River 7-3
7.4 Species of Concern 7-4
7.4.1 The Three Species 7-4
7.4.2 Colorado River Cutthroat Trout 7-7
7.5 Existing Wildlife Management and Habitat Improvement Efforts 7-9
7.5.1 Three Species Restoration Efforts 7-9
7.5.1.1 Upper San Rafael Wildlife Management Area 7-11
7.5.1.2 Hatt Ranch, Frenchmans Wash, and Chaffin Ranch 7-13

7.5.2 Colorado River Cutthroat Trout Restoration Efforts 7-14
7.6 Additional Needs/Recommendations 7-15
7.6.1 Minimum Flow Requirements for the San Rafael River 7-16
7.6.2 Lower San Rafael Reach Gain/Loss Study 7-16

Appendices (Digital only, see CD attached to rear panel)

A – San Rafael River and Muddy Creek Simulation—RiverWare Model Design and Approach
B – Emery County Surface Water Storage Options
C – Price River, San Rafael River, and Muddy Creek TMDLs for TDS

List of Figures & Tables

Figure Page

1-1, Location map of the San Rafael River and Muddy Creek watersheds 1-7
1-2, Land ownership map of the San Rafael River and Muddy Creek watersheds 1-9

2-1, Average annual precipitation in inches (1961-1990) 2-2
2-2, USGS stream-flow gages in the San Rafael River and Muddy Creek watersheds 2-4
2-3, Annual streamflow (acre-feet) of Huntington, Ferron, and Muddy creeks 2-5
2-4, Mean daily streamflow (cfs) of Huntington, Ferron, and Muddy creeks 2-5
2-5, San Rafael River Model Diagram 2-11
2-6, Muddy Creek Model Diagram 2-13
2-7, Summary of flow in the San Rafael River Watershed from the hydrologic model 2-27
2-8, Summary of flows in the Muddy Creek watershed from the hydrologic model 2-29
2-9, Storage frequency curve for raising Rolfson Dam 10 feet. 2-31
2-10, Yield-capacity curve for raising Rolfson Dam 10 feet 2-31
2-11, Storage frequency curve for enlarging Miller Flat Reservoir 2-33
2-12, Yield-capacity curve for enlarging Miller Flat Reservoir 2-33
2-13, Storage frequency curve for new off-stream reservoir on Rock Canyon Creek 2-35
2-14, Yield-capacity curve for new off-stream reservoir on Rock Canyon Creek 2-35
2-15, Storage frequency curve for enlarging Spinners Reservoir 2-37
2-16, Yield-capacity curve for enlarging Spinners Reservoir 2-37
2-17, Average annual flow downstream from Lower Emery Reservoir 2-38
2-18, Storage frequency curve for new Lower Emery Reservoir 2-39

3-1, 2010 per capita water use in Public Community Systems (gpcd) 3-4
3-2, Location of agricultural croplands 3-6

4-1 Geologic map of potential water-bearing formations 4-7
4-2 Geologic cross-section of potential water-bearing formations 4-8
4-3 Reconstructed well logs of Emery Town wells #1 and #2 4-12

5-1, Location of all potential reservoir sites considered 5-6
5-2, Sample descriptive summary and topographic drawing of dam and reservoir 5-7
5-3, Location and name of final potential reservoir sites 5-9

6-1, Impaired water bodies in the San Rafael River and Muddy Creek watersheds 6-4
6-2, General location map of proposed nonpoint source management measures 6-11
6-3, Preliminary project implementation schedule 6-25

7-1, Artistic rendering of flannelmouth sucker, bluehead sucker, and roundtail chub 7-4
7-2, Artistic rendering of Colorado River cutthroat trout 7-7
7-3, DWR Wildlife Management Areas along the San Rafael River 7-10

Table | Page

1-1, Land ownership in the San Rafael River and Muddy Creek watersheds 1-8

2-1, Average annual streamflow at long-term USGS stream gages 2-3
2-2, Existing lakes and water storage reservoirs (greater than 100 acre-feet) 2-6
2-3, San Rafael River water budget summary 2-9
2-4, Muddy Creek water budget summary 2-10
2-5, Long-term stream gages in the San Rafael River and Muddy Creek watersheds 2-14
2-6, Breakdown of storage pools in Joes Valley Reservoir 2-22
2-7, Outflow and evaporation from reservoirs in the San Rafael River watershed 2-24
2-8, Summary of major diversions in the San Rafael River watershed 2-25
2-9, Summary of downstream flows in the San Rafael River watershed 2-26
2-10, Outflow and evaporation from reservoirs in the Muddy Creek watershed 2-26
2-11, Summary of major diversions in the Muddy Creek watershed 2-28
2-12, Summary of downstream flows in the Muddy Creek watershed 2-28
2-13, Scenario Summary – Raising Rolfson Dam 2-30
2-14, Scenario Summary – Enlarging Miller Flat Reservoir 2-32
2-15, Scenario Summary – New off-stream reservoir on Rock Canyon Creek 2-34
2-16, Scenario Summary – Enlarging Spinners Reservoir 2-36

3-1, Total M&I Water Use by Year (acre-feet) 3-2
3-2, 2010 Water Use in Public Community Systems (acre-feet) 3-3
3-3, Irrigated agricultural croplands (acres) 3-5
3-4, Surveyed agricultural croplands for the year 2011 (acres) 3-8
3-5, Estimated agricultural water depletions (acre-feet) 3-9
3-6, Census population and GOPB population projections 3-11
3-7, Current and projected water demands in Public Community Systems (acre-feet) 3-11

4-1,Wastewater treatment plants in the study area 4-17
4-2, Estimated water reuse potential 4-18

5-1, Basic data for all 93 potential reservoir sites considered 5-3
5-2, Basic data for the 28 final reservoir sites 5-10
5-3, Cost estimates for the final 28 reservoir sites 5-12
5-4, Approved but unperfected water rights within the study area 5-13

Executive Summary

Introduciton

The water resources of the San Rafael River and Muddy Creek are critical to the success of the rural populations located nearby. Since the founding of the earliest settlements to today, water resources have been harnessed to sustain life, grow crops, and support a variety of other economic endeavors. While this development has allowed the human population to thrive, it has negatively impacted the environment and created a situation which potentially threatens the survival of several native aquatic species. As a result of this threat, stakeholders have banded together to study ways to avoid the challenges that would present themselves if these species were to decline enough to warrant federal protection under the Endangered Species Act.

This study is a result of this proactive stakeholder involvement. The purpose of the study is to provide a framework for potential actions and management strategies that will help maintain and improve the availability of water resources for existing water users and the environment within the project area. This study accomplishes this by:

- Developing a water budget and hydrologic model for both watersheds (Section 2).
- Identifying current water demands and estimating future water demands (Section 3).
- Exploring opportunities to improve system operation and implement additional efficiency measures to make water available for future growth and downstream environmental needs (Section 4).
- Identifying the most cost effective and feasible sites to store any additional water that may be available (Section 5).
- Summarizing existing water quality plans and developing a water quality improvement plan (Section 6).

- Compiling and summarizing existing data regarding threatened, endangered and sensitive aquatic species (Section 7).

This study was prepared by the Utah Division of Water Resources, with valuable assistance from the Emery County Public Lands Council—Water Resources Subcommittee, Emery Water Conservancy District, San Rafael Conservation District, and U.S. Natural Resources Conservation Service.

Water Budget and Hydrologic Models

The Utah Division of Water Resources conducted a water budget of the two watersheds within the study area. The budget includes all available hydrologic data for the period from 1989 to 2009 and estimated that the average annual outflow from the San Rafael River at its confluence with the Green River to be 49,000 acre-feet. The water budget also estimated the average annual outflow from Muddy Creek to the Dirty Devil River to be 9,500 acre-feet. The division also created a hydrologic model (using the popular RiverWare software) for the San Rafael River and another independent model for Muddy Creek. These models include all available hydrologic data for the period from 1950 to 2010. The San Rafael River model estimated the average annual flow in the San Rafael River, just below the confluence of the three creeks, to be 68,600 acre-feet. Similarly, the Muddy Creek model estimated the average annual flow in Muddy Creek, just below the Muddy Creek diversion, to be 13,900 acre-feet. There are many reasons why the model output is higher than the water budget output. The most significant reason is the different period of record—the models include the high water years of 1983 & 1984, while the water budget does not. Another reason is that the water budget includes riparian water depletions all the way to the bottom point in each watershed, while the models only include such uses to a point higher-up in each watershed. Either way, the estimated volumes represent an approximate amount of water available that could possibly be captured and released to meet downstream environmental needs and/or future development demands. Any future water uses

would need to comply with Utah water rights laws that protect existing water users and would likely come from the transfer of water rights that have been approved but have not yet been perfected.

Current and Projected Water Demands

By far the largest water use in the study area is for irrigated agriculture. DWRe estimates these uses to be approximately 80,300 acre-feet annually (67,400 acre-feet in the San Rafael watershed and 12,900 acre-feet in the Muddy Creek drainage). This does not include approximately 50,000 acre-feet of water that leaves the San Rafael watershed to irrigate land in the Price River drainage near Elmo and Cleveland. DWRe estimates that current municipal and industrial water uses in the study area amount to approximately 32,900 acre-feet per year. The vast majority of this is used in the San Rafael River watershed for industrial cooling at two coal-fired power plants and a small amount for coal mining activities (26,000 acre-feet); the remainder is mostly for public community water systems (6,900 acre-feet).

DWRe has also estimated future water uses in the agricultural and M&I sectors. While agricultural demands could either increase or decrease slightly over the next 50 years, M&I water demands could either decline slightly, or increase approximately 30 percent if additional cooling water for expanded power production is necessary. Environmental water demands could also grow if it is found necessary to provide water for instream flows or habitat preservation in order to preserve several fish species that could become listed as threatened or endangered under federal law. Several studies are underway to try to quantify the amount of water that would be necessary to protect these species.

Innovative Water Management Strategies

Over the years, local water users have increased the automation of their water delivery systems to increase efficiency and improve water management capabilities. Additional automation would help

refine these capabilities and continue to increase water efficiency. Cooperative agreements between water users has also helped provide flexible water management within the study area and avoid conflict. Future agreements may be necessary to successfully resolve future conflict.

Although limited in their potential application, there are two other water management strategies that may prove useful in helping meet future water needs within the study area. These are aquifer storage and recovery (ASR) and water reuse. This study explored the potential for ASR to help meet the Town of Emery's water supply challenges and concluded that the concept has potential application there. Water reuse could also be implemented on a small scale to utilize the treated effluent from the wastewater treatment plants located within the basin. DWRe estimates that up to approximately 700 acre-feet of the effluent produced over the next several decades could be put to use annually.

Opportunities for Additional Surface Water Storage

The study also investigated the potential to store water in new reservoirs or enlarge existing reservoirs throughout the study area. As part of this detailed investigation, DWRe identified 93 potential reservoir sites (including six enlargements of existing sites). Through a series of steps to analyze their potential, the number of sites was reduced to 28, which may have potential to increase water storage within the study area. Preliminary cost estimates for 26 of these sites were prepared and suggest that anywhere from 319 to 14,500 acre-feet of water could be stored at various locations. The estimated cost for this new storage ranged from $800 to $22,000 per acre-foot. Development of any of these sites would require extensive environmental review and detailed investigation to determine their actual feasibility.

Water Quality Assessment and Improvement Plan

Certain segments of the San Rafael River and its tributaries do not meet the water quality standards associated with its beneficial uses. The same is true for portions of Muddy Creek. The main impairment is high concentrations of salts, or total dissolved solids (TDS). The source of these impairments is return flows from irrigated agriculture as well as natural overland and subsurface flow over or through the Mancos Shale formation, which is prominent within the study area. A TMDL has been prepared to address these impairments and improve the water quality where possible. This study also includes an improvement plan outlining specific projects that could be implemented to help improve water quality. The goal of this plan is to satisfy EPA watershed plan requirements, making the projects detailed in the improvement plan eligible for Section 319 funding through DWQ's rotating funding opportunities in 2015.

Managing Aquatic Wildlife to Avoid Future Conflict

Three endangered fish species are known to inhabit the lower reaches of the San Rafael River. Although the San Rafael River is not considered critical habitat for these species, and thus not subject to certain recovery measures, there are three other sensitive fish species (flannelmouth sucker, bluehead sucker, and roundtail chub) that are native to the San Rafael River. Two of these species are also found in Muddy Creek. A fourth species, the Colorado River cutthroat trout, is also native to certain portions of San Rafael River's tributaries. If any of these four species were to become listed as threatened or endangered under the federal Endangered Species Act, they would become eligible for special protections under the law. These protections may include mandatory efforts to improve the habitat that these species rely on in an effort to curb further population declines and promote their recovery. Such mandates could adversely affect existing land owners and water users within the study area.

One of the primary goals of this study is to provide a toolbox of water management and storage options that could help protect fish habitat and avoid the federal listing of these species. To help accomplish this goal, the study provides a summary of the existing data and knowledge of the affected species and the habitat that is critical to their survival. It also summarizes the habitat improvement efforts that have been implemented thus far and discusses future improvement efforts and other needs. It is hoped that this study will provide a basic framework for future restoration efforts and help lay a strong foundation of cooperation with the land owners and water users within the affected watersheds.

Section 1 – Introduction

1.1 Background

The waters of the San Rafael River, Muddy Creek, and their tributaries are important and valuable resources of the Colorado Plateau region in central Utah. Not only have these waters shaped some of the most dramatic and scenic vistas and canyons in the region, but they have sustained many settlements located at the foot of the Wasatch Plateau on the western flank of the San Rafael Desert. From the time the first settlers moved to the region to today, the diversion of water onto the land to irrigate crops has been essential to the rural lifestyle. This way of life was further cemented into the landscape with the construction of several large dams and reservoirs with the help of the federal government, including Joes Valley and Millsite reservoirs. Not only did these reservoirs allow the expansion of irrigated agriculture, but they (along with other reservoirs) helped enable the eventual construction of two large power plants in the area to take advantage of coal resources located nearby.

While the development of water resources through legal water rights applications has benefitted the human population, these developments did not fully consider the impacts they would have on the

Millsite Dam is the site of one of the region's most popular golf courses. Several holes are located near the dam's scenic spillway.

downstream environment. Not only did dams and diversions deplete water from streams and rivers during critical spawning periods, but human uses of the water decreased water quality downstream of local populations and farmland. As a result, several native aquatic species suffered. Not until recently have these environmental issues garnered significant attention.

In the summer of 2006, the Utah Division of Wildlife Resources (DWR) entered into several agreements with other western states and federal land management agencies to work together to conserve and protect four native aquatic species found within the Colorado River Basin.[1,2] The intent of these agreements is to prevent the listing of these species under the Endangered Species Act and avoid the prescriptive measures mandated to protect listed species.

Since the signing of these agreements, DWR has been working to better understand the current status of these species and develop plans and implement projects to preserve them. As part of this effort, DWR has been working to develop essential partnerships with local governments and other stakeholders. One such effort involves the Water Resources Subcommittee (Subcommittee) of the Emery County Public Lands Council, of which DWR is a member.

The Subcommittee is made up of representatives from a variety of entities, including local irrigation companies, PacifiCorp, Utah Division of Water Rights, and others. The Subcommittee recognized the importance of DWR's efforts to protect these species while maintaining existing water rights and decided to seek funding to help DWR achieve its conservation goals and enhance the availability of water resources for all water users.

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[1] Utah Division of Wildlife Resources, *Range-wide Conservation Agreement and Strategy for Roundtail Chub (Gila robusta), Bluehead Sucker (Catostomus discobolus), Flannelmouth Sucker (Catostomus latipinnis),* Pub. No. 06-18, (Dept. of Natural Resources, Salt Lake City, Utah: 2006).

[2] Colorado River Cutthroat Trout Conservation Team. *Conservation agreement for Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus) in the States of Colorado, Utah, and Wyoming.* (Colorado Division of Wildlife, Fort Collins: 2006).

With the help of the Subcommittee and Utah's congressional delegation, the Emery County Public Lands Council received a congressional appropriation through the Natural Resources Conservation Service (NRCS) to study the water resources within the San Rafael River and Muddy Creek watersheds. The study looked at the availability of water resources and determine if and how water might be made available to the downstream environment as well as enhance the supplies available for existing water users.

In early 2010, the Subcommittee invited the Utah Division of Water Resources (DWRe) to meet with the Subcommittee and NRCS to discuss the details of the study and who should be contracted to do the work. Because of the extensive work DWRe had already done within the basin and its expertise in watershed planning, the Subcommittee preferred DWRe over other available contractors and ultimately selected DWRe to write this study.

Since that time, DWRe has met with the Subcommittee many times to define the objectives of the study and coordinate its efforts. In July of 2010, an official contract was signed with NRCS and DWRe began working on various project components. DWRe is scheduled to complete all work by the end of 2012. This report is the culmination of these efforts.

1.2 Emery County General Plan

In 1996, Emery County adopted the *Emery County General Plan.*[3] The purpose of the plan is "to address certain social, economical, and environmental issues."[4] The plan accomplishes this by adopting a series of policy statements, objectives, and action/implementation strategies. The *Emery County General Plan* is particularly noteworthy in context of this watershed plan, because it

[3] Emery County, *Emery County General Plan—County Policies, Objectives, and Action Steps,* (Emery County, Castle Dale: 1996), Rev. 1999. A joint project of Emery County, the Governor's Office of Planning and Budget, and the Utah Association of Counties.
[4] Ibid, 3.

contains a water resources section with a series of simple and direct policy positions. The 1996 plan was recently updated and adopted by Emery County in the summer of 2012. The following subsections summarize key components of the new water resources section.

1.2.1 Water Quality and Watershed Health

Emery County recognizes the importance of water resources to the residents of the county. The county believes that providing adequate supplies of water of sufficient quality is essential to future growth and development and "will protect this valuable resource by promoting watershed protection measures and supporting the efficient management and use of water resources."

Emery County has adopted a General Plan that contains policies relating to water resources.

Emery County is concerned about the effects of industry, recreation, and residential development on water quality. The county supports efforts to protect and improve the water quality. It is the county's position that "parties causing resource damage are responsible to perform and/or finance adequate and appropriate mitigation measures." The county supports land use practices that decrease the growth of noxious weeds and non-native phreatophytes and promotes proper ground cover to prevent erosion. The county supports "domestic livestock grazing on the watersheds and recognizes the benefits of grazing on public and private lands as a management tool to promote the health of a watershed."

1.2.2 Additional Water Storage

Emery County "feels that additional storage facilities are needed for the County to fully utilize its water resources" and would like "to develop an adequate system of storage facilities that would allow the excess spring runoff to be captured and utilized later in the growing season." If additional storage cannot be acquired, the county supports "improved coordination between water users and existing storage facilities."

1.2.3 Water Conservation and Wetlands

Emery County supports efforts by all water users to improve irrigation efficiency, conserve water, and reduce salinity loads to natural waterways. The county established as its policy, that "water which is conserved through more efficient conveyance or use will be committed to fulfilling present needs of existing water users, and the conserved water will be committed to downstream use, only upon the state laws of appropriation."

Although Emery County recognizes the value of wetlands throughout the county, the county feels that wetlands not located in natural riparian areas are the result of irrigation practices. Where choices are to be made between water efficiency and preserving these "man-made" wetlands, the county's position is to favor water efficiency. The county has also taken the position that "any water rights which are designated for wetland use must be obtained in compliance with the state water laws of appropriation."

1.2.4 Environmental Water Uses and Water Rights

Emery County also recognizes the importance of water resources to the environment. The county supports efforts to determine the quality and quantity of water that is necessary to protect native aquatic species and maintain proper ecological function. However, the county "urges that all uses of water," including water for environmental purposes "be approved and administered through the

Utah State appropriation system." **Emery County feels very strongly that** "private water rights must be protected from federal and state encroachment and/or coerced acquisition" and will resist any effort to acquire water without appropriate compensation.

1.3 Project Area

The project area consists of the two primary watersheds located in Emery County, Utah—the San Rafael River and Muddy Creek watersheds. Figure 1-1 shows the location of each watershed. The project area encompasses most of the inhabited areas of Emery County, and includes the communities of Huntington, Lawrence, Orangeville, Castle Dale, Clawson, Ferron, Molen, Moore, and Emery. Most of the area is uninhabited and includes the San Rafael Swell, a prominent geologic feature located in the heart of both watersheds which spans approximately 2,800 square miles.

1.3.1 Watershed Features

The San Rafael River is tributary to the Green River, a major tributary of the Colorado River. The San Rafael River is formed by three main tributaries which originate in Sanpete County high in the Wasatch Plateau at an elevation of around 11,000 feet. The longest tributary is Huntington Creek, with a length of about 54 miles. The three tributaries come together at a location approximately 4-1/2 miles southeast of Castle Dale and form the San Rafael River. The river then flows approximately 90 miles through the San Rafael Swell terminating in the Green River at an elevation of approximately 4,000 feet.

Muddy Creek is the next major watershed south of the San Rafael River. The headwaters of Muddy Creek originate in Sanpete and Sevier counties high in the Wasatch Plateau at an elevation of around 10,500 feet. Muddy Creek is approximately 120 miles long and flows through the southwestern edge of the San Rafael Swell before it meets the Fremont River and forms the Dirty Devil River (elev. 4,250 feet).

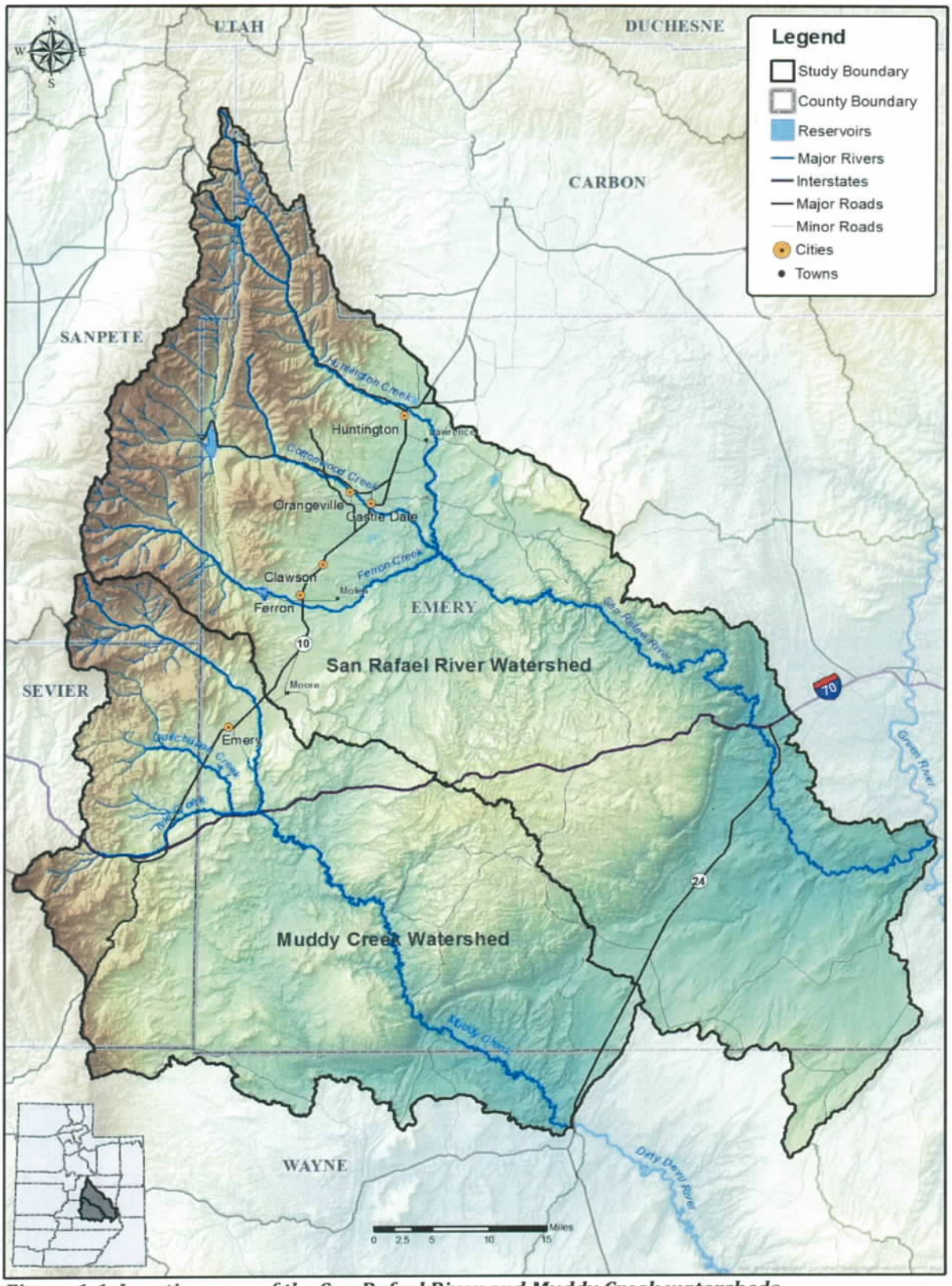


Figure 1-1, Location map of the San Rafael River and Muddy Creek watersheds.

1.3.2 Land Ownership

Figure 1-2 shows the land ownership within the study area and Table 1-1 shows land ownership by each individual watershed. Approximately 2.11 million acres, or 83 percent of the land within the project area, is owned by the federal government and is managed by the Bureau of Land Management (1.56 million acres), US Forest Service (0.54 million acres), and National Park Service (18,200 acres). Approximately 0.25 million acres, or 10 percent of the land within the project area, is owned by the State of Utah and is managed by the State Institutional Trust Land Association (0.24 million acres), Division of Wildlife Resources (5,500 acres), and the Division of State Parks and Recreation (3,400 acres). Private land makes up the remaining 0.18 million acres, or 7 percent of the land area.

Table 1-1, Land ownership in the San Rafael River and Muddy Creek watersheds.

Land Owner	San Rafael River Watershed (acres)	Muddy Creek Watershed (acres)	TOTAL (acres)
Bureau of Land Management	915,635	644,045	**1,559,680**
US Forest Service	337,729	197,507	**535,236**
National Park Service	54	18,183	**18,237**
State Trust Lands	159,874	84,151	**244,025**
Wildlife Resources	5,531	0	**5,531**
State Parks and Recreation	386	3,012	**3,398**
Private	136,774	44,899	**181,673**
TOTAL	**1,555,983**	**991,797**	**2,547,780**

1.4 Purpose of Study

The purpose of the San Rafael River/Muddy Creek Watershed Study is to provide a framework for specific actions and management strategies that will help maintain and improve the availability of

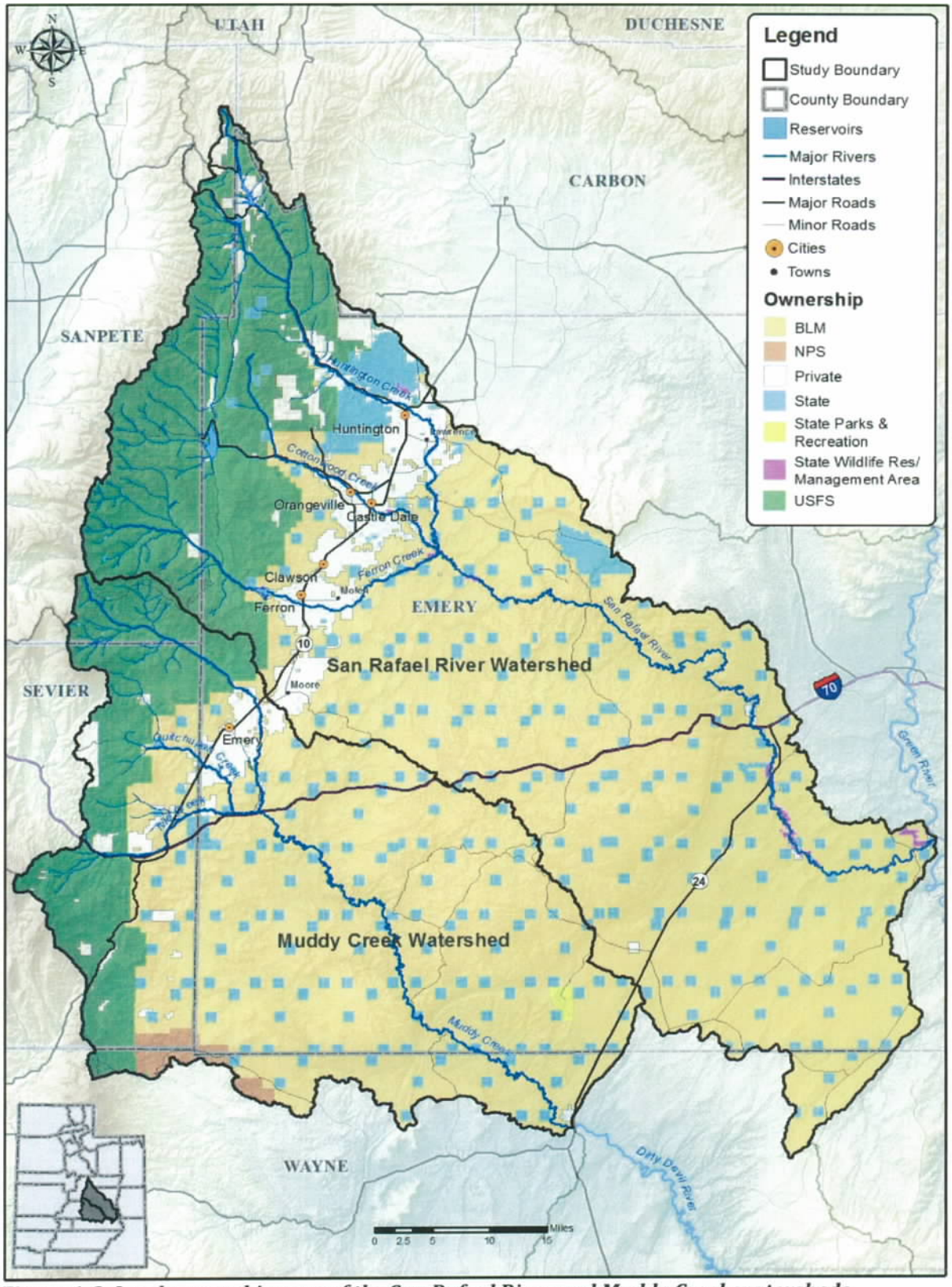


Figure 1-2, Land ownership map of the San Rafael River and Muddy Creek watersheds.

water resources for existing water users and the environment within the project area. This study accomplishes this purpose by:

- Developing a system-wide water budget and hydrologic model for both watersheds (Section 2).
- Identifying current water demands and estimating future water demands (Section 3).
- Exploring opportunities to improve system operation and implement additional efficiency measures to make additional water available for future growth and downstream environmental needs (Section 4).
- Identifying the most cost effective and feasible sites to store any additional water that may be available (Section 5).
- Summarizing existing water quality plans and developing a water quality improvement plan (Section 6).
- Compiling and summarizing existing data regarding threatened, endangered and sensitive aquatic species (Section 7).

This study has brought stakeholders together in a collaborative and cooperative process. This process will help foster sound water management that will enhance the quality and sustainability of the water and other natural resources within the study area.

1.5 Project Participants

Many local, state, and federal stakeholders have participated in the project. Direct participants and their respective roles are listed in the following paragraphs:

1.5.1 Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) is one of several agencies organized under the U.S. Department of Agriculture. NRCS's mission is to provide leadership in a partnership effort to help people conserve, maintain, and improve the nation's natural resources and environment. NRCS helps public officials develop sound policies and plans for natural resource development and

protection and helps land users plan and apply integrated resource management systems. NRCS is the project funding agency and has provided oversight over expenditures associated with the project. NRCS has also provided technical review of project documents and other deliverables. NRCS received $10,000 of the projects total federal cost ($200,000) to administer the contract, process the required contract reporting paperwork, and provide technical review.

1.5.2 Utah Division of Water Resources

The Utah Division of Water Resources (DWRe) is one of seven agencies under the Utah Department of Natural Resources. DWRe's mission is to plan, conserve, develop and protect Utah's water resources. DWRe is the principal technical author of the study and has coordinated the efforts of all other participants. The division conducted all necessary hydrologic analysis and modeling, summarized existing and future water supplies and demands, identified potential dam sites and prepared preliminary cost estimates for these sites, and compiled all other study components included in this report and delivered it to NRCS and the Emery County Public Lands Council's Water Resources Subcommittee. DWRe received $190,000 from NRCS and $12,000 from the Utah Division of Wildlife Resources to conduct this work and also contributed more than $80,000 of in-kind services that were applied toward the project's required local match.

1.5.3 Emery County Public Lands Council, Water Resources Subcommittee

The Emery County Public Lands Council operates under the authority of the Emery County Commission. The Council's mission is to "represent the public lands interests of Emery County and its citizens and to perform an advocacy role for local users and stakeholders; to work in partnership with federal and state agencies in fashioning management decisions and policies affecting lands within Emery County; and to participate in the development, coordination and implementation of the planning objectives of federal, state, and local entities to ensure harmony between the

objectives of these various entities and the *Emery County General Plan.*"[5] The Emery County Public Lands Council desires to aggressively preserve the community heritage of Emery County and seeks to do so by vigorously participating in and influencing all public land planning and decision making.

Sunset over Huntington Reservoir. (Photo courtesy of Spencer Baugh.)

The Emery County Public Lands Council, Water Resources Subcommittee has provided overall guidance for the project and coordinated public participation. These efforts include more than $13,000 of in-kind services that were applied toward the project's required local match.

1.5.4 Emery Water Conservancy District

The Emery Water Conservancy District (EWCD) is a local government entity organized under the authority of the State of Utah's Water Conservancy District Act. EWCD's mission is to "manage, develop, and protect existing water rights and related resources to ensure an economic future for the people of Emery County." EWCD has helped DWRe identify key water resources needs of the local water users and has provided critical data and information used in the creation of the hydrologic river models. EWCD has also helped identify opportunities for future cooperation and

[5] Emery County Public Lands Council, Mission Statement. Retrieved from the Emery County web page: http://www.emerycounty.com/publiclands/index.htm, November 15, 2011.

additional efficiency measures discussed in this report. These efforts include more than $22,000 of in-kind services that were applied to the project's required local match.

1.5.5 Utah Division of Wildlife Resources

The Utah Division of Wildlife Resources (DWR) is one of seven agencies under the Utah Department of Natural Resources. DWR's mission is to "serve the people of Utah as trustee and guardian of the state's wildlife." DWR has provided key technical support to DWRe for the wildlife section of the report including data and review of the document. DWR also contributed $12,000 cash toward the project's required local match. This was transferred to DWRe to help pay for the preparation and publication of this document.

1.5.6 San Rafael Conservation District

The San Rafael Conservation District is a limited purpose local government entity and is a political subdivision of the State of Utah. It consists of 5 supervisors, elected by their constituents who are charged with the care and protection of all natural resources within the district's boundaries. The district has a representative on the Emery County Public Lands Council, Water Resources Subcommittee, and also employs a watershed coordinator who coordinates water quality improvement projects throughout the San Rafael River watershed. In addition to supporting the overall planning process, the district helped identify specific water quality improvement projects included in Section 6 of this report.

Section 2 – Water Budget and Hydrologic Models

2.1 Water Budget

As part of this study, the Utah Division of Water Resources conducted a detailed water budget of the San Rafael River and Muddy Creek watersheds. A water budget is an estimate of all the water entering, stored within, and leaving a watershed and is also called a hydrologic budget or water balance. The timeframe for a water budget can vary, but typically spans a single year or is the average of several years. The timeframe of the water budget conducted for this study is 1989-2009 and most of the data presented in this section are averages over this time frame.

2.1.1 Precipitation

Climate in the study area is typical of similar areas throughout the west, with wide ranges in temperature between summer and winter, and between day and night. The high mountain regions experience relatively long, cold winters and short, cool summers. The lower valleys are more moderate with less variance between maximum and minimum temperatures. As part of the high plains of the Colorado Plateau, the study area is classified as semi-arid.

The study area experiences four seasons with a major portion of the precipitation occurring as snow in the mountains during the winter months and producing high flows during the spring runoff. The San Rafael River watershed receives about 11.9 inches of precipitation annually; the Muddy Creek watershed receives about 10.2 inches. This precipitation is distributed as shown in Figure 2-1, from a low of around 5 inches in the lowlands of the San Rafael Desert to a high of about 33 inches on the mountain peaks.

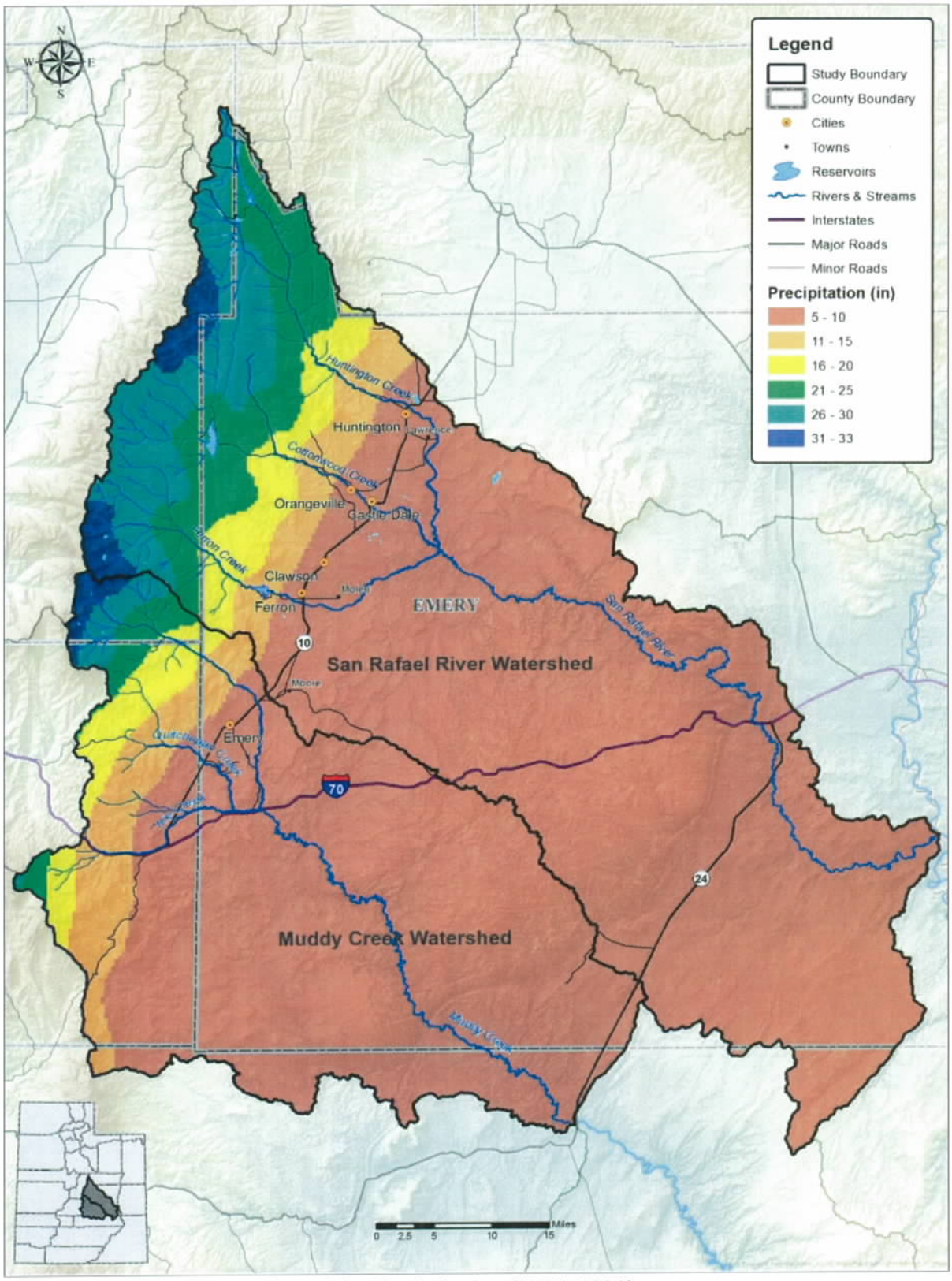


Figure 2-1, Average annual precipitation in inches (1961-1990).

2.1.2 Surface Water

The portion of precipitation not initially evaporated or transpired by vegetation eventually makes its way into streams and other surface water-bodies, or percolates into the ground. Surface water is quantified at gaging stations on stream segments. The water supplies available in the San Rafael River and Muddy Creek watersheds come primarily from surfaces water sources. Due to geological constraints, there is very little groundwater that has been developed in either of these drainages.

The U.S. Geological Survey (USGS) monitors an extensive network of gaging stations throughout Utah, including several within the study area (see Figure 2-2). However, only three of these stations have a long-term record of flow that covers a period of more than 50 years. The mean annual flow at each of these stations is contained in Table 2-1. Figure 2-3 shows the annual flow at each station over the entire period of record. The Huntington Creek gage has the largest mean annual flow of all the three stream gages at 72,569 acre-feet. Ferron Creek and Muddy Creek have a mean annual flow of 47,858 and 28,238 acre-feet, respectively.

Table 2-1, Average annual streamflow at long-term USGS stream gages.

Gage Name	Period of Record	Mean Annual Flow (acre-feet)
Huntington Creek, Near Huntington UT	1909-1974, 1976-1979	72,569
Ferron Creek, Near Ferron UT	1911-1922, 1947-Present	47,858
Muddy Creek, Near Emery UT	1910-1915, 1949-Present	28,238

Figure 2-4 contains the mean daily flow data available from these three stream gages. The distinct flow characteristics of each of the creeks are apparent from these hydrographs. As expected, Huntington Creek has the highest peak runoff, which occurs anywhere from mid-May to the first week of June. Surprisingly, Ferron Creek's average peak runoff is almost as high as Huntington Creek, but it lags that of Huntington Creek by about two weeks. Muddy Creek peaks around the same time as Ferron Creek but is less than half as high. Base flows for Ferron and Muddy Creek are about the same at around 10 cfs, while Huntington Creek's base flow is around 20 cfs.

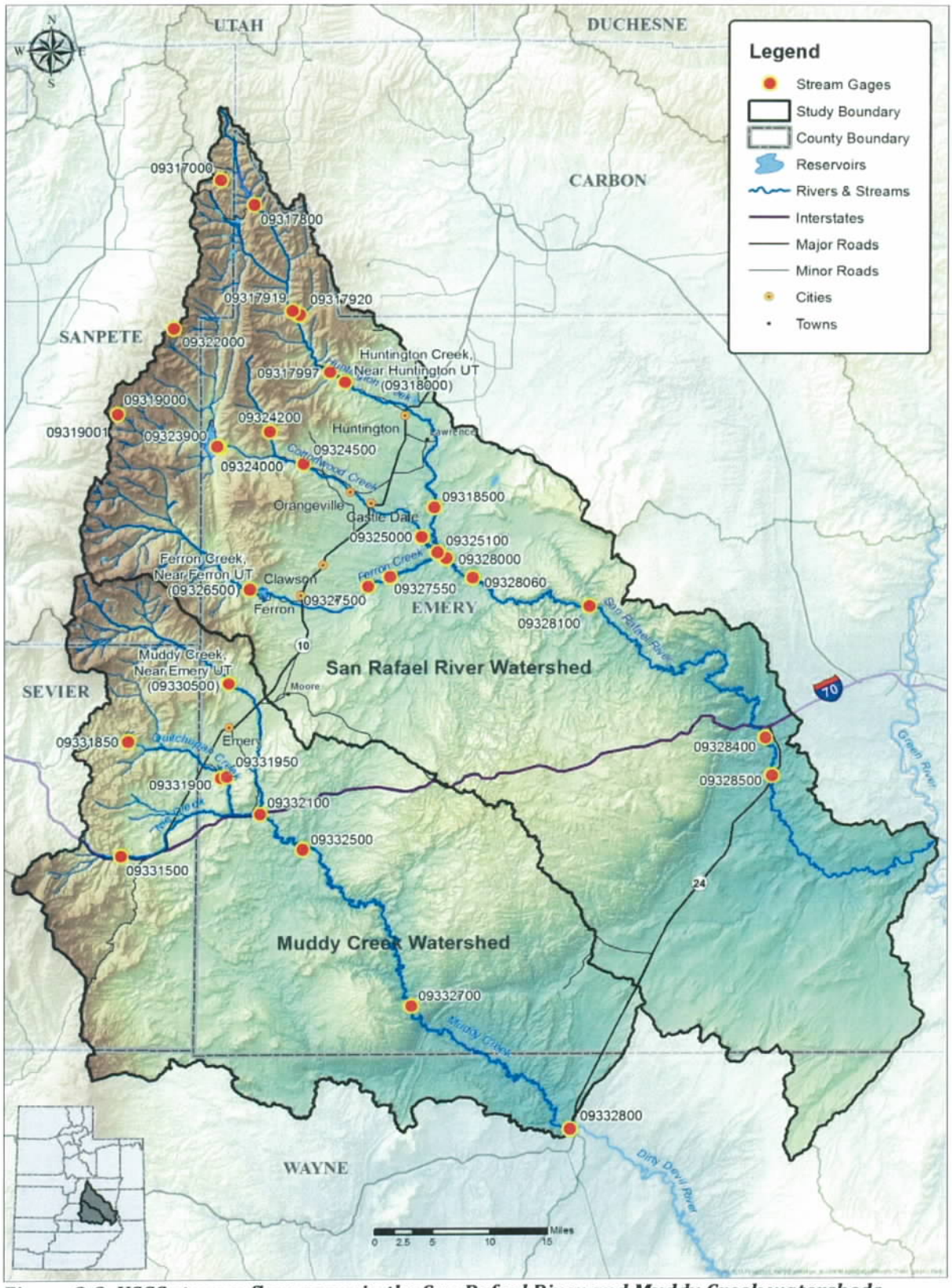


Figure 2-2, USGS stream-flow gages in the San Rafael River and Muddy Creek watersheds.

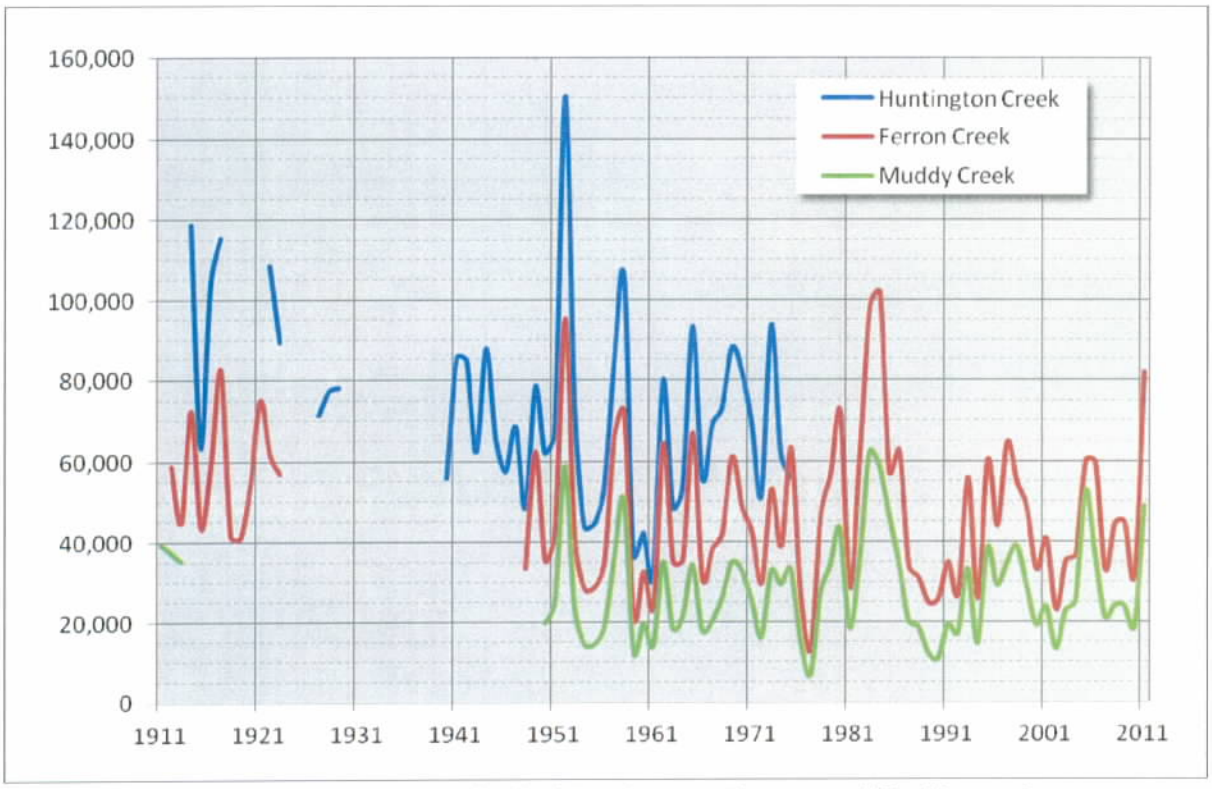


Figure 2-3, Annual streamflow (acre-feet) of Huntington, Ferron, and Muddy creeks.

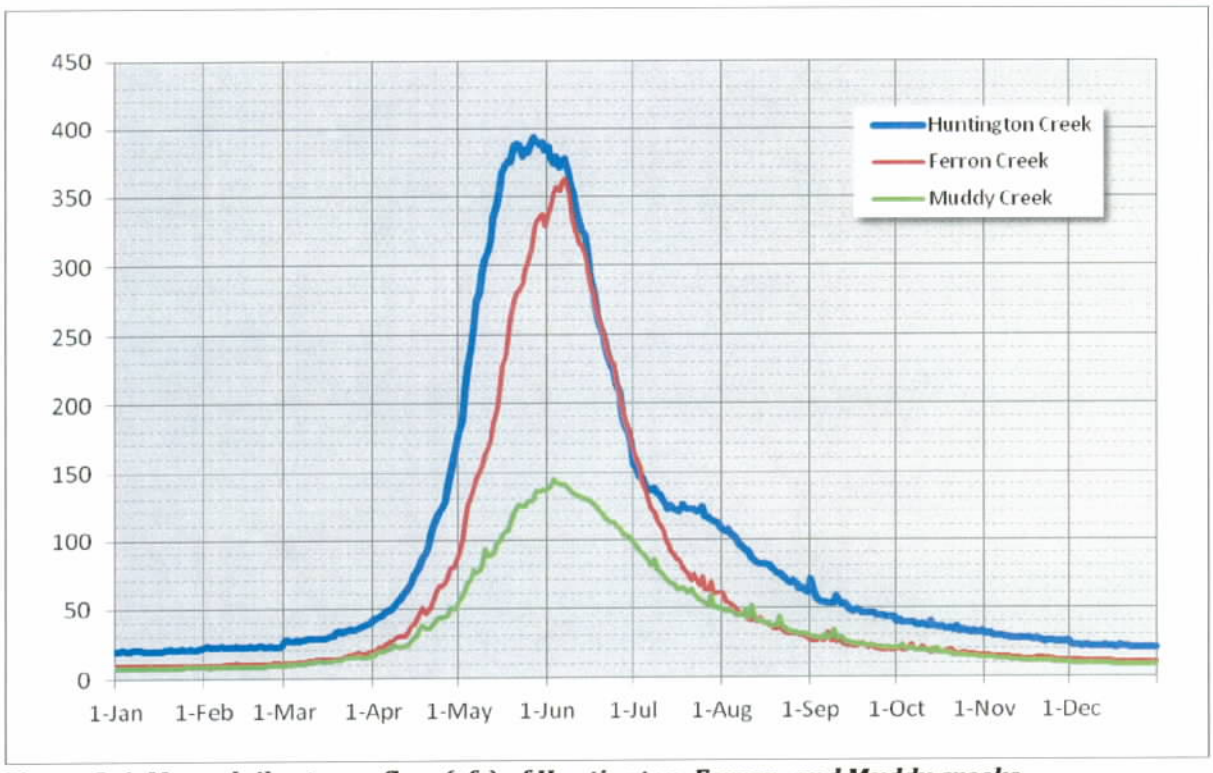


Figure 2-4, Mean daily streamflow (cfs) of Huntington, Ferron, and Muddy creeks.

The hydrographs shown in Figure 2-4 also illustrate the importance of reservoir storage to the study area. More than 64 percent of the annual flow occurs during a brief 3-month period from May through July. If some of this water were not captured and stored, it would be impossible to meet all the downstream demands during the late-summer, fall, and winter months. Storage reservoirs allow the peak runoff to be captured and released when the water is needed for late-season irrigation and year-round power and drinking water needs.

Table 2-2 contains a list of all the storage reservoirs within the study area with a capacity greater than 100 acre-feet. The total capacity of reservoirs in the San Rafael River and Muddy Creek watersheds are approximately 137,600 acre-feet and 2,000 acre-feet, respectively.

Table 2-2, Existing lakes and water storage reservoirs (greater than 100 acre-feet).

Name	Stream	Capacity (ac-ft)	Purpose
San Rafael River Watershed			
Electric Lake	Huntington Creek	31,500	FC,P,R
Huntington Reservoir	Left Fork Huntington Creek	5,616	FC,I,R,P
Cleveland Reservoir	Left Fork Huntington Creek	5,340	FC,I,R,P
Rolfsen Reservoir	Left Fork Huntington Creek	620	FC,I,R
Huntington No. Reservoir	Huntington Cr (off-stream)	5,420	FC,I,R
Miller Flat	Miller Flat Creek	5,560	FC,I,R,P
Grassy Lake	Little Creek	132	R
Petes Hole Reservoir	Seely Creek (off-stream)	180	R
Joes Valley Reservoir	Seely Creek	62,450	FC,I,MI,P
Potters Ponds (1 & 2)	Lowry Water	110	R
Ferron Reservoir	Indian Creek	450	R
Willow Lake	Willow Creek	120	R
Wrigley Spring Reservoir	Slide Hollow	133	R
Millsite Reservoir	Ferron Creek	18,000	FC,I,MI,R
Buckhorn Reservoir	Buckhorn Wash	2,002	I
	TOTAL	**137,633**	-
Muddy Creek Watershed			
Emery Reservoir	North Fork Muddy Creek	145	I
Spinners Reservoir	North Fork Muddy Creek	675	R
Julius Flat Reservoir	North Fork Muddy Creek	725	I
Sheep Valley Reservoir	North Creek-Ivie Creek	465	I
	TOTAL	**2,010**	-

Key: FC= Flood Control, I=Irrigation & Stock Watering, MI=Municipal & Industrial, P=Power, R=Recreation.
Source: Utah Division of Water Rights and Emery Water Conservancy District.

2.1.3 Groundwater

To date the development of groundwater resources in the study area has been relatively minor. Neither the unconsolidated deposits nor the consolidated (bedrock) aquifers located within the study area are attractive targets for groundwater development. Unconsolidated aquifers are of very limited occurrence and where they do occur are of limited size and typically have low permeability. Thus they lack both adequate hydrologic and dimensional properties and are not practical targets for groundwater development. Consolidated (bedrock) aquifers are typically deeply buried making access to them both expensive and difficult. Thus, economic constraints largely preclude consideration of their development as sources of additional water.

Several other reasons contribute to the lack of groundwater development: 1) The existing surface water sources have been adequate to meet the demands for irrigation and M&I needs and 2) the quality of the groundwater in most of the study area is not desirable for domestic, municipal, and some agricultural uses.

2.1.4 Water Uses

Precipitation is the main input to the water budget equation, while natural and human uses are the primary outputs. While the environment uses the bulk of the precipitation that falls within the study areas, human uses are also significant. These include exports out of the study areas and

Panoramic view of Millsite Reservoir and State Park near Ferron.

agricultural and municipal and industrial (M&I) depletions within the study areas. Depletion is the consumption of water within a given area that makes it unavailable for other uses; it includes evaporation and transpiration from plant and animal tissues. Depletion is that portion of a water diversion that does not make its way back into the hydrologic system.

There are several small exports out of the San Rafael River watershed into the San Pitch and Price river watersheds. These are estimated to be approximately 7,109 acre-feet to the San Pitch watershed and 27,895 acre-feet to the Price River watershed annually, for a total export of about 35,000 acre-feet per year. There is also an export from the Muddy Creek watershed near Emery to the San Rafael River watershed. This export averages 6,500 acre-feet annually.

Agricultural depletions amount to approximately 64,700 acre-feet per year in the San Rafael River watershed and 15,800 acre-feet per year in the Muddy Creek watershed. M&I depletions amount to approximately 34,500 acre-feet in the San Rafael River watershed and 2,100 acre-feet in the Muddy Creek watershed annually. (See Section 3 for a more detailed discussion of these water uses.)

2.1.5 Water Budget Summary

2.1.5.1 San Rafael River

The total precipitation within the San Rafael River watershed is about 1,548,200 acre-feet per year (see Table 2-3). Water usage within the basin, as well as imports and exports from the basin, groundwater recharge and net basin yield (the amount of water originating in the basin that makes its way into the Green River and leaves the basin) are all well defined. From these known data it can be inferred that roughly 87 **percent of the basin's natural water supply** (1,341,600 acre-feet per **year) is used by the basin's natural systems. This number includes natural evaporation and plant** transpiration. This results in a basin yield (that portion of naturally occurring water that is

available for use) of 206,600 acre-feet per year, approximately 13 percent of the basin's total annual precipitation.

Subtracting exports from the basin yield and adding imports results in a total average annual available water supply of 178,100 acre-feet per year. Deducting agricultural depletions, M&I depletions, reservoir evaporation, and wetland and riparian depletions leaves an average annual outflow to the Green River of 49,000 acre-feet.

Table 2-3, San Rafael River water budget summary.

Category	Average Annual Volume (Acre-Feet)*
Total Precipitation	1,548,200
Used by Vegetation and Natural Systems	1,341,600
Basin Yield	*206,600*
Exports Out of Basin	35,000
Imports Into Basin	6,500
Available Supply	*178,100*
Agricultural Depletions	64,700
M&I Depletions	34,500
Other Depletions**	29,900
Outllow to the Green River	**49,000**

* Values based on 1989-2009 period of record.
** Net reservoir evaporation and wetland and riparian depletions.

2.1.5.1 Muddy Creek

The total precipitation within the Muddy Creek watershed is about 845,600 acre-feet per year (see Table 2-4). Net water depletions and exports from the basin are all well defined. From these known data it can be inferred that roughly 95 percent of the basin's natural water supply (802,500 acre-feet per year) is used by the basin's natural systems. This number includes natural evaporation and plant transpiration. This results in a basin yield of 43,100 acre-feet per year, approximately 5 percent of the basin's total annual precipitation. About 6,500 acre-feet of water is exported out to the San Rafael River watershed to irrigators near the Town of Moore.

Subtracting exports from the basin yield results in a total average annual available water supply of 36,600 acre-feet per year. Deducting agricultural, M&I, and other depletions leaves an average annual outflow to the Dirty Devil River of 9,500 acre-feet.

2.2 Hydrologic Models

Table 2-4, Muddy Creek water budget summary.

Category	Average Annual Volume (Acre-Feet)*
Total Precipitation	845,600
Used by Vegetation and Natural Systems	802,500
Basin Yield	*43,100*
Exports Out of Basin	6,500
Available Supply	*36,600*
Agricultural Depletions	15,800
M&I Depletions	2,100
Other Depletions**	9,200
Outflow to the Dirty Devil River	**9,500**

* Values based on 1989-2009 period of record.
** Net reservoir evaporation and wetland and riparian depletions.

As part of this study, the Utah Division of Water Resources acquired the popular hydrologic modeling software RiverWare. This modeling program is widely used throughout the United States to model river systems and provides water managers with the ability to study and analyze available hydrologic data under various operating scenarios, and thus optimize overall system operation and management. For purposes of this study, an independent model was prepared for both the San Rafael River and Muddy Creek watersheds. The primary purpose in creating these models was to provide a tool for simulating scenarios of new reservoirs and or management practices that could enhance the use of water within each watershed.

The following sections outline the basic structure of the model, including data inputs and outputs. Also included is an example model simulation of a potential reservoir.

2.2.1 San Rafael River Watershed

The San Rafael River flows through the heart of the watershed, and is tributary to the Green River. There are three major tributaries that feed the San Rafael River, and all converge at nearly the same location. These tributaries are Huntington Creek, Cottonwood Creek, and Ferron Creek. Figure 2-5 is a schematic diagram of the San Rafael River Model.

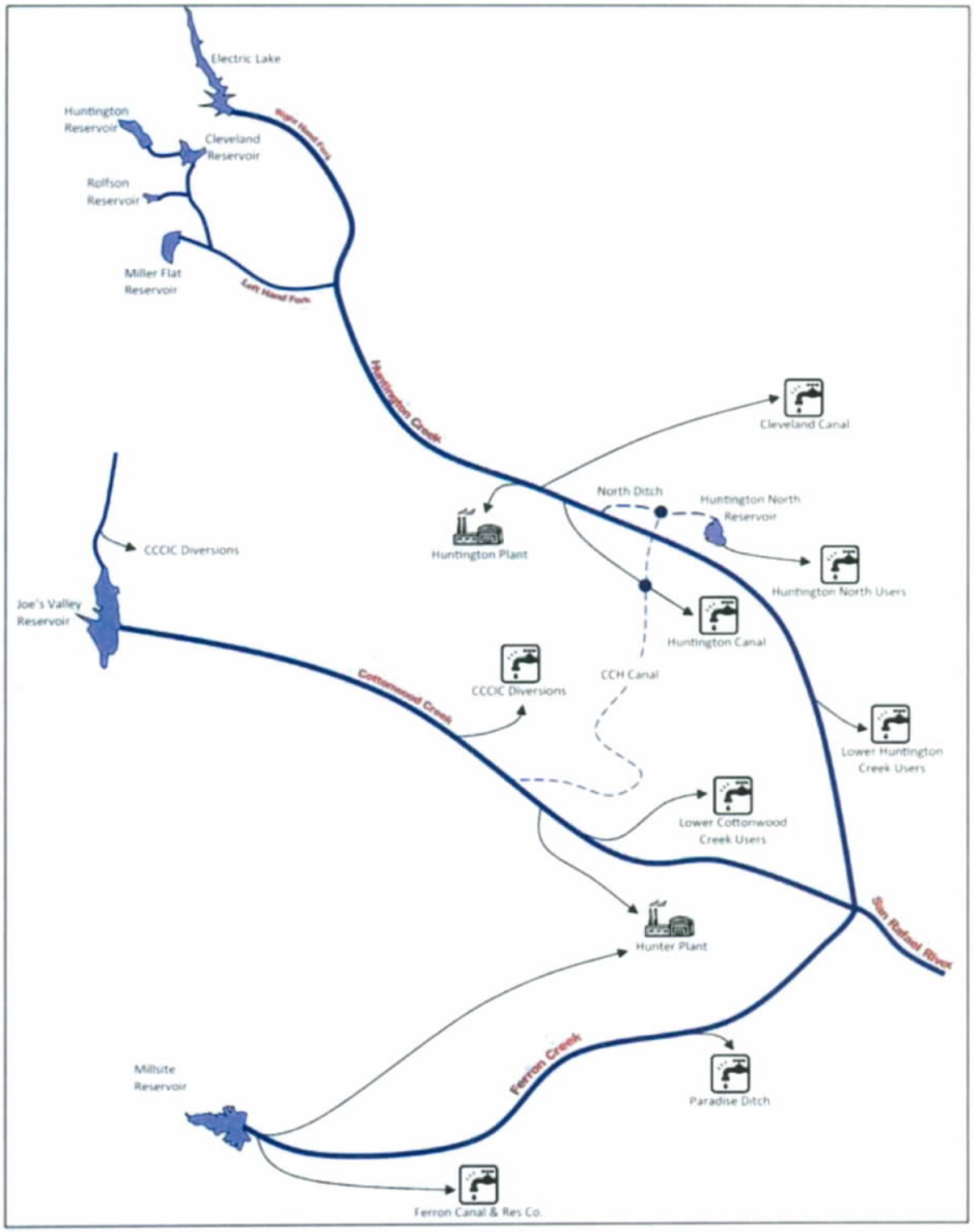


Figure 2-5, San Rafael River Model Diagram.

Huntington Creek is the northern-most stream and is the primary source of water for irrigation in and around the towns of Elmo, Cleveland, Huntington, and Lawrence. Water consumed for power production at PacifiCorp's Huntington Plant also comes from this stream.

The headwaters for the Huntington Creek originate at two stems high in Huntington Canyon, which are referred to as the Left Hand Fork (LHF), and the Right Hand Fork (RHF), the Right Hand Fork being the most Northerly of the two. Near the tops of both these stems are reservoirs that capture a portion of the runoff produced in the individual watersheds. The LHF has four reservoirs that are owned and operated by the Huntington Cleveland Irrigation Company (HCIC), while the RHF has one reservoir which is owned and operated by PacifiCorp.

The next major stream South of Huntington Creek is Cottonwood Creek. The bulk of water that flows in Cottonwood Creek comes from two tributaries called Seely Creek and Lowry Water. The Seely Creek drainage is home to the United States Bureau of Reclamation's (USBR) Joes Valley Project. Joes Valley is the only notable reservoir currently in this particular drainage. The greater percentage of water use from Cottonwood Creek drainage is down in the valley communities, Orangeville and Castledale, but there is a small percentage used up-stream from Joes Valley Reservoir. Cottonwood Creek Consolidated Irrigation Company (CCCIC) is the major irrigation company that delivers water to users in this area. PacifiCorp also receives water from Cottonwood Creek for the Hunter Power Plant.

The last major stream that is tributary to the San Rafael River is Ferron Creek, south of Cottonwood Creek. Millsite Reservoir is the largest in the Ferron drainage and is located just above Ferron. There are also two smaller reservoirs higher in the drainage: Duck Fork and Ferron Reservoirs.

The three water users on the Ferron Creek drainage are PacifiCorp's Hunter Plant, Ferron Canal and Reservoir Company (FCRC), and Paradise Ditch. Millsite Reservoir is owned and operated by FCRC

and serves the communities of Ferron and Clawson, as well as PacifiCorp's Hunter Power Plant. The towns of Ferron, Molen, and Clawson are where the agricultural use from this stream occurs.

2.2.2 Muddy Creek Watershed

The Muddy Creek watershed is smaller by comparison to the San Rafael. This drainage is the next in line just south of Ferron Creek. This creek does not feed into the Green River, but is tributary to the Dirty Devil River, which eventually flows to the Colorado River. There are currently three active reservoirs in the Muddy Creek drainage. All three reservoirs are owned and operated by the Muddy Creek Irrigation Company (MCIC). MCIC is the major water user on Muddy Creek and has one major diversion that diverts water to the towns of Emery and Moore and surrounding farms. Figure 2-6 is a schematic diagram of the Muddy Creek Model.

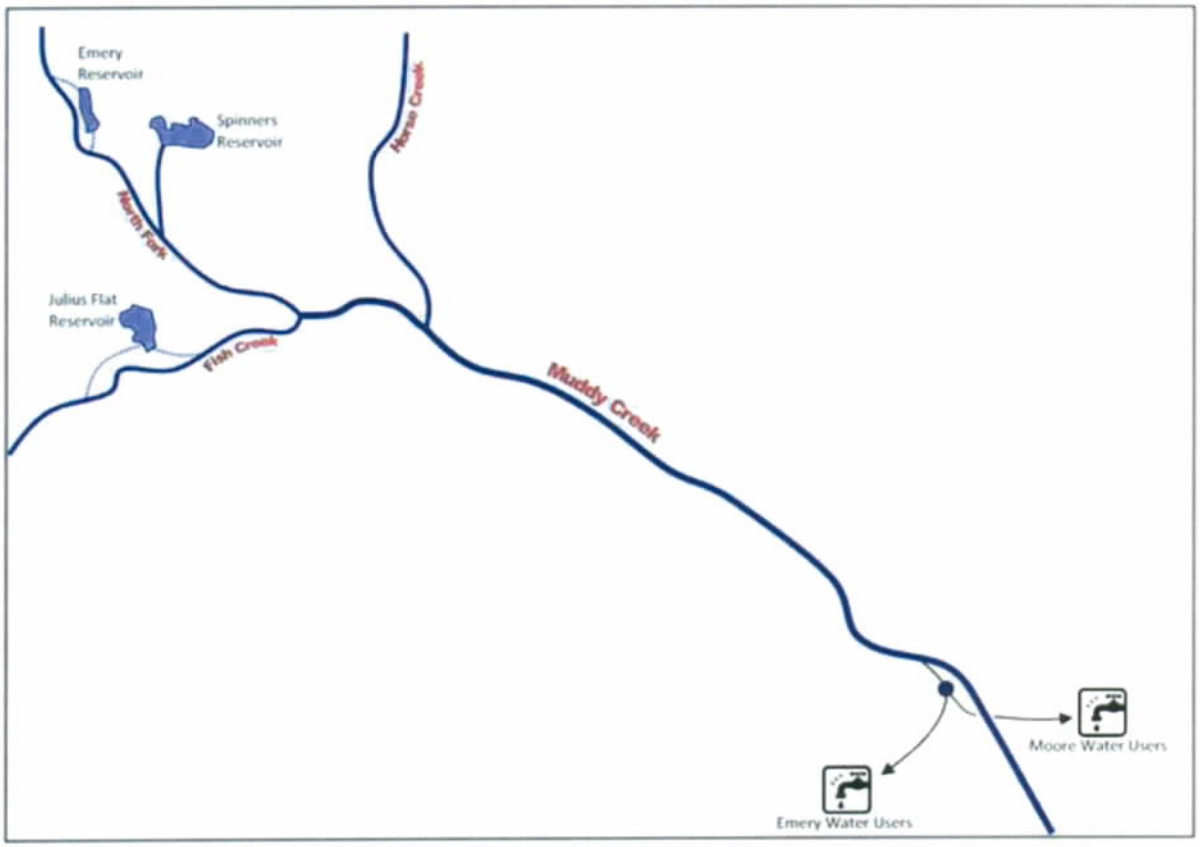


Figure 2-6, Muddy Creek Model Diagram.

2.2.3 Stream Flow Data and Correlations

In the San Rafael River and Muddy Creek watersheds, there are a number of United States Geologic Survey (USGS) stream-flow gages (see Figure 2-2 shown previously). Most of these gages have not been active for long durations, but there is a small number that cover long enough periods that they proved useful in water supply analysis. Table 2-5 shows details of these stream-gages.

Table 2-5, Long-term stream gages in the San Rafael River and Muddy Creek watersheds.

Gage Name	USGS Gage No.	Years
Ferron Creek Near Ferron UT	09326500	1911-1922, 1947-Present
Huntington Creek Near Huntington UT	09318000	1909-1974, 1976-1979
Muddy Creek Near Emery UT	09330500	1910-1915, 1949-Present

In order to fill the gaps in the stream flow records and estimate stream flows for ungaged areas, it was necessary to "reconstruct" stream flows for critical streams and time periods. This process relied heavily upon the existing long-term records available on Huntington, Ferron, and Muddy creeks but also required the use of various hydrologic modeling tools and algorithms including USGS's StreamStats tool and the Area-Altitude method. The reconstructed streamflows were then calibrated with available stream flows to produce a reliable stream flow record for use by the model. For a detailed description of methods used to create the stream flow records used in the San Rafael River and Muddy Creek models, see Appendix A.

2.2.4 Irrigation Diversions

Most of the irrigation in the two watersheds is handled by irrigation companies. These irrigation companies are distributers to smaller water users who have stock in the company. Each of these irrigation companies will be discussed individually as to the role they play in their watersheds. Information on the details of major diversions, reservoirs, and their connectivity came from a

combination of research and conversations with local stake holders who have an extensive knowledge about the systems in the area.

2.2.4.1 Huntington-Cleveland Irrigation Company (HCIC)

HCIC is a combination of two irrigation companies that operate major canals within the Huntington Creek drainage. It should be noted, however, much of the water delivery system is being converted to pipe over the next few years, and the descriptions of the service areas that follow are based on the system as it will be in the near future.

As mentioned previously, HCIC has four reservoirs in the LHF drainage. These reservoirs are: Huntington, Cleveland, Rolfson, and Miller Flat. Huntington and Cleveland are a system of reservoirs where all of Huntington's releases are diverted into Cleveland reservoir. Both Huntington and Cleveland Reservoirs have approximately 5,340 acre-feet of storage capacity at the spillway crest. Rolfson is a relatively small reservoir with about 620 acre-feet of storage at the spillway crest. Miller Flat is the largest of all HCIC Reservoirs and has a storage capacity of approximately 5,560 acre-feet at the spillway crest.

As seen in the schematic model diagram (Figure 2-1), the first major diversion down-stream from these reservoirs is the Huntington Plant diversion. The next is a series of diversions for HCIC which starts with the Cleveland Canal

Huntington Creek Irrigation Company Diversion.

(120 cfs physical capacity), followed by the Huntington Canal (90 cfs physical capacity), and the North Ditch (100 cfs physical capacity). The North Ditch also delivers water to the Huntington North Reservoir. There are number of smaller canals further down-stream which have their own private water rights. These diversions include Avery Canal, Brasher Canal, and Jeff Canal. The Avery Ditch users, however, are the only users that have rights in HCIC along with a private right. Huntington Canal delivers only to users on the South side of Huntington Creek, while Cleveland Canal delivers mostly to users North of Huntington Creek. North Ditch delivers to users on both sides of Huntington Creek.

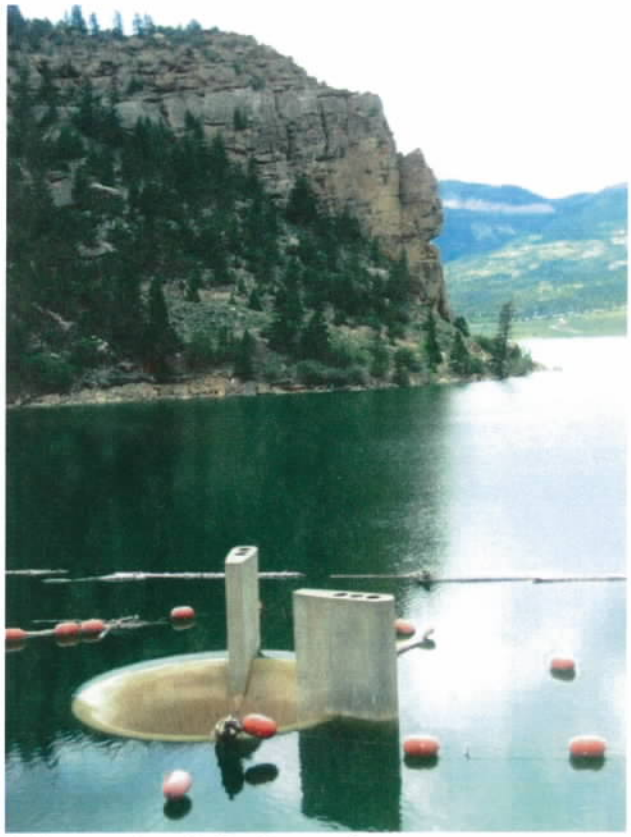
Another notable source of water for HCIC is the Cottonwood Creek Huntington Canal (CCH Canal). The CCH Canal transports project water stored in Joes Valley Reservoir to the HCIC service area. The EWCD, who operates the canal, as well as Huntington North Reservoir, has the ability to deliver water to either Huntington Canal or Huntington North as necessary.

A significant portion of the land served by the Cleveland Canal, and the North Ditch is actually in the Price River drainage. Because of this not all of the return flow (non-depleted water) from HCIC diversions flows into the San Rafael River. Through GIS analysis it was determined that 73 percent **of the Cleveland area's return flow** (or 8,823 acre-feet) and 38 percent **of the North Ditch area's** return flow (or 1,843 acre-feet) goes to the Price River drainage. The remainder of this return flow eventually makes its way to the San Rafael River.

2.2.4.2 Cottonwood Creek Consolidated Irrigation Company (CCCIC)

Like HCIC, CCCIC was also formed from group of smaller irrigation companies, hence the name **"Consolidated." CCCIC is the major distributor of agricultural water to the area.** Like HCIC, CCCIC is also in the process of converting its canal system to pipe, although HCIC is farther along in this

process. The same approach of describing the system in a future context is being applied when discussing CCCIC.



Spillway at Joes Valley Reservoir.

As mentioned above, Joes Valley is the only reservoir which serves the Cottonwood Creek users. The reservoir has a capacity of approximately 62,450 acre-feet at the spillway crest. Since there were multiple benefactors from this project, the reservoir has been divided into separate "pools" for each entity's use. One of these "pools" belongs to CCCIC, which is the only storage the company has in the system. These "pools", as well as other Joes Valley Reservoir details, are discussed more fully in the Water Rights and Operational Practices section. There are pools for the Cottonwood Creek Consolidated Irrigation Company (CCCIC), PacifiCorp's Hunter Plant, HCIC, and smaller pools for the cities of Huntington and Castledale, as well as the town of Orangeville.

The CCCIC diversions are the first down-stream from Joes Valley Reservoir, followed by the Cottonwood Creek Huntington (CCH) Canal, and PacifiCorp's Hunter Plant diversion. Several smaller ditches, that are not part of CCCIC, are located further down in the system.

The lower Cottonwood Creek users, who receive water through Mill, Wilberg, and Wilson ditches, are in a position in the system to receive a significant portion of their demand from return flow. All return flows in this particular drainage eventually makes their way back to the San Rafael River.

2.2.4.3 Ferron Canal and Reservoir Company (FCRC)

As the major irrigation company on the Ferron Creek, FCRC serves the majority of the irrigated land in the drainage, the main exception being Paradise Ranch, which has its own private water right.

Water stored in Millsite and Wrigley reservoirs is the only storage available to the irrigation company. The capacities of the reservoirs at their spillway crests are 18,000 and 133 acre-feet, respectively. Millsite Reservoir was constructed by the NRCS in the 1970s and an extensive upgrade is being planned. The project addresses dam safety concerns and will result in a new spillway configuration and the restoration of storage lost to sedimentation. These improvements on the dam will result in reservoir dimensions altered from the original construction, however, the model does not currently reflect these changes. Like Joes Valley Reservoir there are multiple "pools" that delineate various users water rights in Millsite Reservoir.

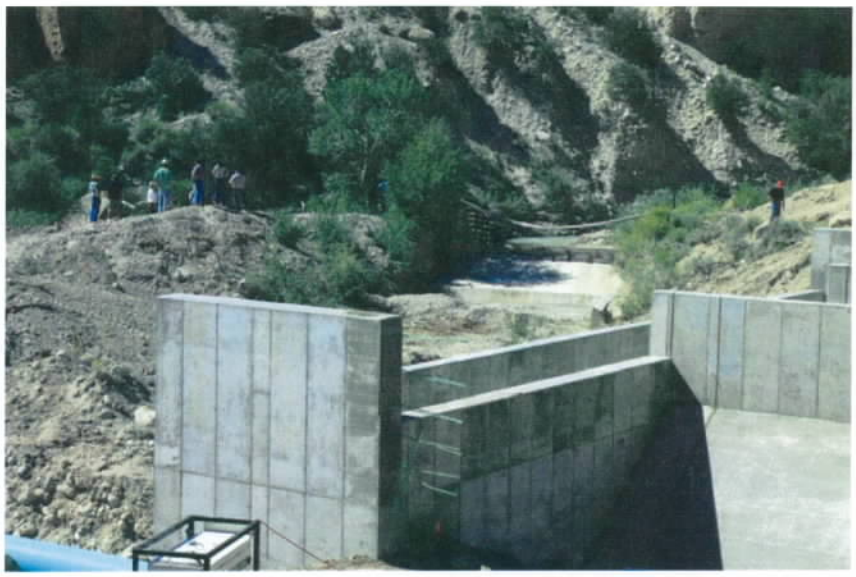
Water is delivered directly from Millsite Reservoir to PacifiCorp's Hunter Power Plant. There is also a major diversion for FCRC directly downstream from the reservoir. This diversion serves all irrigating members of the company. The only other diversion on Ferron Creek is Paradise Ranch's. Like the other smaller water users in the area, this diversion is in a position to receive return flow from the upstream users.

2.2.4.4 Muddy Creek Irrigation Company (MCIC)

The only water user on Muddy Creek is MCIC. MCIC has one major diversion that is divided for the towns of Emery and Moore. Most of the land area served is on the West side of Muddy Creek in the town of Emery.

As mentioned earlier, there are a few small reservoirs used by MCIC. These reservoirs are so small in comparison to the total volume of water that flows down Muddy Creek that their benefit is minute. These reservoirs are Emery, Julius Flat, and Spinners. There are two diversions for each of

these off stream reservoirs, and each has a normal capacity of 10 cfs, but due to sedimentation and debris, one of the Emery Reservoir diversions is currently not functioning. Emery Reservoir has a capacity at the spillway crest of 145 acre-feet, Spinners has a capacity of 675 acre-feet, and Julius Flat has a capacity of 725 acre-feet.



Construction of the new Muddy Creek Diversion's, sedimentation basin. The old diversion dam is visible in the background.

2.2.5 Power Plant Diversions

PacifiCorp owns and operates two coal-fired power plants in the San Rafael River watershed, the Huntington and Hunter power plants. These power plants are two of the largest water users within the San Rafael watershed and have a significant impact on the surrounding communities.

2.2.5.1 Huntington Plant

The Huntington Plant is located near the town of Huntington, up Huntington Canyon. While water diversion to this plant is not the largest along Huntington Creek, because of its facilities, holdings in irrigation companies, and position on the creek, it has a significant impact on all other water users.

In order to provide a reliable water supply to the Huntington Plant, PacifiCorp owns and operates a storage reservoir, Electric Lake, on the right hand fork of Huntington Creek. Electric Lake is the largest reservoir in the Huntington Creek watershed and has a capacity of 31,500 acre-feet at the

spillway crest. This reservoir along with shares in HCIC, and their own rights on the stream, are the sources of water for this power plant.

The Huntington Plant diversion is the first major diversion on Huntington Creek. Water from this diversion is used almost exclusively as cooling water, and as such is essentially one-hundred percent depleted. Any effluent that remains is disposed of on a few small parcels of agricultural land located near the plant so that no water returns to the river.

2.2.5.2 Hunter Plant

The Hunter Plant is located between Cottonwood and Ferron creeks near the community of Castle Dale. Like the Huntington plant, the Hunter plant has a significant impact on water related matters in the area. The plant receives water from both Cottonwood and Ferron creeks.

Like the Huntington Plant, the Hunter Plant also has acquired water shares in the local irrigation companies. These shares are primarily for direct flows from Cottonwood and Ferron creeks. The plant also has storage rights in Millsite and Joes Valley reservoirs. These pools are typically used to serve the Hunter Plant when other supplies are not available.

There is a diversion on both Cottonwood Creek and Ferron Creek for the Hunter Plant. These water diversions ultimately feed into the company's regulating pond called Snow Lake, and from there are used for cooling water. The Hunter Plant also has a similar operation to the Huntington Plant, where the effluent is disposed of on a few some small parcels of land, to ensure no flow returns to the creeks.

2.2.6 Water Rights and Operational Practices

A basic understanding of the water rights in each of the individual drainages within the study area is important as these rights influence the operational practices of water users. This section will

briefly describe the operation of the major stream systems. Much of the material in this section was provided by the Price Office of the Utah Division of Water Rights (DWRi).

2.2.6.1 Huntington Creek

The highest priority water rights on Huntington Creek are direct flow rights owned by HCIC. These rights total 352.25 cfs, which is a significant amount in comparison to the annual flow of the river. After these rights are a series of HCIC storage rights and private rights for the smaller canals mentioned previously. Because of the high-priority of HCIC's water rights, PacifiCorp found it beneficial to acquire water shares from HCIC, and now owns 34 percent of the company shares, all of which are considered first class (highest priority).

The Huntington Plant requires water year-round to generate power. So, typically during the winter PacifiCorp releases 12 cfs from Electric Lake. Because a portion of HCIC and PacifiCorp storage rights are junior in priority to a few of the lower canals, HCIC (and PacifiCorp) are not allowed to fill their reservoirs completely if the lower canals are not satisfied.

Most of the other operations on Huntington Creek generally function as would be expected. Water is called for by each user as it is needed and available. If there is not enough direct flow, then reservoir storage is called for. Water from storage for HCIC could come from either their own reservoirs or from Joes Valley through the CCH Canal. Huntington North Reservoir is essentially operated as a regulating pond, and Miller Flat and Rolfson Reservoirs are usually set to a more constant outflow during the irrigation season, while Huntington and Cleveland Reservoir releases are adjusted to accommodate for varying demand.

2.2.6.2 Cottonwood Creek

Like Huntington Creek, CCCIC has the largest fraction of water rights on the stream, and most of these rights are relatively high priority. However, there is one very notable difference in how the

Joes Valley Project has affected water rights and operations. With the introduction of the Joes Valley Project came an agreement between CCCIC and the U.S. Bureau of Reclamation. CCCIC was given a portion of storage and in turn they agreed to limit their early season (April-June) irrigation to 15,200 acre-feet.

As has been mentioned earlier, Joes Valley has been divided into pools of storage for each party whom the reservoir was intended to benefit. There are pools for the CCCIC, PacifiCorp, HCIC, and smaller pools for Huntington, Castle Dale, and Orangeville cities. Table 2-6 shows a breakdown of each of these pools and their volumes. The capacity of Joes Valley was designed to provide two years of storage for each pool. PacifiCorp is the only water user that is allowed to carry-over storage from year to year.

Table 2-6, Breakdown of storage pools in Joes Valley Reservoir.

Water User	1-Year Pool (ac-ft)
Huntington-Cleveland Irrigation Co. (HCIC)	11,324
Cottonwood Creek Consolidated Irrigation Co. (CCCIC)	4,761
PacifiCorp	8,576
Huntington City	189
Castle Dale City	55
Orangeville City	45
TOTAL	**24,950**
2-Year Total	**49,900**

Similar circumstances to the HCIC and Huntington Plant relationship exist between CCCIC and the Hunter Plant. As a result PacifiCorp has also acquired rights in CCCIC at 27% of total shares. However, PacifiCorp's rights in the company only apply to direct-flow, consequently the Hunter Plant has no rights to CCCIC's 4,761 acre-feet of storage in Joes Valley Reservoir. PacifiCorp has storage rights for 8,576 acre-feet in Joes Valley Reservoir.

As with Huntington Creek, the smaller water users do not have storage on the system, and must rely on their direct flow rights. These private rights range in priority and many of them are actually above the reservoir. The rights that are below the reservoir all have higher priority than the USBR right for Joes Valley storage.

2.2.6.3 Ferron Creek

The highest priority right on Ferron Creek is not FCRC, but rather Paradise Ditch. This is a small direct flow right and allows for a fairly reliable supply for the ditch. The remainder of direct flow rights are owned by FCRC. This situation again has influenced PacifiCorp to obtain rights in the major irrigation company to use at the Hunter Plant. PacifiCorp has 37 percent of FCRC rights and this includes storage allotted to the irrigation company in Millsite Reservoir.

2.2.7 Trans-basin Diversions

There are a number of trans-basin diversions in the Huntington, Cottonwood, and Ferron creek drainages that divert water west around the ridge to the San Pitch watershed. Although gaging has been done at varying times on these diversions, to simplify the model, it was assumed that these diversions will continue to be operated as they have in the past and therefore unnecessary to include them explicitly into the analysis.

2.2.8 Summary of Base Model Output

The San Rafael River and Muddy Creek models are hydrologic models that are capable of simulating existing conditions. As such, they produce meaningful estimates of the water available at various times and in various locations throughout the watersheds. Similar to the water budgets, the models produce an estimate of the total available water supply and yield within each watershed as well as the water diverted and consumed for various purposes. This basic data output is summarized in the following sections. Although similar to the results of the water budgets discussed previously,

the model output is not the same. The primary reason for this is the models include a longer period of hydrologic data, while the water budget only includes data from 1989-2011. The primary reason the Utah Division of Water Resources used both methods of estimation for this report was because the water budget provides a detailed overview of available water supply and uses over a defined time period, while the hydrologic models represent tools that can be updated, refined, and used multiple times to support water management decisions over many years. Furthermore, the results of one method serve to validate and strengthen the output from the other, assuming the results of both are similar.

2.2.8.1 San Rafael River – Summary of Existing Conditions

Table 2-7 contains estimates of outflow and evaporation from major storage reservoirs in the San Rafael River watershed. As shown, the average annual outflow from these reservoirs is approximately 164,400 acre-feet. The average annual evaporation is about 7,200 acre-feet.

Table 2-7, Outflow and evaporation from reservoirs in the San Rafael River watershed.

Subwatershed/ Reservoir	Average Annual Outflow (ac-ft)	Average Annual Evaporation (ac-ft)
Huntington Creek		
Electric Lake	7,635	556
Huntington	4,144	146
Cleveland	5,404	120
Rolfson	2,875	50
Miller Flat	8,214	183
Huntington North	14,159	953
Subtotal	***42,431***	***2,008***
Cottonwood Creek		
Joe's Valley	74,168	3,271
Ferron Creek		
Millsite	47,764	1,950
TOTAL	**164,363**	**7,229**

Table 2-8 contains a summary of all the major diversions from the three main tributaries of the San Rafael River. As shown, the average annual diversions from Huntington Creek, Cottonwood Creek, and Ferron Creek are approximately 66,800, 55,200, and 34,200 acre-feet, respectively. The average annual diversion from entire watershed totals approximately 156,300 acre-feet. According to the model, average annual shortages range from 17

percent in the Huntington and Cottonwood creek drainages to 23 percent in the Ferron Creek drainage, for a total annual shortage of about 35,000 acre-feet for the three tributary watersheds.

Table 2-8, Summary of major diversions in the San Rafael River watershed.

Subwatershed/ Diversion	Average Annual Diversion (ac-ft)	Average Annual Shortage (ac-ft)	Average Annual Shortage %
Huntington Creek			
Huntington Plant	11,000	-	-
Cleveland Canal	29,888	6,924	19%
Huntington Canal Users	8,537	1,796	17%
Huntington North Users	14,057	4,642	25%
Lower Huntington Canals			
Avery Canal	*309*	*1*	*0%*
Jeffs Canal	*2,722*	*313*	*10%*
Brasher Canal	*331*	*161*	*33%*
Subtotal	***66,845***	***13,836***	***17%***
Cottonwood Creek			
CCCIC	30,270	10,231	25%
Hunter Plant (CCCIC)	5,720	-	-
Hunter Plant (Joe's Valley)	3,838	-	-
CCH Canal	11,338	57	0%
Lower CWC Canals			
Mill Ditch	*2,563*	*113*	*4%*
Willberg Ditch Class 1	*121*	*31*	*20%*
Willberg Ditch Class 2	*201*	*153*	*43%*
Wilsonville Ditch	*1,096*	*509*	*32%*
Cities (Joe's Valley)			
Castledale	*55*	-	-
Orangeville	*45*	-	-
Subtotal	***55,247***	***11,093***	***17%***
Ferron Creek			
Hunter Plant (Millsite)	4,920	-	-
Hunter Plant (FCRC)	4,373	-	-
FCRC	24,155	9,988	29%
Paradise Ditch	716	38	5%
Subtotal	***34,164***	***10,027***	***23%***
TOTAL	**156,256**	**34,956**	**18%**

Table 2-9 contains a summary of downstream flows within the San Rafael River watershed. As shown, approximately 46,000 acre-feet flows past the diversions on the three major tributaries to the San Rafael River. Approximately 15,300 acre-feet of return flows make their way to the San Rafael River from upstream irrigation diversions. The model also estimates 7,300 acre-feet of natural inflows, which results in an estimated average of 68,600 acre-feet entering the San Rafael River each year. Figure 2-7 shows a summary of these flows.

Table 2-9, Summary of downstream flows in the San Rafael River watershed.

Flow Category		Average Annual Flow (ac-ft)
Non-Diverted Flow from		
Huntington Creek		11,200
Cottonwood Creek		20,200
Ferron Creek		14,600
	Subtotal	**46,000**
Return Flows to		
Huntington Creek		4,600
Cottonwood Creek		6,500
Ferron Creek		4,200
	Subtotal	**15,300**
Reach Gains		7,300
Flow to San Rafael River		**68,600**

Period of Record: 1950-2010.

2.2.8.2 Muddy Creek - Summary of Existing Conditions

Table 2-10 contains estimates of outflow and evaporation from the reservoirs in the Muddy Creek watershed. As shown, the average annual outflow from these reservoirs is about 1,700 acre-feet, and annual evaporation is 71 acre-feet.

Table 2-10, Outflow and evaporation from reservoirs in the Muddy Creek watershed.

Reservoir		Average Annual Outflow (ac-ft)	Average Annual Evaporation (ac-ft)
Emery Reservoir		345	7
Julius Flat Reservoir		933	47
Spinners Reservoir		425	17
	TOTAL	**1,703**	**71**

Table 2-11 contains a summary of the two major diversions from Muddy Creek. As shown, the average annual diversion from Muddy Creek totals about 17,800 acre-feet. According to the model,

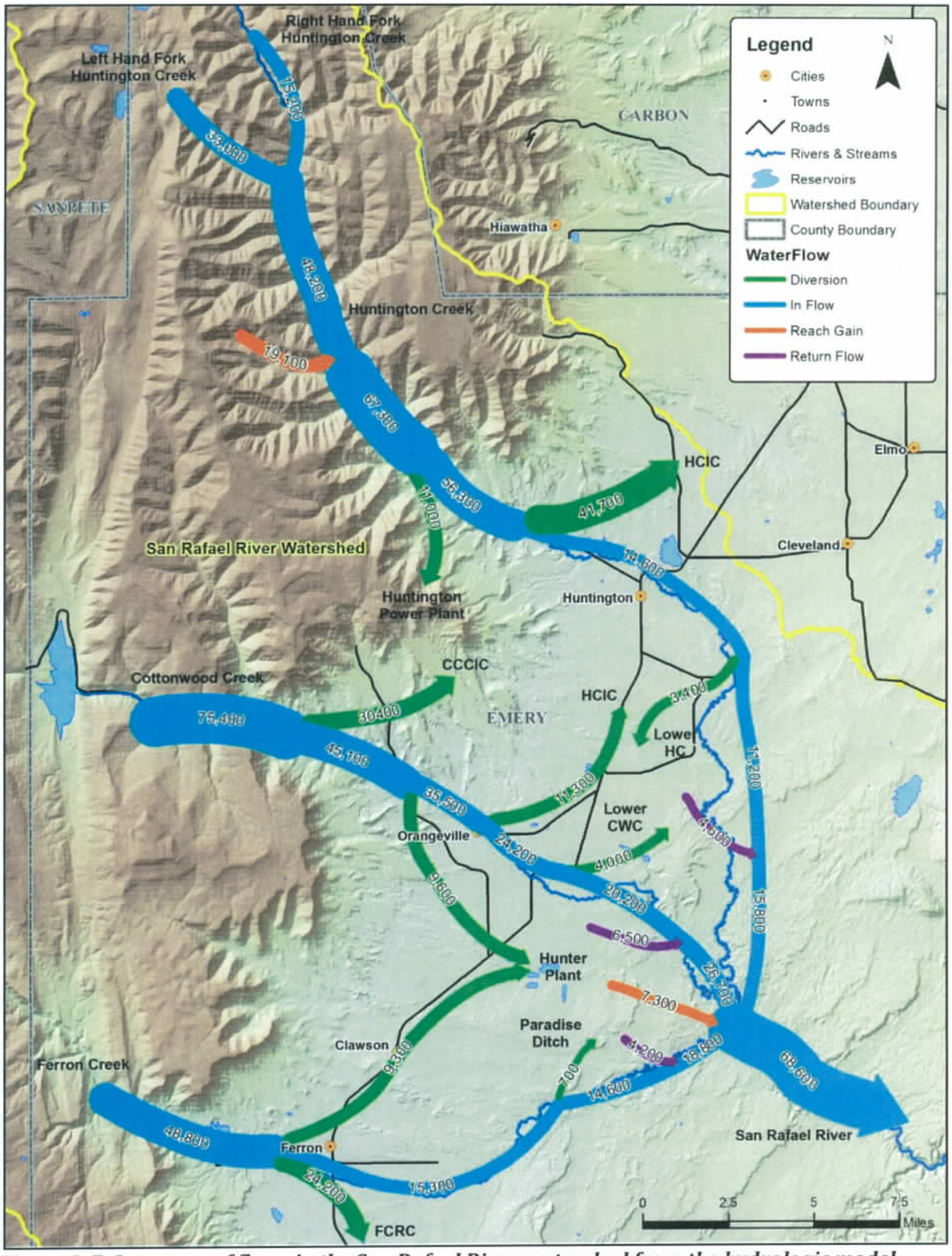


Figure 2-7, Summary of flows in the San Rafael River watershed from the hydrologic model.

annual shortages amount to approximately 11,400 acre-feet or approximately 39 percent of the demand and are shared equally by Emery and Moore irrigators.

Table 2-11, Summary of major diversions in the Muddy Creek watershed.

Diversion	Average Annual Diversion (ac-ft)	Average Annual Shortage (ac-ft)	Average Annual Shortage %
Emery	12,952	8,288	39%
Moore	4,891	3,130	39%
TOTAL	**17,843**	**11,418**	**39%**

Table 2-12 contains a summary of downstream flows within the Muddy Creek Watershed. As shown, 140 acre-feet of return flows make their way to the San Rafael River from the Moore irrigation diversion. Approximately 9,600 acre-feet flows past the diversion on Muddy Creek annually and average of 13,900 acre-feet flows down Muddy Creek after return flows (approx. 4,300 ac-ft) from Emery diversions are added back in. The model does not estimate natural inflows entering Muddy Creek beyond the irrigated lands near Emery. Figure 2-8 shows a summary of these flows.

Table 2-12, Summary of downstream flows in the Muddy Creek watershed.

Flow Category	Average Annual Flow (ac-ft)
Return Flow to San Rafael River (from Moore diversion)	140
Muddy Creek Non-Diverted Water	9,620
Return Flow to Muddy Creek	4,280
Muddy Creek Downstream Flow	13,900

Period of Record: 1950-2010.

2.2.9 Scenario Analysis

In addition to the ability to produce basic hydrologic simulations, both the San Rafael River and the Muddy Creek models have the capability to analyze structural and operational changes to the water storage and delivery systems within each watershed. For example, a new storage reservoir could be placed in the system and the model used to analyze the hydrologic changes that would result.

While each model is capable of analyzing an endless number of scenarios, only a few were included

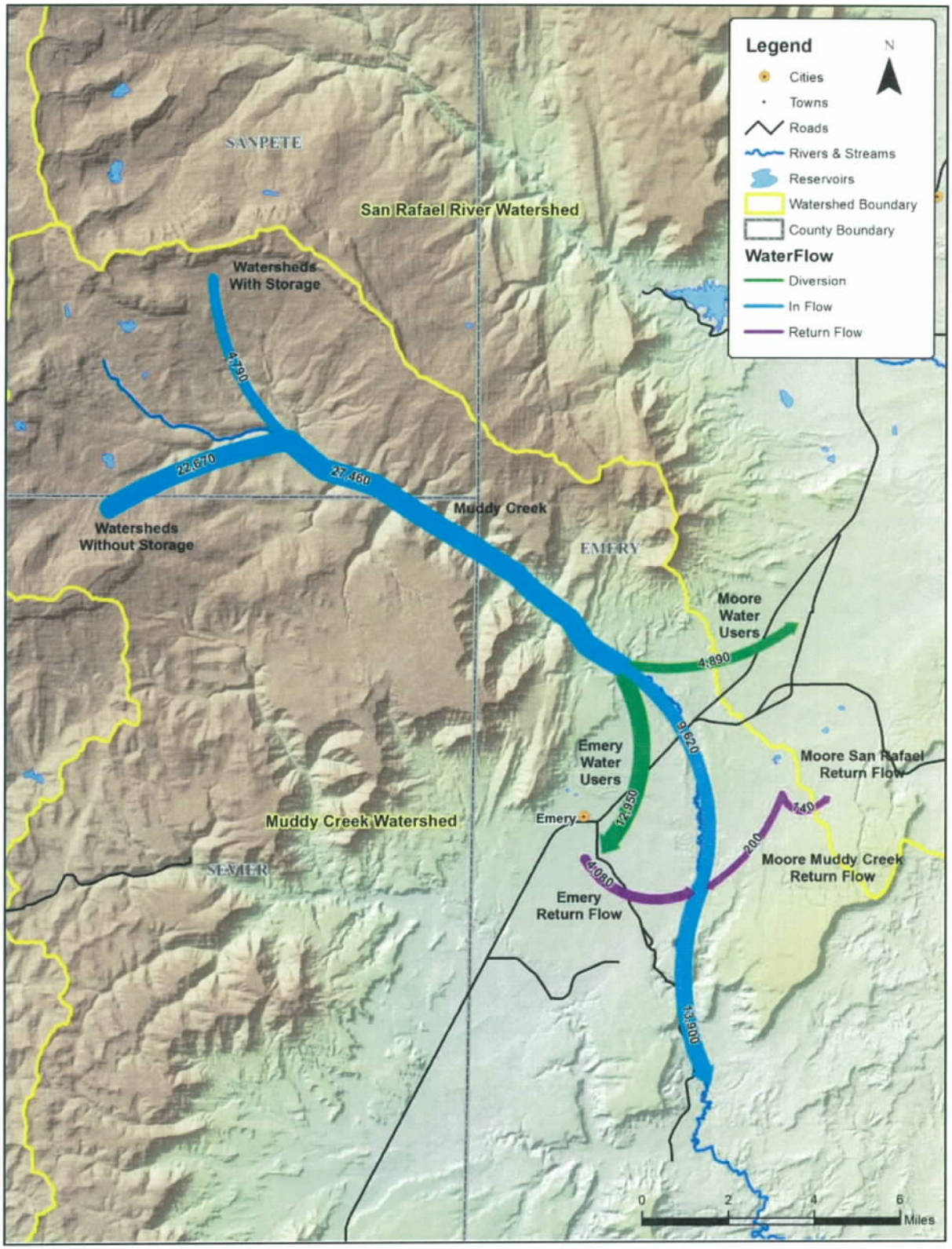


Figure 2-8, Summary of flows in the Muddy Creek watershed from the hydrologic model.

in this report to provide examples of the models' capabilities. These are summarized in the following sections. As needed, the Utah Division of Water Resources will analyze additional scenarios to help local stakeholders study various alternatives. The division hopes that these models will serve as valuable water management tools to support future water management and decision-making within the study areas.

2.2.9.1 Enlarging Rolfson Reservoir

This scenario involves raising Rolfson Reservoir's dam crest 10 ft, and spillway crest 8 ft. These changes required the production of new elevation-volume, elevation-area, and spillway tables for use by the model. Summary results for this scenario are presented in Table 2-13. As shown, raising Rolfson Dam 10 feet increases the storage capacity of the reservoir by 506 acre-feet, double its original capacity of 504 acre-feet. However, the model estimates that raising the dam would only increase the yield by 232 acre-feet, or less than half the increase in capacity. These results show what may be a common theme in the entire Huntington Creek drainage—namely, increasing storage capacity may produce only a nominal additional yield.

Table 2-13, Scenario Summary – Raising Rolfson Dam.

	Average Annual Values (acre-feet)	
	Existing Conditions	*Reservoir Scenario*
HCIC Diversions	41,721	41,951
Storage Capacity	504	1,010
Evaporation	50	73
Outflow	2,875	2,863
Increase in Yield		232
Increase in Storage		506
Storage:Yield Ratio		2.2:1

The model also produced a reservoir storage frequency curve and a yield-capacity curve, which are shown in Figures 2-9 & 2-10. A storage frequency curve shows the statistical likelihood that the

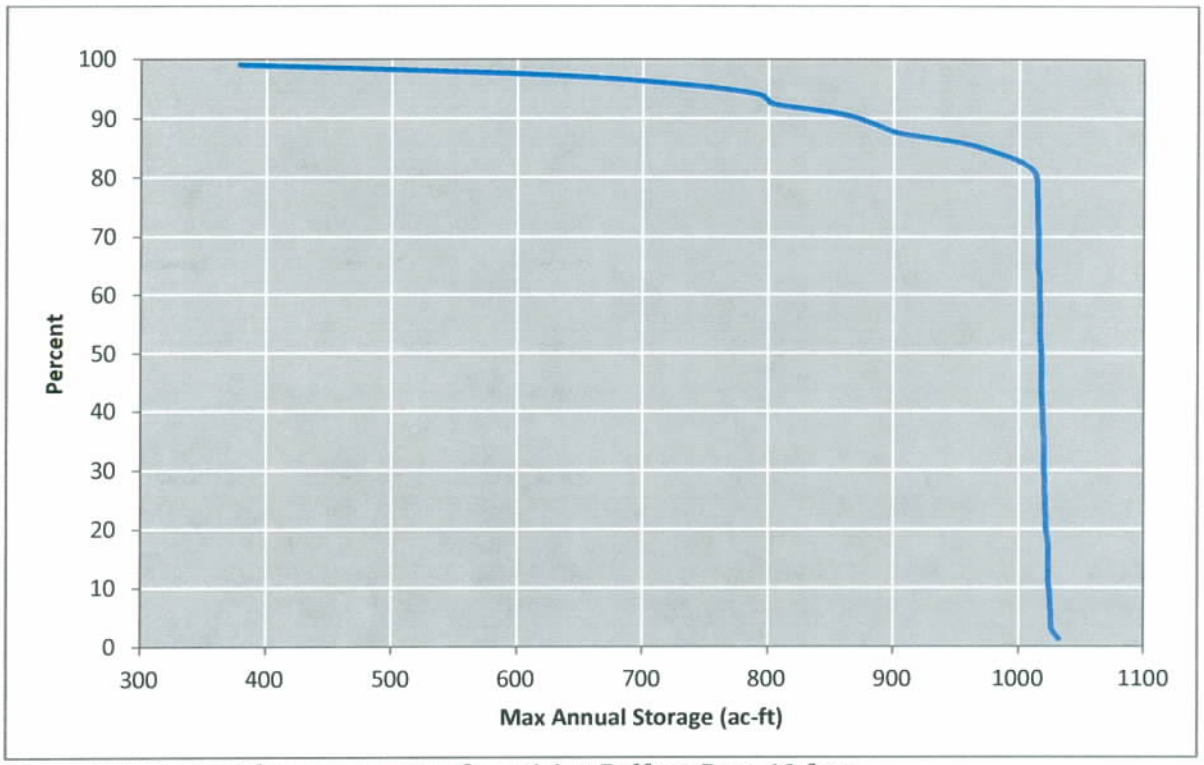


Figure 2-9, Storage frequency curve for raising Rolfson Dam 10 feet.

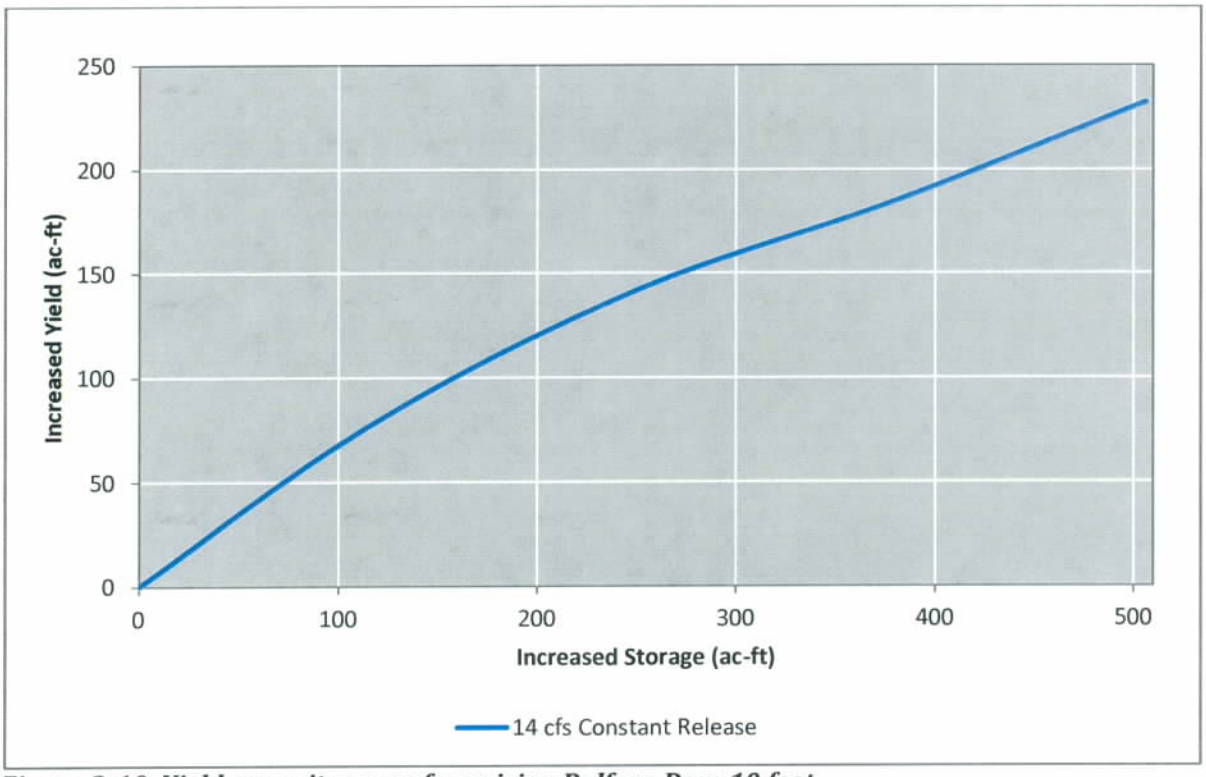


Figure 2-10, Yield-capacity curve for raising Rolfson Dam 10 feet.

enlarged reservoir will reach a particular level of storage, based on the entire period of record simulated by the model. The yield-capacity curve shows how much yield increases with increased capacity. As shown, raising Rolfson Dam 10 feet would result in the reservoir filling more than 80 percent of the time, a very favorable outcome.

2.2.9.2 Enlarging Miller Flat Reservoir

There are two essential aspects of this scenario: (1) To raise Miller Flat Reservoir's dam crest by 25 feet and the spillway crest 20 feet. (2) Diverting 20 cfs of Staker Creek into the enlarged reservoir. Staker Canyon, the drainage just north of the Miller Flat drainage, would be diverted into an existing, abandoned ditch to add to the inflows of the reservoir during the filling months. The water supply available for diversion from this particular canyon was determined using the same methods outlined previously, the specifics of which can be found in Appendix A. This scenario also required the modification of releases from Miller Flat changed from 40 cfs to 60 cfs. The results of this scenario are shown in Table 2-14. As shown, raising Miller Flat Dam 25 feet increases the storage capacity of the reservoir by 4,190 acre-feet, an increase of about 80 percent. However, the model estimates that raising the dam would only increase the yield by 934 acre-feet, or less than one-fourth the increase in capacity.

Table 2-14, Scenario Summary – Enlarging Miller Flat Reservoir.

	Average Annual Values (acre-feet)	
	Existing Conditions	*Reservoir Scenario*
HCIC Diversions	41,721	42,655
Storage Capacity	5,250	9,440
Evaporation	183	238
Outflow	8,214	9,792
Increase in Yield	-	934
Increase in Storage	-	4,190
Storage:Yield Ratio	-	4.5:1

The model also produced a reservoir storage frequency curve and a yield-capacity curve, which are shown in Figures 2-11 & 2-12. A storage frequency curve shows the statistical likelihood that the

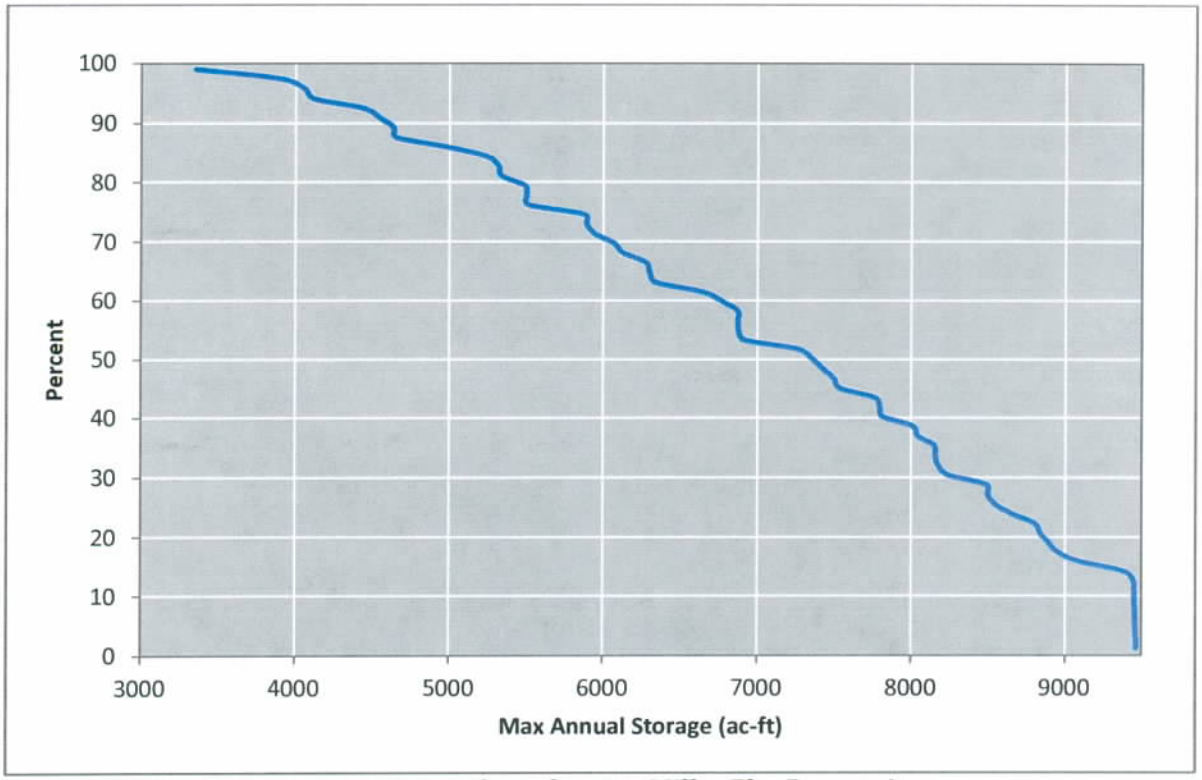


Figure 2-11, Storage frequency curve for enlarging Miller Flat Reservoir.

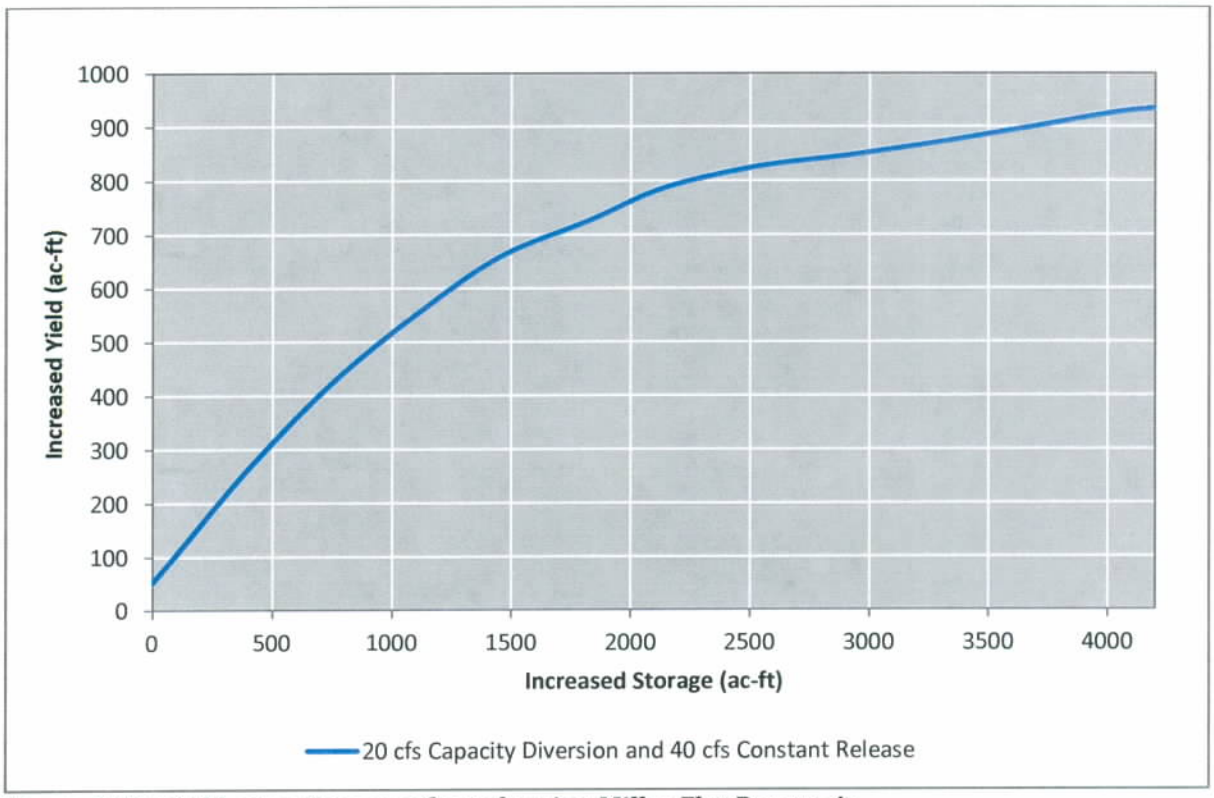


Figure 2-12, Yield-capacity curve for enlarging Miller Flat Reservoir.

enlarged reservoir will reach a particular level of storage, based on the entire period of record simulated by the model. As shown, raising Miller Flat Dam 25 feet and diverting 20 cfs of Staker Creek into the enlarged reservoir during the runoff period would result in the reservoir filling less than 15 percent of the time. The yield-capacity curve shows that the increases in yield begin to diminish when the increased storage capacity rises above approximately 1,500 acre-feet.

2.2.9.3 New Off-stream Reservoir on Rock Canyon Creek

This is a new off-stream reservoir located on a tributary to Cottonwood Creek that joins near the bottom of the watershed. To make this option more feasible, an additional diversion would take water from Cottonwood Creek to supply the reservoir. In order to examine the effectiveness of this scenario it was necessary to apply a fictitious demand to the reservoir. Lacking necessary details of possible downstream environmental demands, a value 2,000 acres of irrigated land was used to provide a demand with which to evaluate the reservoir. The diversion to the reservoir was assumed to have a capacity of 100 cfs. The results of this scenario are shown in Table 2-15. As shown, constructing a new off-stream reservoir on Rock Canyon Creek would increase the storage capacity in the San Rafael drainage by about 13,700 acre-feet. However, the model estimates that the new reservoir would only increase the yield by about 4,900 acre-feet, or less than one-third the increase in capacity.

Table 2-15, Scenario Summary – New off-stream reservoir on Rock Canyon Creek.

	Average Annual Values (acre-feet)	
	Existing Conditions	*Reservoir Scenario*
New User Diversions	2,337	7,243
Storage Capacity	-	13,741
Evaporation	-	1,762
Outflow	-	349
Increase in Yield		4,906
Increase in Storage		13,741
Storage:Yield Ratio		2.8:1

The model also produced a reservoir storage frequency curve and a yield-capacity curve, which are shown in Figures 2-13 & 2-14. A storage frequency curve shows the statistical likelihood that the

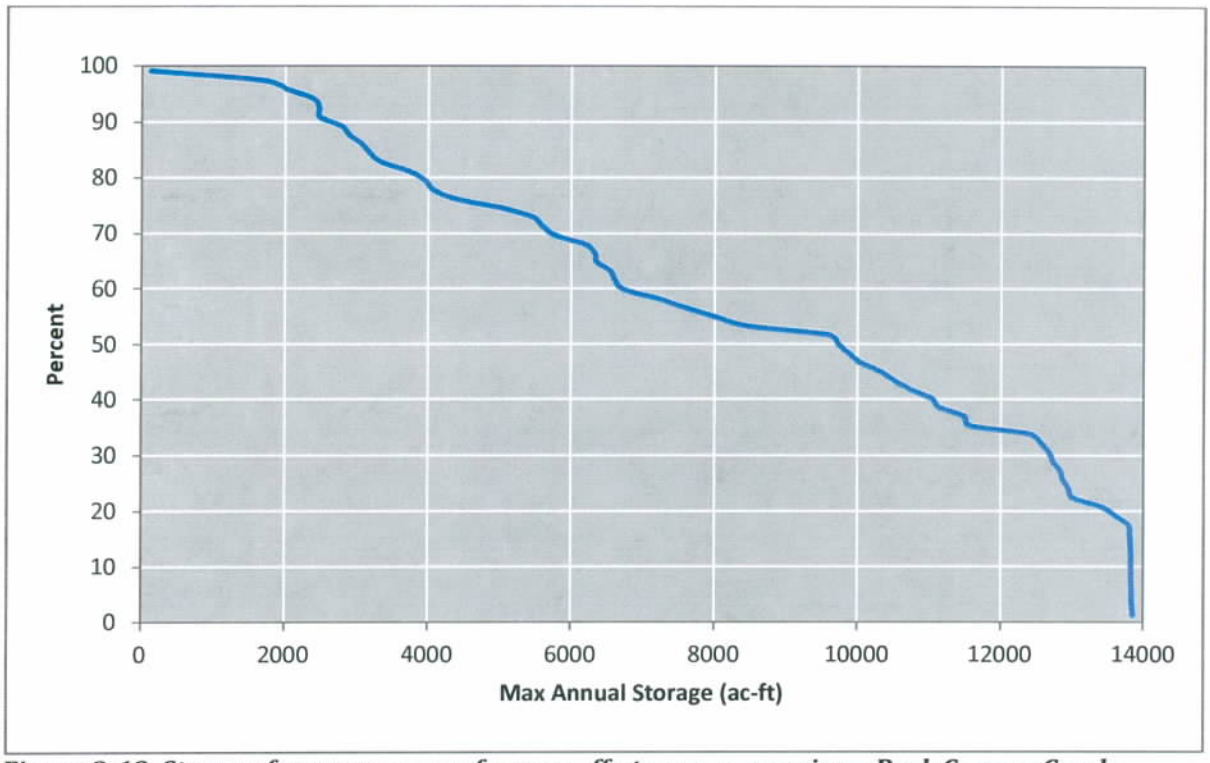


Figure 2-13, Storage frequency curve for new off-stream reservoir on Rock Canyon Creek.

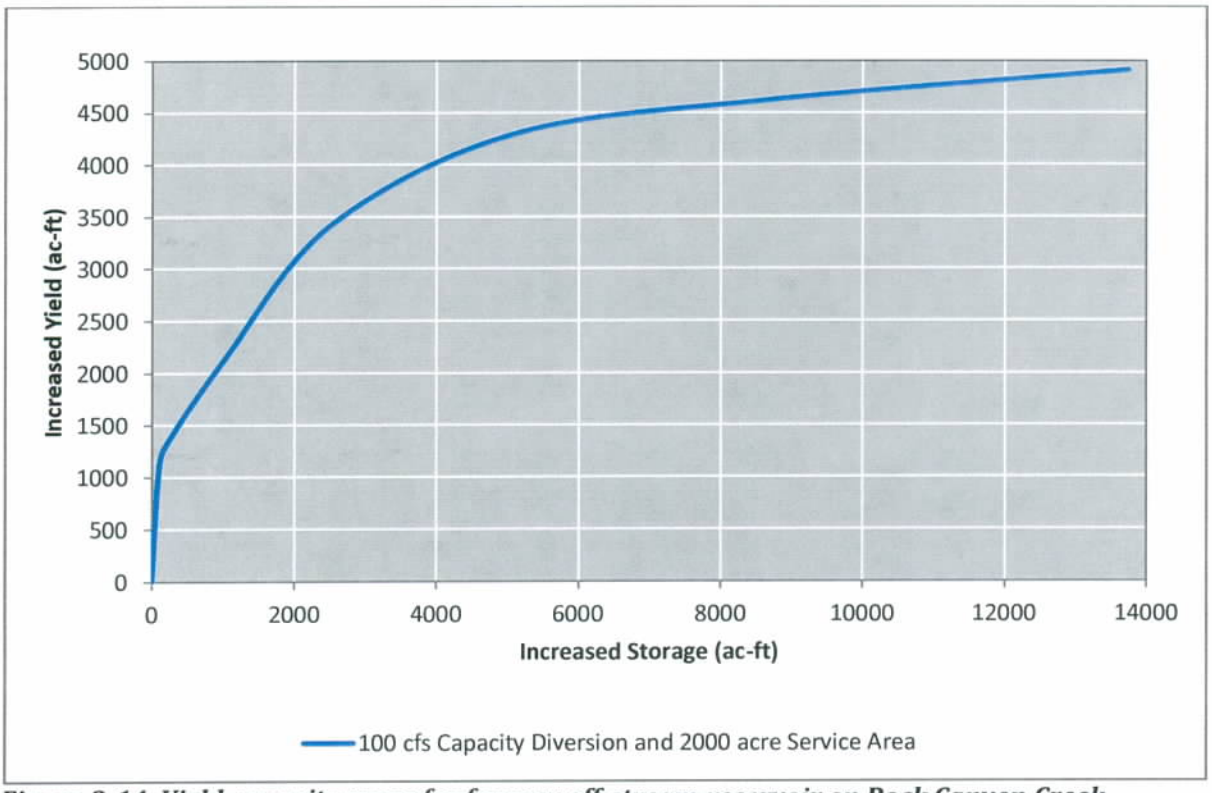


Figure 2-14, Yield-capacity curve for for new off-stream reservoir on Rock Canyon Creek.

enlarged reservoir will reach a particular level of storage, based on the entire period of record simulated by the model. As shown, the new Rock Canyon Creek Reservoir would fill less than 20 percent of the time and the increases to yield with increased capacity begin to decline at reservoir capacities above about 3,000 acre-feet.

2.2.9.4 Enlarging Spinners Reservoir

There are two essential aspects of this scenario: (1) To raise Spinners Reservoir's dam crest by 24 feet and the spillway crest 20 feet. (2) Diverting 20 cfs of Horse Creek into the enlarged reservoir. The results of this scenario underscore the current problem with Spinners Reservoir–the issue being it does not fill annually. Diverting water from Horse Creek alone could be a simple way to ensure Spinners Reservoir fills and increase yield. The results of this scenario are shown in Table 2-16. As shown, enlarging Spinners Reservoir 24 feet and diverting 20 cfs from Horse Creek into the reservoir increases the storage capacity of the reservoir by 403 acre-feet and the yield by 239 acre-feet.

Table 2-16, Scenario Summary – Enlarging Spinners Reservoir.

	Average Annual Values (acre-feet)	
	Existing Conditions	*Reservoir Scenario*
Muddy Creek Diversions	17,843	18,082
Storage Capacity	638	1,041
Evaporation	17	31
Outflow	425	804
Increase in Yield		239
Increase in Storage		403
Storage:Yield Ratio		1.7:1

The model also produced a reservoir storage frequency curve and a yield-capacity curve, which are shown in Figures 2-15 & 2-16. A storage frequency curve shows the statistical likelihood that the enlarged reservoir will reach a particular level of storage, based on the entire period of record simulated by the model. As shown, the enlarged Spinners Reservoir would fill less than 15 percent

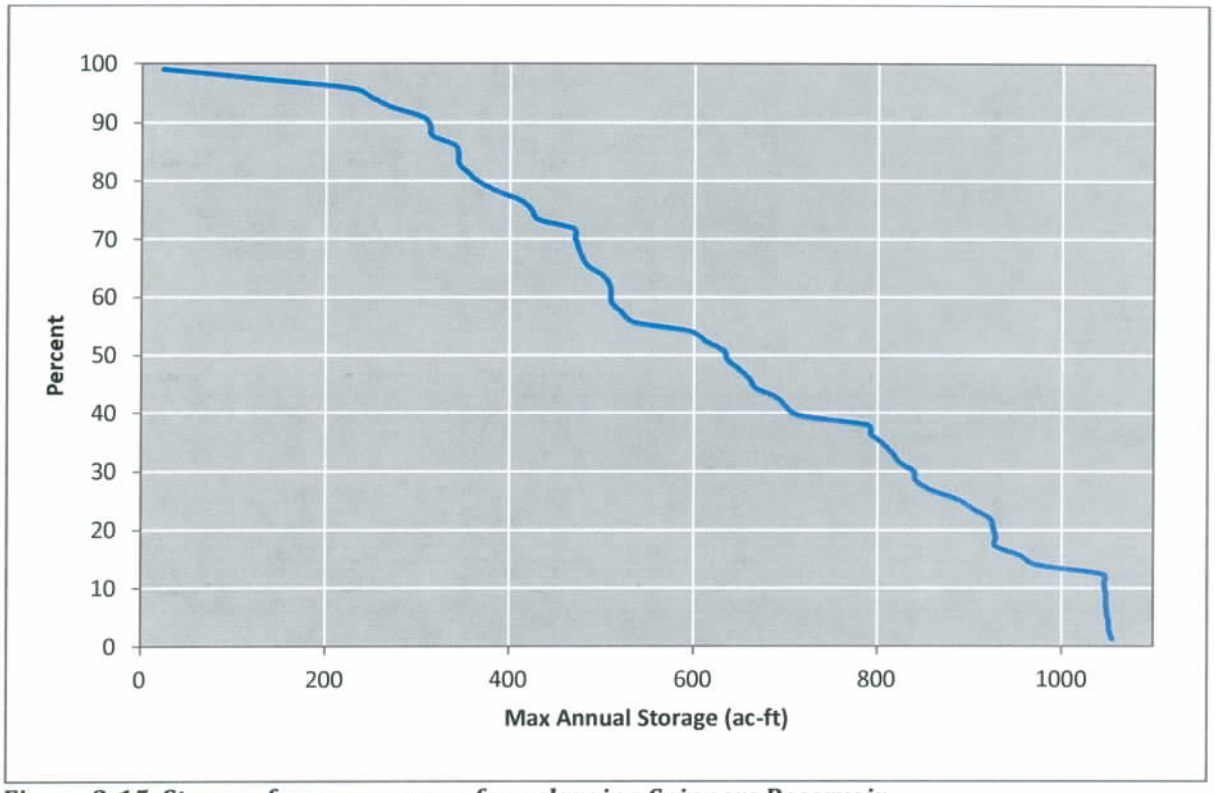


Figure 2-15, Storage frequency curve for enlarging Spinners Reservoir.

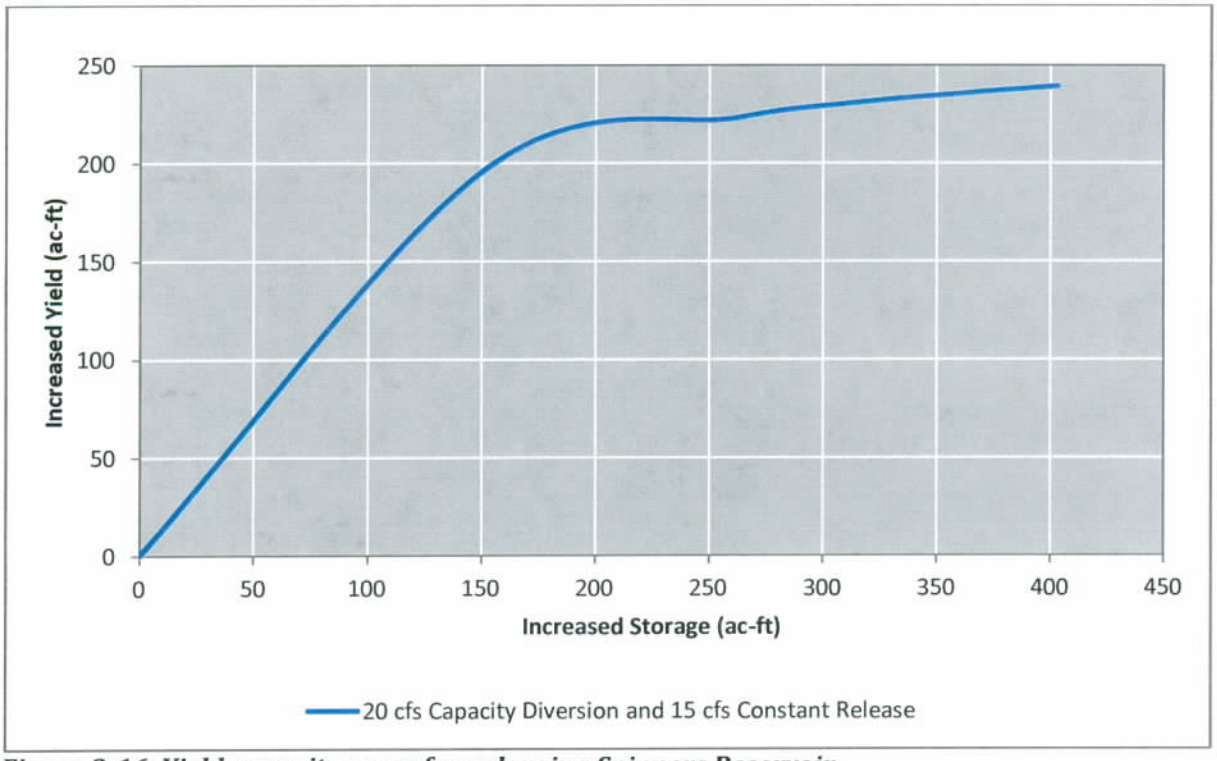


Figure 2-16, Yield-capacity curve for enlarging Spinners Reservoir.

of the time and the increases to yield with increased capacity begin to decline when increased reservoir capacity rises above 200 acre-feet.

2.2.9.5 New On-stream Lower Emery Reservoir

This potential reservoir would be located well below the main diversion on Muddy Creek, and its likely uses would, of course, be limited by its positioning in the watershed. For this scenario instead of investigating this reservoir as an irrigation supply, it will be treated as a base-flow supply to demonstrate the model's capability to simulate a reservoir's effectiveness at meeting potential downstream environmental demands. Supposing there is interest in maintaining a base flow on the Muddy Creek, this reservoir could facilitate in meeting this flow during times when stream-flow is exceptionally low. A target base-flow of 20 cfs was selected as an arbitrary flow to test, but does not represent any official base-flow desired by stakeholders. Results from this type of application of a potential reservoir require somewhat different presentation than an irrigation analysis. Figure 2-17 shows a graph of how the downstream flow of the river is effected by a new reservoir. From

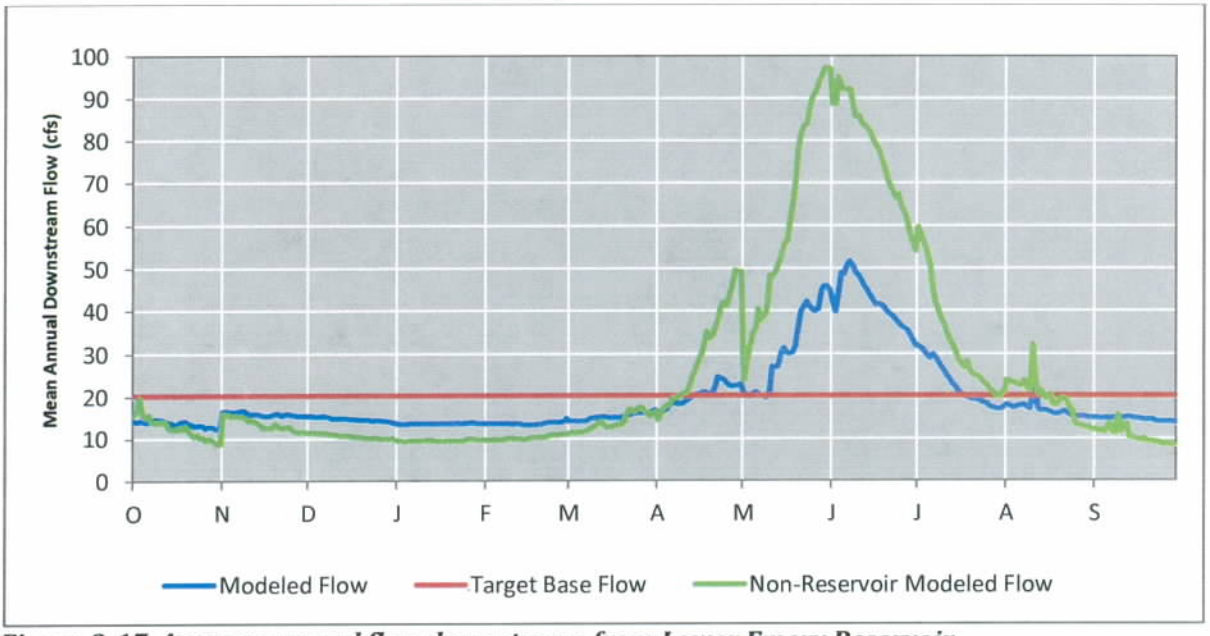


Figure 2-17, Average annual flow downstream from Lower Emery Reservoir.

the figure you can observe that, on average, the modeled base flow without the reservoir is around 9.5 cfs, while with the reservoir it is about 14 cfs, thus maintaining a 4.5 cfs higher base flow.

The model also produced a reservoir storage frequency curve, which is shown in Figures 2-18. A storage frequency curve shows the statistical likelihood that the enlarged reservoir will reach a particular level of storage, based on the entire period of record simulated by the model. As shown, the Lower Emery Reservoir would fill less than 30 percent of the time.

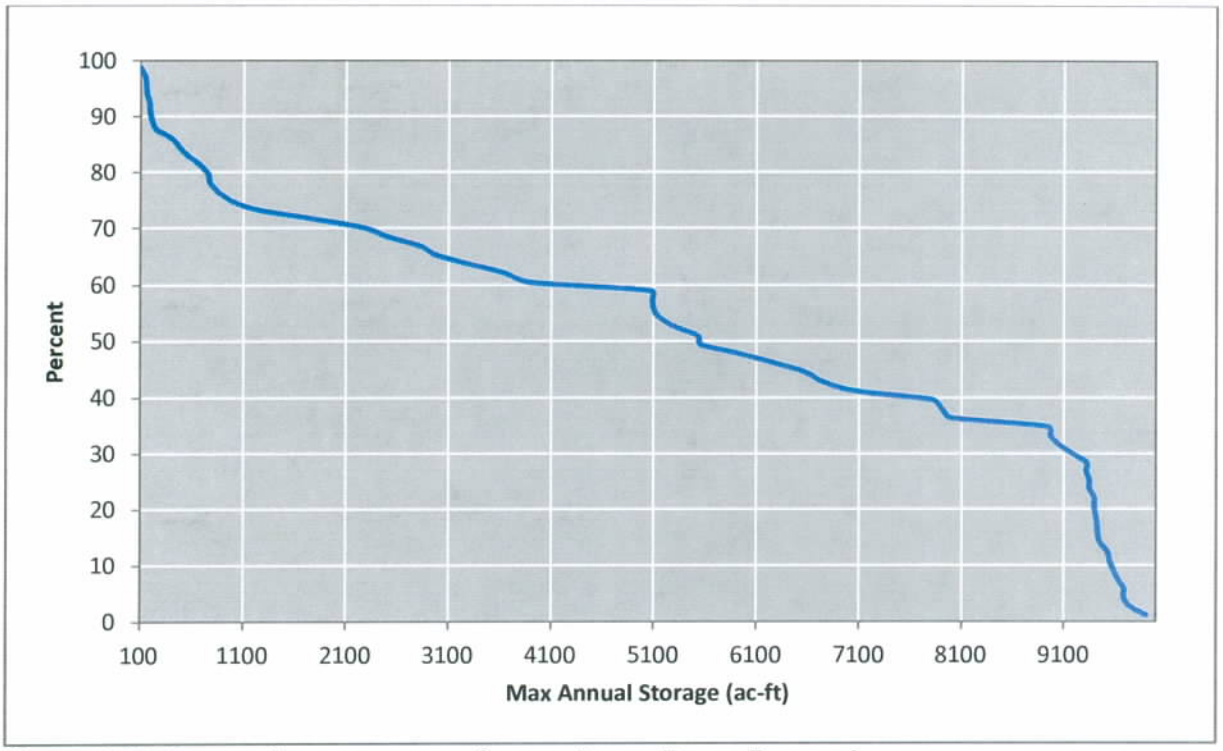


Figure 2-18, Storage frequency curve for new Lower Emery Reservoir.

Section 3 – Current and Projected Water Demands

Section 2 provided an overall snapshot of the available water resources and uses within the San Rafael River and Muddy Creek watersheds. This section provides more details about existing uses and estimates future water demands to the year 2060. These projections are based on estimates of future **population provided by the Governor's Office of Planning and Budget** (GOPB) as well as input from local stakeholders. Although it is difficult to predict future water demands with a high degree of accuracy, long-term projections are still useful and will help water managers and other stakeholders better prepare for changes in future conditions.

3.1 Current Water Use

3.1.1 Municipal & Industrial Water Use

Municipal and industrial (M&I) water use includes all the water, both potable (drinking water) and nonpotable (secondary), used by residential, commercial, institutional (primarily governments, schools, hospitals, and churches), and industrial users. In Utah, this data is reported by the type of entity that supplies the water and is broken down into the following four categories: (1) Public Community Systems, (2) Public Non-community Systems, (3) Self-supplied Industries, and (4) Private Domestic.

For this study, DWRe collected M&I water use data for the years 2009 and 2010 for the entire study area. This was done by taking the data reported to the Utah Division of Water Rights and verifying its accuracy with individual water suppliers. Where data was not adequately reported and could

not be verified, DWRe estimated the water use using sound engineering methods. The data for both years is shown in Table 3-1.

Table 3-1, Total M&I Water Use by Year (acre-feet)

Water Supplier Category	2009			2010		
	Potable	Non-Potable	Total	Potable	Non-Potable	Total
Public Community Systems	1,833	5,201	7,034	1,707	5,223	6,930
Public Non-Community Systems	21		21	21		21
Self-Supplied Industries*		28,487	28,487		25,957	25,957
Private Domestic	5		5	5		5
TOTAL	**1,858**	**33,688**	**35,547**	**1,733**	**31,180**	**32,913**

* Self Supplied Industries: Rhino Industries, Energy West, and PacificCorp.

As shown, self-supplied industries make up the largest component of total M&I use at 28,487 acre-feet in 2009 and 25,957 acre-feet in 2010 (roughly 80% of the total). Public community system water use, although much smaller, makes up the next most significant component at 7,034 acre-feet in 2009 and 6,930 acre-feet in 2010 (roughly 20% of the total). All other uses amount to less than one percent of the total or 26 acre-feet per year. The following sections provide further details of 2010 water uses for public community systems and self-supplied industries.

3.1.1.1 Public Community Systems

There are ten public community water systems in the study area. Eight of these systems are operated by the Castle Valley Special Service District. Table 3-2 shows the estimated water uses of each system. The total water use is broken down into both potable (drinking water) and non-potable (or secondary) components.

As shown in Table 3-2, the four largest public community systems are Castle Dale, Orangeville, Ferron, and Huntington. Water use in these four systems makes up 77 percent of the total use in the study area. Another interesting aspect of the data is that the largest use of water, by far, is for

outdoor irrigation of landscapes (75% of total). Such a large percentage of water use by secondary systems is unusual and results in a very high per capita water use of 644 gpcd (see Figure 3-1). The statewide average per capita water us in Public Community Systems is only 245 gpcd.[1]

Table 3-2, 2010 Water Use in Public Community Systems (acre-feet)

Public Community System	Potable					Total Non-Potable (Secondary)*	TOTAL
	Residential	Commercial	Institutional	Industrial	Total Potable		
San Rafael River Watershed							
Castle Valley SSD							
Castle Dale	364	3	8	49	423	924	**1,347**
Orangeville	223	2	5	7	237	834	**1,071**
Clawson	21				22	139	**161**
Cleveland	76		2		78	373	**451**
Elmo	55		1		56	302	**358**
Ferron	239		10		249	1,408	**1,657**
Huntington	302	43	14	4	363	919	**1,281**
North Emery Water Users	196	11	1		208		**208**
Trail Canyon Resid. Sys.	7				7		**7**
Subtotal	***1,483***	***59***	***41***	***60***	***1,643***	***4,898***	***6,542***
Muddy Creek Watershed							
Emery	62		1		64	325	**388**
TOTAL	**1,545**	**59**	**42**	**60**	**1,707**	**5,223**	**6,930**

3.1.1.2 Self-supplied Industries

There are three industrial water users in the study area that supply their own water. These are Rhino Industries, Energy West, and PacifiCorp. In 2010, total water use by these three corporations amounted to approximately 26,000 acre-feet (see Table 3-1). Most of this was used for cooling water at the Hunter and Huntington coal-fired power plants, which are owned and operated by PacifiCorp. **PacifiCorp's water supplies are comprised** of a combination of natural flow rights and

[1] Many residential lots in the study area include large garden plots that are not typical of the state's more urban areas. Some residents also irrigate part of their lot as pasture for livestock animals. These factors result in a higher than normal per capita use rate.

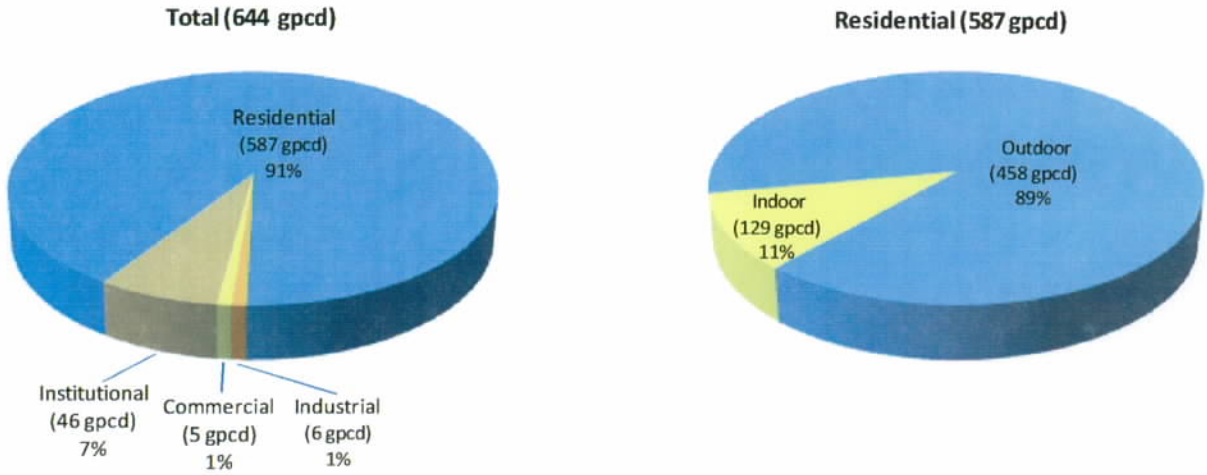
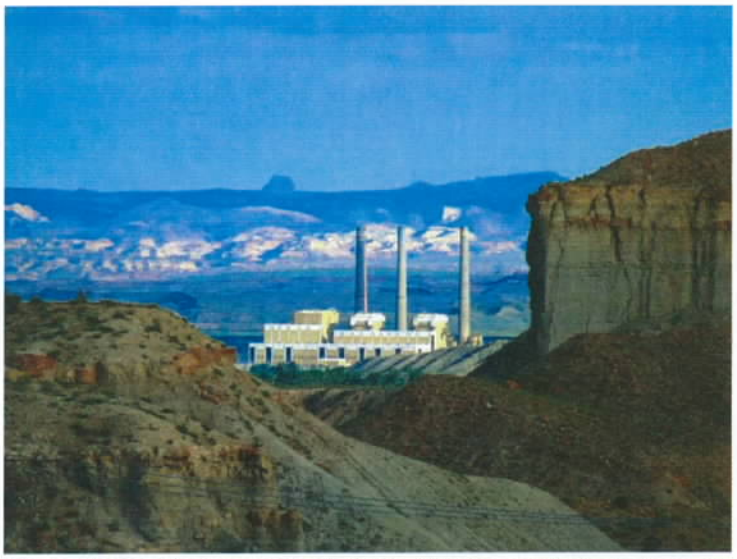


Figure 3-1, 2010 per capita water use in Public Community Systems (gpcd)

storage rights acquired through the acquisition of shares in local irrigation companies, storage water supply agreements with the U.S. Bureau of Reclamation, Emery Water Conservancy District, and Ferron Canal and Reservoir Company, as well as a private flow right on Huntington Creek and a private storage right at PacifiCorp's Electric Lake. Rhino Industries and Energy West own and operate coal mines in the study area and use a relatively small amount of water as part of the coal-extraction process and for dust control.

The Huntington Power Plant has two steam electric units, each with a capacity of 498 MW. The first unit came online in 1974 and the second in 1977. The Hunter Power Plant has three steam electric units. The first two units have a capacity of 488 MW each and came online in 1978 and 1980. The third unit has



Hunter Power Plant near Castle Dale. (Photo courtesy of Spencer Baugh.)

a capacity of 496 MW and came online in 1983. Both plants utilize a recirculating cooling system that requires approximately 600 gallons of water for every MWh of power produced. Water that is delivered to the plant is recirculated several times until the salinity reaches a certain point. At that point the water is considered industrial wastewater and is sent to large storage basins where it cools and is eventually disposed of via irrigation on land owned by PacifiCorp.

3.1.2 Agricultural Water Use

The DWRe has been collecting water-related land use data for several decades. Data were collected for the West Colorado River planning area, which includes the San Rafael River and Muddy Creek watersheds, in 1991, 1999, 2005, and 2011. Field boundaries for the data set is created from aerial photography in a Geographic Information System (GIS). Field boundaries are digitized into a database file and then these data are sent into the field on a mobile PC. Incorporating GPS information, the data is then categorized by crop or land use type and irrigation type (sprinkle or flood). After completion of field identification, the data are run through a quality control process, compiled and summarized. A summary of the surface-irrigated acres for each year is shown by county in Table 3-3.

Table 3-3, Irrigated agricultural croplands (acres).

Watershed/County	1991	1999	2005	2011
San Rafael River Watershed				
Emery*	25,050	24,867	30,256	32,157
Sanpete				62
Subtotal	***25,050***	***24,867***	***30,256***	***32,219***
Muddy Creek Watershed				
Emery	5,931	7,360	8,620	5,757
Sevier	1,514	1,016	1,179	1,280
Subtotal	***7,445***	***8,376***	***9,799***	***6,944***
TOTAL	**32,495**	**33,243**	**40,055**	**39,163**

* Does not include irrigated croplands near Cleveland and Elmo that are located in the Price River drainage (approx. 12,000 acres), but are irrigated with water out of Huntington Creek.

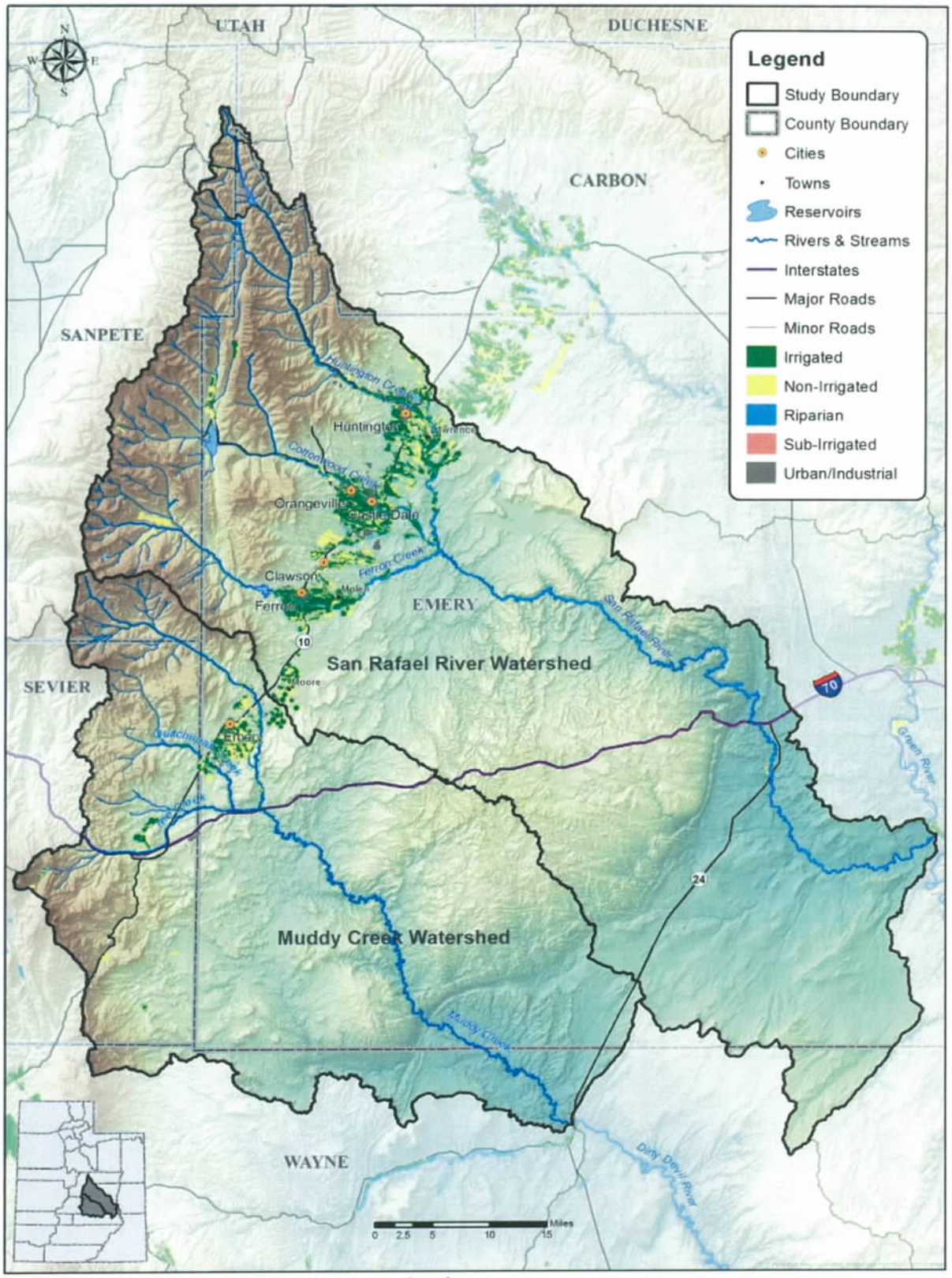


Figure 3-2, Location of agricultural croplands.

While the data shows an increase in irrigated lands since 1999, much of this is likely the result of improved data collection processes. Part of this increase can also be attributed to the favorable water supply conditions in 2011, when water was relatively abundant throughout most of the irrigation season.

Center-pivot sprinkler near Cleveland.

A detail of the 2011 data, including crop types and sub-irrigated and non-irrigated categories is shown in Table 3-4. See also Figure 3-2. As shown, nearly two-thirds of the agricultural land in the study area is used to produce animal feed crops—alfalfa, hay, and pasture. Only about one-third of the agricultural land is used to produce high-value crops. Of the 38,586 surface-irrigated acres, DWRe estimates that 22,487 acres are irrigated using conventional flood irrigation methods and 16,100 acres are irrigated using pressurized sprinkle irrigation.

Table 3-5 shows the estimated water depleted (consumptively used) in 2011 and previous years to irrigate these crops, using either flood or sprinkle irrigation methods. An estimate of water consumed by sub-irrigated and non-irrigated crop lands is not included. As shown in Table 3-5, consumptive use of water within the study area has varied from a low of 62,386 acre-feet in 1991 to a high of 84,171 acre-feet in 2005. In 2011, a year with ample water available, total water consumption was estimated to be 80,347 acre-feet.

Table 3-4, Surveyed agricultural croplands for the year 2011 (acres).

Category/Cover Type	Muddy Creek Watershed			San Rafael River Watershed			TOTAL
	Emery	Sevier	*Subtotal*	Emery	Sanpete	*Subtotal*	
Surface-Irrigated							
Alfalfa	1,759	14	***1,773***	13,009		***13,009***	**14,783**
Beans				22		***22***	**22**
Corn				260		***260***	**260**
Grain	18		***18***	506		***506***	**523**
Grass Hay	1,093	1,071	***2,164***	2,125		***2,125***	**4,289**
Oats	136		***136***	692		***692***	**828**
Orchard	1		***1***	5		***5***	**6**
Other Horticulture				2		***2***	**2**
Other Vegetables	2		***2***	0		***0***	**2**
Pasture	2,297	101	***2,398***	15,109	55	***15,164***	**17,561**
Potatoes	10		***10***	0		***0***	**10**
Sorghum	139		***139***	160		***160***	**300**
Subtotal	**5,455**	**1,187**	***6,642***	**31,890**	**55**	***31,945***	**38,586**
Surface-Irrigation Method							
Flood	*4,123*	*664*	***4,787***	*17,645*	*55*	***17,699***	***22,487***
Sprinkle	*1,331*	*523*	***1,854***	*14,245*		***14,245***	***16,100***
Sub-Irrigated							
Grass Hay	6		***6***				**6**
Pasture	301		***301***	263	7	***270***	**571**
Subtotal	**307**		***307***	**263**	**7**	***270***	**577**
Non-Irrigated							
Dry Alfalfa				1			**1**
Dry Grain/Seeds	1		***1***				**1**
Dry Idle				87			**87**
Dry Pasture	9	6	***15***	90			**105**
Fallow-Irrigated Land	17		***17***	216			**233**
Idle-Irrigated Land	2,218	806	***3,023***	15,368	1,134	***16,502***	**19,526**
Range Pasture	1,837	74	***1,911***	1,076	106	***1,182***	**3,093**
Subtotal	**4,082**	**886**	***4,968***	**2,648**	**1,240**	***17,684***	**23,046**
TOTAL	**9,844**	**2,072**	***11,916***	**34,801**	**1,301**	***49,899***	**62,209**

Source: Utah Division of Water Resources' water-related land use program, 2011.

Table 3-5, Estimated agricultural water depletions (acre-feet).

Watershed/County	1991	1998	2005	2011
San Rafael River Watershed				
Emery*	49,383	48,215	65,847	67,286
Sanpete	0	0	0	121
Subtotal	***49,383***	***48,215***	***65,847***	***67,407***
Muddy Creek Watershed				
Emery	10,698	11,980	16,456	10,741
Sevier	2,304	1,601	1,868	2,199
Subtotal	***13,003***	***13,581***	***18,324***	***12,940***
TOTAL	**62,386**	**61,796**	**84,171**	**80,347**

* Does not include water use on croplands near Cleveland and Elmo that are located in the Price River drainage, but are irrigated with water out of Huntington Creek (approx. 50,000 ac-ft).

3.1.3 Environmental

Unlike M&I and agricultural water use, environmental water use is not measured. However, it can be estimated by assuming it is equal to the amount of water remaining within a defined boundary after accounting for all other uses. Environmental water use includes all the water evaporated from natural water bodies[2] or transpired through plant (except cultivated crops) and animal tissues, plus the water that flows out of the area boundary through surface streams and rivers or subsurface channels. Environmental water use also includes non-consumptive uses by terrestrial and aquatic wildlife.

As detailed previously in Section 2, environmental water use in the San Rafael River watershed is estimated to be about 1,371,500 acre-feet per year, or approximately 89 percent of the total water volume that falls on the watershed as precipitation.[3] For the Muddy Creek watershed, this amount is 811,700 acre-feet per year or 96 percent of the total precipitation.[4]

[2] Evaporation from man-made reservoirs is typically not included in the calculation of environmental water use.
[3] For details, see the entries for "Used by Vegetation and Natural Systems" and "Other Depletions" shown in Table 2-3.
[4] Ditto, Table 2-4.

3.2 Projected Future Water Demands

Accurately predicting future water demands is a difficult task. Many different factors affect future water use, including population, commodity prices, climatic conditions, etc. Within the study area, predicting future water use is made even more difficult by the high percentage of total water use at the local power plants. Water use at these facilities could be impacted by changing federal energy policies, particularly if these policies continue to favor cleaner, less carbon-intensive energy sources. This section discusses these challenges and makes projections of future water demand based on the best available knowledge.

3.2.1 Municipal & Industrial Water Demands

3.2.1.1 Public Community Systems

Future municipal and industrial (M&I) water demands within public community systems are largely dependent upon population. The U.S. Census Bureau conducts a detailed census of the population every ten years. The Utah Governor's Office of Planning and Budget (GOPB), in coordination with local area of governments, models population for the State of Utah and provides estimates by individual community and county to the year 2060. The 2000 and 2010 Census population and GOPB's 2008 population projections for 2030 and 2060 are included in Table 3-6.

As shown in Table 3-6, the total population of the study area declined 2.2 percent between 2000 and 2010. The study area is one of only a handful of areas in Utah to decline in population. Despite this, GOPB projects the population to increase in the coming decades from 8,750 in 2010 to 10,651 in 2030 and 11,197 in 2060. Most of the current population is concentrated in the cities of Castle Dale, Ferron, Huntington, and Orangeville. The "Balance of County" number is an estimate by DWRe of the portion of the population who live in the unincorporated areas of Emery County within the boundaries of the San Rafael River and Muddy Creek watersheds. The balance of county

population includes those who live outside the boundaries of existing communities and is scattered throughout the basin, but primarily near existing communities.

Table 3-6, Census population and GOPB population projections.

Community	Population			
	Census 2000	Census 2010	2030*	2060**
San Rafael River Watershed				
Castle Dale city	1,657	1,630	2,033	2,136
Clawson town	153	163	219	232
Ferron city	1,623	1,626	1,973	2,075
Huntington city	2,131	2,129	2,592	2,724
Orangeville city	1,398	1,470	1,687	1,772
Balance of Emery County**	1,680	1,444	1,769	1,860
Subtotal	***8,642***	***8,462***	***10,273***	***10,799***
Muddy Creek Watershed				
Emery town	308	288	378	398
TOTAL	**8,950**	**8,750**	**10,651**	**11,197**

* GOPB, 2008 Baseline City Population Projections and scenario analysis.
**Balance of county population is based on the percentage of the total county population that resides in the study area.

DWRe uses the population projections provided by GOPB to estimate future water demands in public community water systems. This is done with the help of the Utah Water Supply and Demand Model, which also utilizes water use data obtained for the area from previous surveys as well as other detailed studies. Table 3-7 shows the projected water demands from this model for the years 2030 and 2060 and compares them to the water use for the year 2010. In accordance with the State of Utah's water conservation goal, these projections include water conservation of 15

Table 3-7, Current and projected water demands in Public Community Systems (acre-feet).

Public Community System	2010	2030	2060
San Rafael River Watershed			
Castle Valley SSD			
Castle Dale	1,347	1,285	1,153
Orangeville	1,071	1,021	916
Clawson	161	153	137
Cleveland	451	430	386
Elmo	358	342	306
Ferron	1,657	1,580	1,418
Huntington	1,281	1,222	1,096
North Emery Water Users	208	462	430
Trail Canyon Residential System	7	11	10
Subtotal	***6,541***	***6,506***	***5,852***
Muddy Creek Watershed			
Emery	388	370	332
TOTAL	**6,930**	**6,876**	**6,183**

percent by the year 2030 and a total of 25 percent by the year 2050.

As shown, total water demand of public community systems within the study area is projected to decline from the 2010 level of 6,930 acre-feet to 6,876 acre-feet in 2030 and 6,183 acre-feet in 2060. This is because the projected rate of conservation is greater than the projected increase in population. In other words, it appears that the existing developed supplies within these systems should be more than adequate to meet future demands.

In 2009, Castle Valley Special Service District (CVSSD) updated its facilities plan[5] with projections of water demand for all of its member communities to the year 2030. The projections from this plan are quite a bit higher than the projections shown in Table 3-7, anticipating a total increase in demand of 438 acre-feet (+6%) by 2030 for the member communities as opposed to the Utah Division of Water Resources' (DWRe) projections of a decline in demand of 311 acre-feet (-5%) by 2030 for the same member communities. The main reason for this difference is that CVSSD's plan used the highest rate of secondary use included in the data available and anticipated that the system would grow at an annual rate of 0.55 percent per year (the average over the 12-year period analyzed), while DWRe estimated that per capita water use in secondary systems would decline approximately 15 percent over this same time period. Either way, the projections for future change in water demand for Public Community Systems is not expected to be that significant (approximately 5% as noted above).

3.2.1.2 Self Supplied Industries

PacifiCorp has expressed an interest in securing additional water for future power generation in Emery County. In conjunction with the U.S. Bureau of Reclamation's (USBR) effort to receive an extension of a water rights application for additional storage in Joes Valley Reservoir from the Utah

[5] Johansen & Tuttle Engineering, *Castle Valley Special Service District 2009 Facilities Plan,* (Castle Dale: August 2009.)

State Engineer, PacifiCorp has provided an estimate of potential future water needs for the USBR to include in the water right's 40-year plan. The purpose of the 40-year plan is to identify future water demands in the area serviced by the water right in order to justify holding onto the water right to satisfy future demands. The following is a direct quote from a draft of USBR's 40-year plan.

> The reasons that PacifiCorp is very interested in developing additional power capacity at its Emery County Facilities include the following:
>
> - Electrical transmission infrastructure currently exists capable of supporting additional power generation.
> - PacifiCorp currently owns and operates two power plants in Emery County, and has done so since the early 1970's.
> - PacifiCorp has significant property holdings in Emery County.
> - PacifiCorp (and its predecessors) have been operating in Emery County for many decades and has solid positive relationships with the local communities. PacifiCorp recognizes this important aspect in the development of any future power generation project.
> - Potential coal and natural gas fuel sources are being developed in the local area.
> - Water Right No. 93-1003 could likely be developed in the local area to provide the necessary water.
>
> Given the factors listed above PacifiCorp feels it is likely that a power project could be built in Emery County within the next 40 years and they anticipate the need of an additional 800 megawatts of power generating capacity to help satisfy the future public electricity requirements. PacifiCorp estimates an additional 10,000 acre-feet/year water supply would be necessary for the added electrical generation...[6]

Although PacifiCorp has an interest in additional water for power production at its Emery County facilities, it has no specific plans to expand production over the next decade. In fact, PacifiCorp recognizes that changes in national energy policies could ultimately force the industry to move away from existing coal-fired power plants to a greener type of power production, such as natural gas. If such changes were to occur, it could reduce the overall demand for water in the study area, unless of course new production steps in to utilize the water that would become available as less water-intensive power production methods come online.[7] Cooling water requirements for natural gas powered plants can vary anywhere from less than 100 to about 400 gallons per MWh of power

[6] U.S. Bureau of Reclamation, "40 Year Plan for Water Right No. 93-1003 (A13380)," DRAFT dated February 29, 2012. Draft provided by Justin Record of the Provo Area Office.

[7] Personal communication with Cody Allred, Water Resource Engineer, PacifiCorp, March 12, 2012.

produced.[8] This is roughly 1/6 to 2/3 of the water requirements for the existing recirculating cooling systems.

3.2.1.3 Summary

Given the uncertainty of future power demands, DWRe estimates that future M&I water demands in 2060 could cover a broad range of scenarios. On the low end, DWRe estimates that total M&I water demand could decline slightly to roughly 30,000 by 2060 or increase approximately 30 percent to around 42,000 acre-feet by 2060.

3.2.2 Agricultural Water Demands

Although it is difficult to predict future trends in agricultural markets and the resulting impact on water use, it is very likely that agriculture will remain a steady part of the local culture and economy. While agriculture should remain a key component of economic activity within the study area, it is presumed that agricultural irrigation practices will become more efficient over time. This has already happened with the salinity projects that have been completed to date and will continue into the future as more improvements are implemented.

Increased irrigation efficiency does not necessarily translate into less water being consumptively used (depleted), however. As irrigation becomes more efficient, the water saved is typically held in upstream reservoirs and becomes available for late-season irrigation for which there was often not water available previously. As a result, increased agricultural efficiency often means that the net water depleted from the system actually increases. In most years this is likely to be the case. On the other hand, if excess water is held in reservoirs beyond the irrigation season, those reservoirs will be more likely to spill during a good runoff year, thus increasing the water available

[8] Macknic, Robin, et. al., *A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies,* Technical Report NREL/TP-6A20-50900, (National Renewable Energy Laboratory, Golden, CO: March 2011), 7.

downstream during those years. Despite this, studies indicate that on average, net depletions typically increase with increased agricultural efficiency.

Agricultural water use could also increase in the future for other reasons. For instance, if water use at existing coal-fired power plants becomes more efficient or this water-intensive form of energy production is replaced by less water-intensive forms of energy production (such as natural gas), this water could become available for other uses, including agriculture.

Agricultural water uses could also decline if the economics of agriculture change. Currently, a large percentage of irrigation water is used to grow feed crops for animals. The market for these crops has been favorable recently, with severe drought impacting Texas and other areas throughout the West. However, if market conditions were to change, it could impact the amount of water used to grow these crops.

Considering all these factors, DWRe estimates that agricultural water use within the study area will remain fairly steady into the future, with the potential to either decrease or increase slightly, depending on the circumstances.

3.2.3 Environmental

Although it is not clear what the water demands for environmental purposes will be in the future, it is possible that they will be greater than they are today. Minimum flows may be necessary to provide adequate habitat for a handful of sensitive species. Several studies have been initiated that will help identify the volume of water necessary to help protect habitat and improve conditions for these species. The purpose of these flows would be to halt the decline of these species population and avoid them being listed as federally endangered. Such a listing could adversely impact existing upstream water users. For more information regarding these issues, see Section 7.

Section 4 – Innovative Water Management Strategies

This section discusses several water management strategies that might be beneficial for water users in the San Rafael and Muddy Creek watersheds. Some, such as system automation and cooperative arrangements have already proved valuable and could be expanded to improve overall water management throughout the study area. Others, such as aquifer storage and recovery and water reuse, may not be as broadly applicable but given the right circumstances, could prove effective at meeting specific needs.

4.1 System Automation[1]

In 1992 the Emery Water Conservancy District (EWCD) found there were not enough water flow records to efficiently manage and protect the water resources in Emery County. To rectify this situation, EWCD, in conjunction with the Bureau of Reclamation, created a real-time water monitoring network to record water flows and monitor water use. This network proved to be an invaluable tool and was expanded to include all river and canal systems located in Emery County. Today there are over 40 stations measuring such things as: water use, flow, water quality, operating functions, and weather modifications. EWCD has also automated several reservoirs and canal systems with the help of the Bureau of Reclamation.

The water monitoring network is operated and maintained by EWCD. The network transmits data to EWCD on an hourly basis. The data is then reported on EWCD's website for the benefit of all

[1] Based on a personal communication with Jay Humphries, Manager of the Emery Water Conservancy District, October 31, 2012.

water users. Because of these effective water management tools, EWCD has estimated that approximately 10,000 acre feet of water savings have been realized annually—a significant return on their investment.

Due to the dramatic improvements in water management that have been realized, EWCD would like to add additional equipment to the network. Specifically, EWCD would like the rest of the reservoirs in Emery County to be equipped with real-time monitoring and operational equipment to measure and release water by remote control. EWCD would also like to see all canal company pipelines equipped with flow measuring devices to report data on an hourly basis. Installing this equipment would further improve water efficiency and canal company operations.

4.2 Cooperative Arrangements

4.2.1 Emery Water Conservancy District[2]

Before 1962 all irrigation companies operated more or less independently to meet the needs of their own stockholders. After much deliberation, the Emery County Project was approved by Congress under the Colorado River Storage Act. As a result, local irrigation companies gave up water rights to the U.S. Bureau of Reclamation (USBR) so the Emery County Project could be built.

EWCD was formed in 1962 for the purpose of repaying and operating the Emery County Project. Major components of the project included: **Joe's Valley Reservoir, Huntington North Reservoir,** Swasey Diversion Dam, Service Canal, drainage systems, and Cottonwood Creek Huntington Canal. The Emery County Project was completed in 1966 and Emery Water Conservancy District took over operation in 1970.

[2] Based on a personal communication with Jay Humphries, Manager of the Emery Water Conservancy District, October 31, 2012.

Further cooperative agreements were necessary when Utah Power and Light made plans to locate major power generation facilities in Emery County. Cottonwood and Huntington Irrigation Companies negotiated and signed contracts with Utah Power and Light to have water go to Hunter and Huntington Power Plants. Eventually, three power units were built at Hunter Power Plant, and two power units were built at Huntington Power Plant.

As a result of these cooperative efforts, water use within the county changed dramatically. While agriculture originally used the vast majority of the water, today, about 25 percent is used by the mining and power interests and approximately five percent is used by local municipalities.[3]

4.2.1.1 Ferron Canal and Reservoir Company and Ferron City[4]

When Ferron Canal and Reservoir Company was installing their pressurized irrigation system from 1998-2004, it was necessary to run water lines into a portion of Ferron City to service farmland owned by stock holders of the irrigation company. The irrigation company decided to approach Ferron City for help with the irrigation project because the community had previously installed a pressurized secondary water system for those within the city limits.

The idea was to use the city's secondary system to irrigate approximately 20 acres of farmland within the city limits. As communication between the city, Castle Valley Special Service District (managers of the secondary system) and the irrigation company progressed, it was determined that a portion of the city system was under-pressurized and many citizens did not have the pressure needed to use the system effectively.

An agreement was written between the parties to allow the needed farm connections to the secondary system in exchange for a secondary water connection to the irrigation company's

[3] Rough percentages based on water use data presented in Section 3.
[4] Personal communication from Roger Barton, July 30, 2012.

pipeline on the north end of the city limits, supplying the needed water to pressurize the secondary system to all citizens. This partnership has worked very well for all parties involved.

4.2.1.2 Flood Control Using Irrigation Canals[5]

The local communities have historically used all irrigation company canals in the western portion of Emery County for flood control. As floods from summer rain storms often bring flood water off nearby range land, the water often runs into the canal systems, protecting the communities. This partnership has continued for over 100 years, with the irrigation companies assuming most of the liability, operation and maintenance of the canals. As local irrigation is being converted to pressurized pipeline systems, some canals are being abandoned, and the cities and county will necessarily have to assume maintenance of those canals if their use as a flood control option is still to be needed.

4.2.2 Future Cooperation

All of the cooperative arrangements discussed previously have had a positive impact on the people living in Emery County. Without the willingness of water users and others to work together, life in the county would be drastically different today. As the future presents new challenges, water users within the study area will need to continue to work closely with other stakeholders to ensure a prosperous future.

4.3 Aquifer Storage and Recovery

Aquifer storage and recovery (ASR) is the intentional recharge of an aquifer when water is available and recovery of that water at a later time when it is needed. Aquifer storage can be accomplished by surface spreading or injection wells. Recovery of the water from the target aquifer requires a separate well or wells in the case of surface spreading and in the case of an injection well, the same

[5] Personal communication from Roger Barton, July 30, 2012.

well if it is properly outfitted. While diverting water into spreading basins and allowing it to percolate into the aquifer requires suitable geologic conditions, injection wells simply require a suitable target aquifer.

Although ASR is common in many parts of the United States and the world, it is relatively new to Utah. Over the past 20 years, successful ASR projects have been implemented by several major water districts and cities, including: Jordan Valley Water Conservancy District, Washington County Water Conservancy District, Weber Basin Water Conservancy District, and Brigham City. This section takes the lessons learned from these and other successful projects, and evaluates the potential for implementing ASR to enhance water management within the study area.

4.3.1 Hydrogeologic Assessment of Study Area

Although ASR is a fairly straightforward technology, certain hydrogeologic conditions are preferred. ASR is most practical when unconsolidated and/or bedrock aquifers are not fully saturated and unutilized surface water is available. If such conditions exist, managed ASR may be a beneficial way to increase water storage and provide valuable water management flexibility.

The Utah Division of Water Resources investigated the potential of consolidated (bedrock formations) and unconsolidated deposits (both alluvial and eolian) within the study area to develop additional water storage. This included an assessment of the hydrologic and geologic setting of target aquifers and an assessment of their dimensional properties, accessibility, and current saturation level.

4.3.1.1 Description of Study Area

The San Rafael River/Muddy Creek watershed is located within the High Plateaus and Canyonlands sections of the Colorado Plateau Physiographic Province. This section of the Colorado Plateau is an area of elevated, flat to folded bedrock layers and is characterized by large areas of exposed

bedrock and incised river canyons of which, the canyons cut by the San Rafael River and Muddy Creek are good examples. The areas evaluated for ASR suitability only include Castle Valley and the San Rafael Desert (areas west and east of the San Rafael Swell). This is because these areas are more favorable in terms of aquifer development and aquifer storage enhancement.

4.3.1.2 Aquifer Characteristics

Figure 4-1 is a geologic map of the area surrounding the San Rafael Swell, including Castle Valley and the San Rafael Desert.[6] The map was constructed to show only those unconsolidated deposits and bedrock formations which have potential as aquifers to either produce groundwater or accept artificial recharge to enhance groundwater storage. Figure 4-2 is a cross-section through the San Rafael Swell and surrounding areas. It illustrates how the structural setting of the San Rafael Swell influences the potential bedrock aquifers.

In order to determine if ASR is possible in these areas, the division characterized each of the aquifers that are most likely to be suitable for recharge and found that unconsolidated deposits are of limited usefulness as aquifers. Large deep alluvial filled valleys with well-developed alluvial fans, such as are found along the Wasatch Front, are missing in the Colorado Plateau, including Emery County.[7] Most unconsolidated deposits in the study area are thin, from only a few feet to more than 100 feet thick, and are limited in occurrence and in aerial extent. Furthermore, contribution of sediment to alluvium in Castle Valley is largely from the Mancos Shale Formation and is therefore predominately of clay and silt, resulting in low permeability and reduced storage capacity.

In addition to unconsolidated deposits, the division analyzed various bedrock units, including:

- Ferron Sandstone Member of the Mancos Shale Formation

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[6] Utah Geological Survey, 2012, Geologic Map, accessed February, 2012, from UGS web site: http://www.geology.utah.gov/

[7] Hood, J.W. and Fields, F.K., 1978, *Water Resources of the Northern Uinta Basin Area, Utah and Colorado, With Special Emphasis on Ground-Water Supply:* Utah Dept. of Natural Resources Technical Publication No. 62.

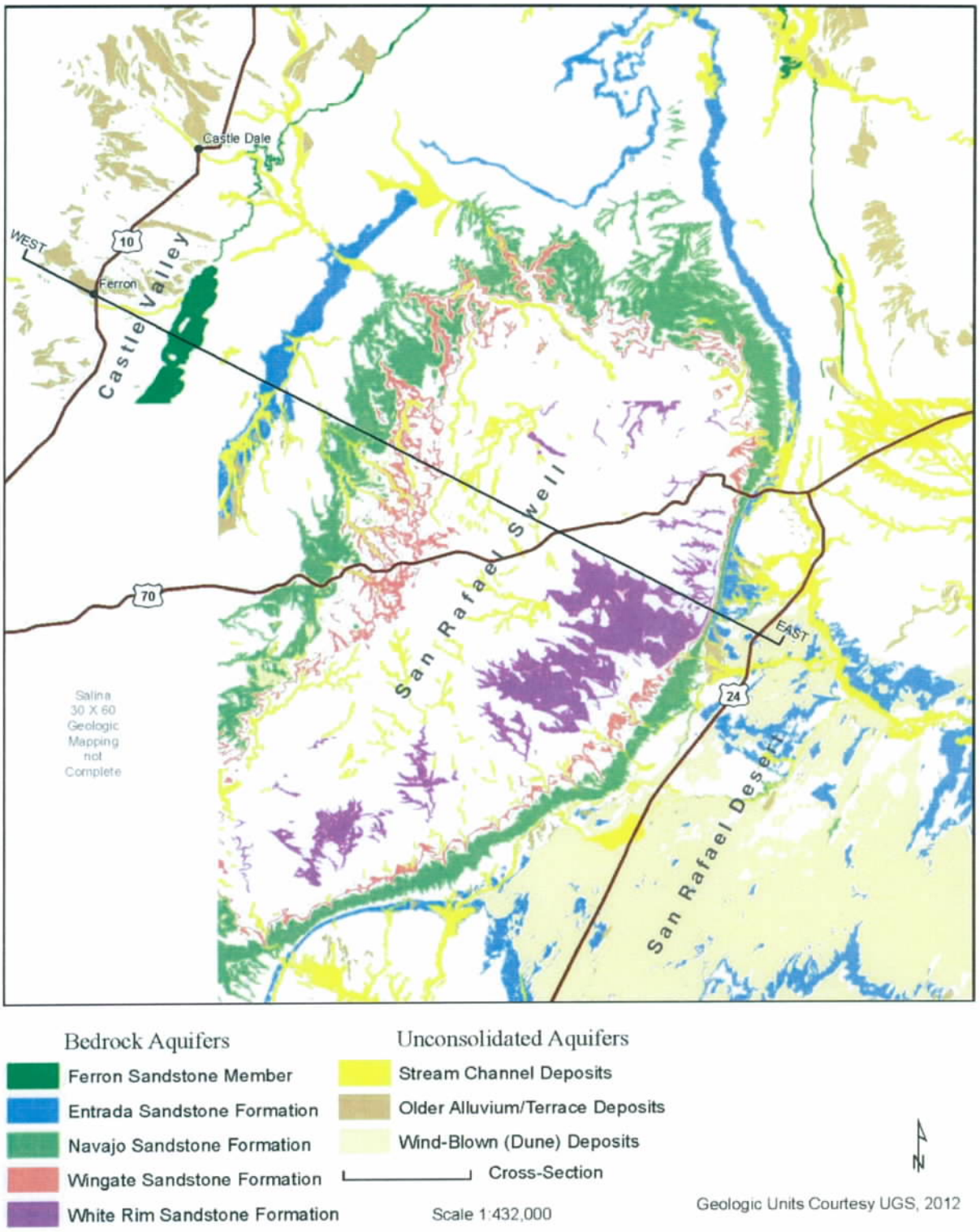

Figure 4-1 Geologic map of potential water-bearing formations.

See foldout Figure 4-2

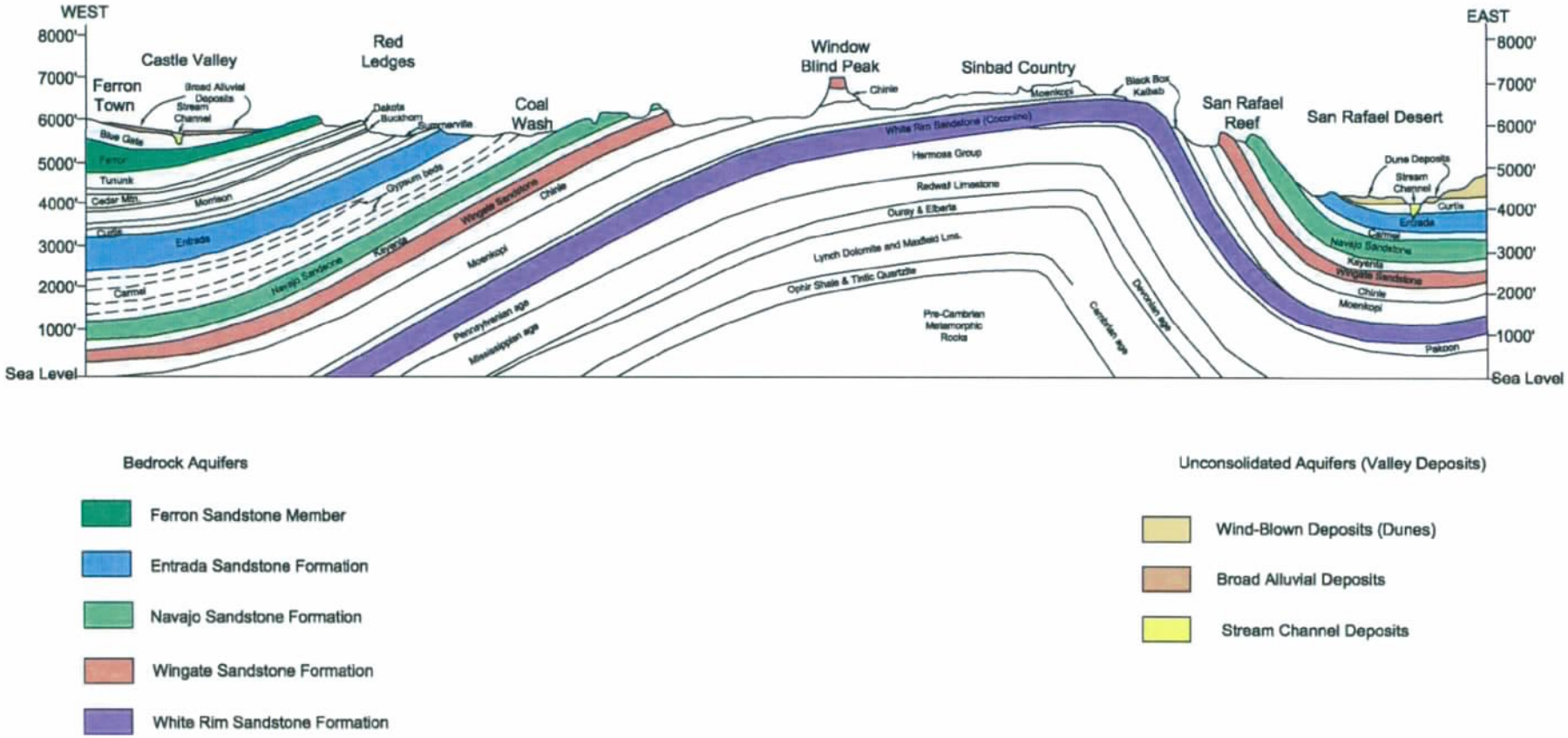

Figure 4-2 Geologic Cross-section of Potential Water-bearing Formations.

- Entrada Sandstone Formation
- Navajo Sandstone Formation
- Wingate Sandstone Formation
- White Rim (Coconino) Sandstone Formation

The Ferron Sandstone Member of the Mancos Shale Formation was included because both of the deep municipal wells for the town of Emery produce water from this formation. Studies indicate that down gradient from the area where these formations outcrop (recharge areas) the Navajo, Wingate, and White Rim Sandstones are fully saturated.[8] This condition is likely found in the Entrada Sandstone also.

Figures 4-1 and 4-2 illustrate how these bedrock aquifers outcrop within or around the margins of the San Rafael Swell and then dive into the subsurface on the east and west limbs of the anticline. For example, the Navajo Sandstone plunges to a depth of greater than 4,000 feet beneath Castle Valley and greater than 1,000 feet beneath I-70 on the east side of the San Rafael Swell.[9] The combination of deep burial, saturated conditions, and the energy costs associated with pumping to or from such great depths, indicate that these bedrock aquifers, in today's economy, have limited prospect as targets for enhanced storage. However, as the following section discusses, there may be opportunities to utilize the relatively shallow and conveniently located Ferron Sandstone formation for specialized ASR projects.

4.3.2 Possible ASR in the Town of Emery

Despite the general conclusion that unconsolidated and bedrock aquifers within the San Rafael River and Muddy Creek watersheds are not likely candidates for ASR, the unique setting and conditions that exist in the town of Emery present a compelling reason to further explore its

[8] Hood, J.W. and Patterson, D.J., 1984, *Bedrock Aquifers in the Northern San Rafael Swell Area, Utah, With Special Emphasis on the Navajo Sandstone:* Utah Department of Natural Resources Technical Publication No. 78.
[9] Ibid.

potential. This section contains an in-depth analysis of this potential along with recommendations for further action.

4.3.2.1 Background

The primary source of drinking water in Emery is Muddy Creek. Muddy Creek is diverted to the town through an irrigation canal and a portion of the water is delivered to the water treatment plant where it is treated to meet drinking water standards. **Emery's dependence on Muddy Creek** presents the town with a potentially devastating problem if the flow of Muddy Creek were to ever be interrupted or contaminated. As a result, the town secured an alternate source of drinking water by constructing wells that extract water from the Ferron Sandstone formation. While the water from these wells meets drinking water standards, it has a foul sulfur odor and as a result is only used during extreme emergencies.

Because of these unique problems, and the success of other ASR projects elsewhere in the state, the Division of Water Resources believes that an ASR project, utilizing injection wells, may be feasible in Emery.

4.3.2.2 Successful ASR Projects in Utah Utilizing Injection Wells

The Ferron Sandstone formation, in the vicinity of the town of Emery, is a confined, bedrock aquifer that contains degraded, but treatable, water in terms of its quality. This type of aquifer typically favors recharge projects that utilize injection wells. Wells that are used to transmit surface water to underground aquifers are frequently referred to as artificial recharge wells, ASR wells, or injection wells.

Two water suppliers in Utah currently operate ASR projects that utilize injection wells. The Jordan Valley Water Conservancy District spent several million dollars installing infrastructure to treat and inject water into the aquifer in the southeastern part of the Salt Lake Valley. This project has been

in operation since the early 1990s. In 2002, Brigham City completed an injection well project with capital costs of only $180,000. This money covered the cost of converting three existing production wells into injection wells. High quality water from springs is injected into the aquifer during periods of low demand, where it is stored until needed during periods of high demand. On average, the project injects 1,400 acre-feet of water per year into the receiving aquifer, recovering a portion of that amount during the peak irrigation season. The recovery permit issued by the State Engineer allows Brigham City to recover 100 percent of the water injected into the aquifer.[10] In addition to storing water for later use, this process of injecting water that meets drinking water standards, has also improved the overall quality of the water that Brigham City pumps out of the aquifer.

4.3.2.3 Pertinent Details of Emery Town's Wells

Emery Town municipal well #1was drilled in 1966. It was drilled as a coal exploration hole but when potable water was found in the Ferron Sandstone Member of the Mancos Shale Formation it was converted to a drinking water well. Well #2 was drilled in 1979 as a municipal well and thus benefits from being designed, from the outset, to meet drinking water standards.[11]

Figure 4-3 was drawn to highlight construction details of each well and to give an expanded view of the Ferron Sandstone aquifer as it was encountered in each well. Water well construction and aquifer properties play a vital role in helping to determine the feasibility of altering one or both wells to accommodate artificial recharge through injection of surface water. It is interesting to note that these wells are only about 112 feet apart from each other (see the inset diagram contained on Figure 4-3).

In this area, geologists have divided the Ferron Sandstone Member into three units, an upper unit, a middle unit, and a lower unit. This is based on mapping conducted in areas where the Ferron

[10] Utah Division of Water Resources, 2005, *Utah State Water Plan Conjunctive Management of Surface and Ground Water in Utah:* State of Utah Department of Natural Resources, 61-62
[11] Johansen & Tuttle, 1979, Municipal Well Project Emery Well #2: For Castle Valley Special Service District.

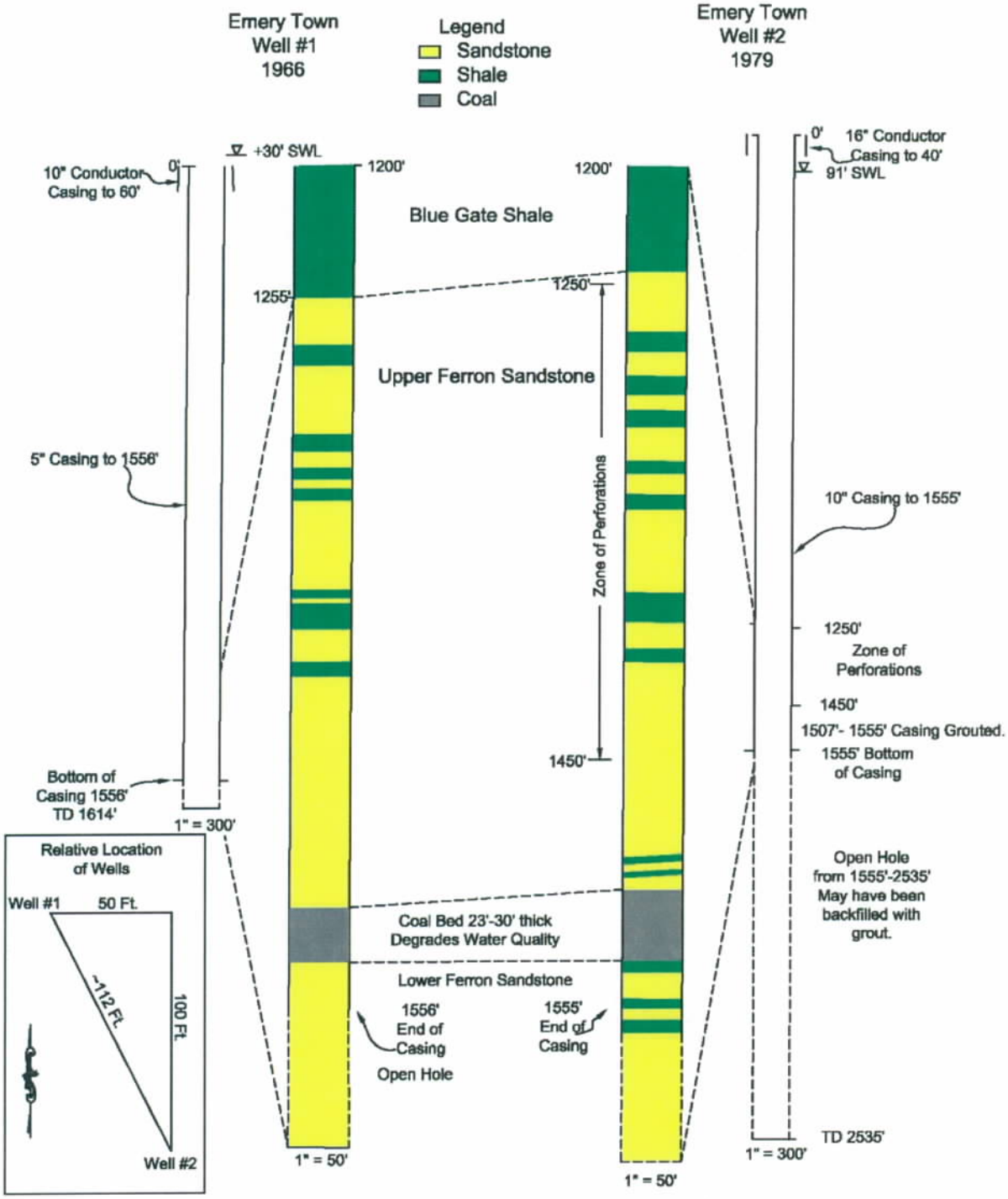

Figure 4-3 Reconstructed well logs of Emery Town wells #1 and #2.

Sandstone is found at the surface in well exposed outcrops. The three fold division, of the Ferron Sandstone Member is based on how many layers or beds of shale are found in each unit. Typically the upper and lower units contain few beds of shale while the middle unit contains a much higher number of shale layers. For the purpose of this study, the Ferron Sandstone formation was divided into an upper aquifer and a lower aquifer. Based on the drillers log of cuttings (see figure 4-3), it appears the upper Ferron has more shale layers than the lower Ferron and with a thick coal bed that roughly divides the upper aquifer from the lower aquifer. The reason for choosing the coal bed as the point of division between the upper and the lower aquifers will be explained in the next section.

Frequent reference to Figure 4-3 during the discussion that follows should help one to visualize the differences between the two wells and between the two aquifers. In well #1, five inch casing was installed through the upper Ferron Sandstone aquifer and through the thick coal bed to a point 21 feet below the bottom of the coal bed, thus sealing them off. Fifty-eight feet of open hole, below the bottom of the casing, is the point of groundwater entry that feeds well #1. The water in the lower Ferron Sandstone aquifer is confined and artesian pressure lifts the water to a static level 30 feet above the ground surface. When this well was first drilled it flowed about 70 gallons per minute.[12]

Well #2 was drilled to intercept water in the lower Ferron Sandstone aquifer just like well #1. However, according to Johansen and Tuttle, 1979 the well driller reported that there was no water in the lower Ferron Sandstone aquifer. Given that these two wells are only about 112 feet apart that report is hard to explain. The decision was made to drill deeper to see if the Dakota Sandstone held water. This is why well #2 is more than 900 feet deeper than well #1. No water was found in the Dakota Sandstone so the decision was made to develop what water they had found in the upper Ferron Sandstone aquifer. The 10 inch casing had already been placed through the upper Ferron

[12] Ibid.

Sandstone aquifer to a depth of 1,555 feet to keep the hole from caving. The casing was shot perforated between 1,250 feet and 1,450 feet. Groundwater in the upper Ferron Sandstone aquifer was also under confined conditions and the artesian pressure raised the water to a static level of 91 feet below the ground surface.

The unequal static water levels between the upper and lower Ferron Sandstone aquifers amount to a difference of about 120 feet. This indicates that each of these aquifers act independently of the other and there is little to no communication between them. Whether this is due to the interbedded shale layers or the thick coal layer acting as an aquiclude to keep them separate is not clear. However, during the pump test of well #2, it was noted that the static water level of well #1 was influenced (Johansen & Tuttle, 1979). This indicates that whatever is acting as a barrier between the upper and the lower Ferron Sandstone aquifers must be leaky to the artesian pressure if not to the water also, and therefore is an aquitard rather than an aquiclude.

4.3.2.4 Implications for Injection and Aquifer Response

At the outset, it can be said that well #1 is not properly constructed to accommodate artificial recharge and injection well technology. The small, five inch diameter of the well is the main issue. The lower Ferron Sandstone aquifer, which is the source **of this well's water supply could receive** recharge, but with such a high artesian pressure it would be expensive to pump against it. In addition, if surface water were injected into the lower aquifer it would create an even greater pressure difference across the thick coal layer. This pressure differential would cause water to migrate through the coal layer. Coal typically contains high iron, sulfate, chlorine, and other elements that would rapidly degrade any water flowing through it. This would tend to negate the advantage of injecting fresh water into the aquifer. Johansen and Tuttle, 1979 report that results of water quality tests from both wells are very similar. This may be due to the fact that the lower aquifer has higher pressure than the upper aquifer. This condition favors the slow upward

migration of groundwater through the thick coal layer. Exposure to the coal would further decrease water quality.

Well #2 and the upper Ferron Sandstone aquifer seem much better suited to accommodate injection well technology. This aquifer is much thicker, although it contains more shale beds. It also occurs above the thick coal bed and may be less likely to be influenced by it. The larger 10 inch diameter casing is better configured for conversion from being solely a production well to an ASR well that can inject water at one time and produce it at another. The artesian pressure in this aquifer is less, as a result it would be less expensive to pump against it during the injection process. As water is injected into this aquifer it would increase the pressure over time. Increased pressure in the upper aquifer would, at some time, match or exceed the pressure in the lower aquifer thus reversing the pressure gradient across the thick coal bed. If the coal bed is leaky the water would flow down through it instead of upward through it. This would reduce the likelihood of the coal bed contaminating groundwater in the upper aquifer.

4.3.2.5 Regulatory Permits

State of Utah law requires that the sponsor of an ASR project obtain several permits. A recharge permit and a recovery permit must be obtained from the Utah Division of Water Rights. An Underground Injection Control permit is also required if an injection well is to be part of the project and can be obtained from the Utah Division of Water Quality. The purpose of these permits is to ensure that the project sponsor has adequate water rights for the water to be recharged and withdrawn and to ensure that the water quality of the receiving aquifer is not degraded.

4.3.2.6 Summary

This preliminary investigation into the feasibility of altering one of the Emery Town wells to accommodate injection well technology suggests that it is worth considering. Obvious benefits

include: storing water underground to be used at times of greater demand, injecting potable water which would mix with or displace existing poor quality water to improve overall quality and the possibility of converting poorly utilized surface water rights to more fully utilized groundwater rights. It is imperative that studies of the aquifer, to determine its dimensional and hydrogeologic properties, be conducted before implementing an ASR project. This work should be done by a consultant with experience with ASR well technology.

4.4 Water Reuse & Recycling

Water reuse is the intentional use of reclaimed wastewater for a beneficial purpose. Recycling is similar to water reuse but limited to the use of reclaimed wastewater for the same purpose that created it, such as for cooling water at an industrial power plant.[13] While water recycling is already used by the two major power plants in the San Rafael and Muddy Creek watersheds, there are no known instances of water reuse. This section discusses the concept of water reuse and recycling and estimates the current and potential uses within the study area.

4.4.1 Current Water Recycling at Power Plants

There are two coal-fired power plants located in Emery County, the Huntington Power Plant located northwest of Huntington and the Hunter Power Plant located south of Castle Dale. Both plants divert large quantities of water from local streams for cooling water and other operational needs. This water is captured in large basins, cooled, and recycled multiple times before eventually being disposed of via land application on land owned by PacifiCorp to grow alfalfa and other salt tolerant crops.

[13] Utah Division of Water Resources, *Water Reuse in Utah,* (Dept. of Natural Resources: Salt Lake City, 2005), 2.

Wastewater effluent from the Huntington Power Plant is applied to 255 acres[14] of land near the plant, while effluent from the Hunter Power Plant is applied to 480 acres[15] of land. The primary crop irrigated by the recycled water is alfalfa. Using the evapotranspiration (ET) value for alfalfa of 25.47 inches at the Castle Dale weather station,[16] DWRe estimates the total amount of water consumed by these crops is approximately 1,560 acre-feet annually.

4.4.2 Estimated Municipal Wastewater Discharges

There are five municipal wastewater treatment plants within the San Rafael River and Muddy Creek watersheds. They serve the communities of Castle Dale, Clawson, Emery, Ferron, Orangeville, and Huntington. Castle Dale and Orangeville utilize the same facility. All of these treatment plants are operated by the Castle Valley Special Service District. Table 4-1 shows some basic data for each plant.

Table 4-1, Wastewater treatment plants in the study area.

Facility*	Treatment Type	Disposal Method	Design Capacity (MGD)	Average Daily Flow (MGD)	Total Flow (ac-ft/year)
Ferron	Lagoon	Discharging	1.700	0.160	179
Emery	Lagoon	Total Containment	0.130	0.025	28
Clawson	Lagoon	Total Containment	na	0.010	11
Castle Dale/Orangeville	Lagoon	Discharging	0.700	0.420	470
Huntington	Lagoon	Discharging	0.300	0.248	278
TOTAL	-	-	**1.000+**	**0.863**	**967**

* Wastewater treatment plants in Cleveland and Elmo are not included because they are located in the Price River drainage.

[14] Utah Division of Water Quality, *Statement of Basis – PacifiCorp Hunter Plant, Ground Water Discharge Permit No. UGW150001,* (Dept. of Environmental Quality, Salt Lake City: September, 2010), 1.
[15] Utah Division of Water Quality, *Statement of Basis – PacifiCorp Huntington Power Plant Renewal of Permit UGW150002,* (Dept. of Environmental Quality, Salt Lake City: August, 2011), 1.
[16] Hill, Robert W., et. al., *Crop and Wetland Consumptive Use and Open Water Surface Evaporation for Utah, Appendix I – Updated Consumptive Use Estimates at NWS Stations,* (Utah State University, Logan, UT: August 2011), 50.

Each of the five facilities utilize evaporative lagoons to capture and treat the wastewater. Two of the five are total containment facilities, while the other three have a permit to discharge effluent, although it is rarely done. The reclaimed wastewater from each of these facilities could be reused for numerous purposes. Depending on the use, additional treatment may be required. Table 4-2 shows rough estimates of the volume of water that could potentially be reused.

Table 4-2, Estimated water reuse potential.

Facility	Potential Reuse* (ac-ft/yr)		
	2010	2030	2060
Ferron	108	130	137
Emery	14	18	19
Clawson	6	8	8
Castle Dale/Orangeville	282	339	356
Huntington	167	203	213
TOTAL	**576**	**698**	**734**

* The potential for reuse shown could increase if evaporation and seepage losses from the treatment lagoons could be reduced.

The most likely use for this water is for the irrigation of forage crops, as no additional treatment would be required. With minimal additional treatment for the two non-discharging plants, the effluent could be discharged directly into natural waterways, providing a small amount of water for instream flows and enhancing the downstream environment.

4.4.3 Regulatory Permits

Like ASR, water reuse is regulated by Utah Law and appropriate permits must be obtained prior to implementing a project. The sections of the law and related rules that regulate water reuse include the following:

- *Utah Code Annotated 19-5* – Utah Water Quality Act
- *R317-1-4* – Utilization of Isolation of Domestic Wastewater Treatment Works Effluent

- *Utah Code Annotated 73-3c* – Wastewater Reuse Act
- *R655*-7 – Administrative Procedures for Notifying the State Engineer

The purpose of these regulations is two-fold: (1) To protect human health and the environment and (2) ensure that the project obtains the appropriate permission to utilize the underlying water rights and that such uses will not adversely impact other senior water rights.

Section 5 – Opportunities for Additional Surface Water Storage

5.1 Background and Purpose

Castle Valley residents have long recognized the need to improve the availability of water. Over the years, local, state, and federal entities have investigated numerous sites throughout the San Rafael River and Muddy Creek watersheds, where dams and reservoirs might be constructed. Relatively few of these sites have been pursued beyond cursory evaluation. Only the most favorable sites have been built to date for a variety of reasons, including compromising geological or geotechnical conditions, inadequate water supply, complicated environmental permitting, public opposition, land ownership, and cost.

The purpose of this section is to identify opportunities for additional surface water storage in the San Rafael River and Muddy Creek watersheds. Increasing storage capacity within these watersheds would not only provide additional water to meet existing demands, but could potentially allow for increased flexibility and capacity to meet downstream environmental water needs.

5.2 Methodology, Process, and Final Site Selection

As with any study of this nature, dam and reservoir site selection is a step by step process whereby potential sites are first identified, then screened using certain criteria related to geological, geotechnical, engineering, economic, social, and environmental considerations. Those with fatal

flaws, or too many unfavorable characteristics, are eliminated; those sites remaining are progressively screened using more rigorous criteria such as dam size compared to storage, as well as utility and cost vs. benefit to prospective users. In this manner a final group of sites exhibiting the most favorable characteristics is obtained. For this study, the Utah Division of Water Resources (DWRe) employed a multi-step process to identify and screen potential reservoirs. Below, a brief summary is presented of each step along with maps and tables showing the potential reservoir sites analyzed and ultimately determined suitable for further consideration. For more details about the process and each potential reservoir site, see Appendix B.

5.2.1 Site Identification

DWRe identified 93 potential dam and reservoir sites from several sources, including reports from state and federal agencies and discussions with local water users. DWRe also found additional sites using USGS 7.5 minute quadrangle mapping at a scale of 1:24,000. At this phase, dam and reservoir sizes were maximized in accordance with the physiographic features with no regard to water availability. Basic information about each site is included in Table 5-1. The 93 sites identified are located as shown on Figure 5-1. The sites are color-coded to indicate what type of reservoir site they represent: A green dot (on the map) or text (in the table) indicates an on-stream reservoir; a purple dot or text indicates an off-stream reservoir; and a red dot or text indicates an existing reservoir that could be enlarged to increase its capacity. The Henningson Reservoir site in the Muddy Creek watershed is also indicated with a red dot and text, as it is an existing reservoir that has been decommissioned for dam safety reasons and could potentially be rebuilt and brought back into service.

Table 5-1, Basic data for all 93 potential reservoir sites considered.

Site Number (on Fig. 5-1) & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (ac-ft)	Emb. Vol./ Res. Storage (cy)/(ac-ft)	Land Ownership At Damsite	Land Ownership of Reservoir Basin
1000 The Breaks	431,780	14,452	29.9	Private	Private, BLM, SITLA
1001 Hambrick Bottom	889,932	47,428	18.7	BLM	BLM, UDWR, Private, SITLA
1002 Hadden Hills	95,614	6,465	14.8	Private	Private, BLM
1013 San Rafael Valley	114,028	10,317	11	BLM	BLM, UDWR, SITLA
1014 Mexican Bend	38,144	18,350	2.1	BLM	BLM
1015 Black Box	211,550	20,414	10.4	BLM	BLM
1016 Fuller Bottom	81,184	8,771	9.2	BLM	UDWR,BLM,SITLA
1017 Cat Canyon 1	224,275	22,776	9.8	BLM	UDWR, BLM, Private, SITLA
1018 Ivie Creek	297,710	10,785	27.6	Private	Private, BLM
1019 Saleratus Bench	827,769	3,756	220.4	SITLA, BLM	BLM, SITLA
1020 Dry Wash 1	261,803	16,329	16	BLM	Private, BLM
1021 Quitchupah 1	220,127	6,991	31.5	Private	Private
1022 Emery South	4,974,420	20,536	242.2	BLM	BLM
1023 Emery East	224,080	2,079	107.7	BLM	BLM, Private
1024 Muddy Creek 5	771,237	48,578	15.9	BLM	Private, BLM
1025 Muddy Creek 10	649,584	23,665	27.4	BLM	BLM, SITLA
1026 Wild Horse Creek	584,142	15,641	37.3	BLM	BLM
1027 Muddy Creek 9	90,065	8,032	11.2	BLM	BLM, SITLA
1028 Muddy Creek 8	153,398	2,906	52.7	BLM	BLM, SITLA
1029 Reds Canyon	819, 954	5,294	154.8	BLM	BLM
1030 Ferron Crk/Georges Fk	444,147	3,597	123.4	USFS	USFS
1031 Koford	483,536	6,772	71.4	USFS	Private, USFS
1032 Paradise Ck. (Bennets)	260, 601	2,351	110.8	USFS	USFS
1033 Lower Scad Valley	3,534,080	10,987	321.6	USFS, Private	USFS, Private
1034 Upper Scad Valley	413,105	6,564	62.9	Private, USFS	USFS
1035 Lower Miller Flat	1,165,000	12,207	95.4	USFS	USFS, Private
1036 Left Fk. Boulger Creek	2,320,840	10,854	213.8	USFS	USFS
1037 Mill Set	2,062,560	33,383	61.7	USFS	USFS, Private
1038 Muddy Creek 7	440,388	8,491	51.8	BLM	BLM, SITLA
1039 Muddy Creek 6	2,182,470	36,008	60.6	BLM	BLM
1040 Quitchupah 2	1,231,700	17,875	68.9	Private, BLM	BLM, Private
1041 Water Hollow	3,483,270	14,085	247.3	Private, BLM	BLM, Private
1042 Quitchupah Creek	4,080,340	21,642	188.5	SITLA, BLM	SITLA, BLM, Private
1043 Muddy Creek 3	1,262,920	13,032	96.9	USFS	USFS
1044 Emery	158,603	11,084	14.3	BLM	BLM, Private
1045 Muddy Creek 4	996,228	6,664	149.5	BLM, Private, USFS	USFS, Private, BLM
1045b Muddy Creek 4b	291,385	1,265	230.3	Private, USFS	Private, USFS
1045c Muddy Creed 4c	132,740	1,043	127.3	USFS	USFS
1046 Muddy Creek 2	1,676, 010	8,502	197.1	USFA	USFS
1047 Muddy Creek 1	26,011,000	176,941	147	USFS	USFS
1048 Horse Creek	952,050	3,938	241.7	USFS	USFS
1050 Molen Seep C	517,731	5,546	93.4	BLM	BLM

Green text=On-stream reservoir, Purple text=Off-stream reservoir

Table 5-1, Continued.

Site Number (on Fig. 5-1) & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (ac-ft)	Emb. Vol./ Res. Storage (cy)/(ac-ft)	Land Ownership At Damsite	Land Ownership of Reservoir Basin
1052 The Box	273,114	17,562	15.6	BLM, Private	Private, BLM, SITLA
1053 Lower Ferron Creek	223,892	10,650	21	BLM, SITLA	Private, SITLA, BLM
1054 Johnny Jensen Hollow	635,560	3,814	166.6	SITLA, Private	SITLA
1055 Cottonwood Wash 1	647,710	9,751	66.4	BLM	BLM, SITLA
1056 Cottonwood Wash 2	1,157,000	19,040	60.7	SITLA	BLM, SITLA
1057 Cottonwood Wash 3	1,524,310	19,636	77.6	BLM	BLM, SITLA
1058 Lower Ferron I	502,787	2,160	232.7	SITLA	SITLA
1059 Lower Ferron J	532,122	2,355	226	USFS	USFS
1060 Lower Ferron H	692,928/258,313	2,680	354.9	BLM, Private	BLM, Private
1061 Lower Ferron G	639,554	1,718	372.3	Private, BLM	BLM, Private
1062 Lower Ferron F	1,088,400	1,876	580.2	BLM	BLM
1063 Lower Ferron D	511,711	4,037	126.8	Private	Private
1064 Lower Ferron C	464,747	3,615	128.6	Private, BLM	Private, BLM
1065 Lower Ferron M	133,187	1,171	113.7	BLM	BLM
1066 Lower Ferron N	3,817, 360	11,553	330.4	BLM	BLM
1067 Lower Ferron B	1,723,460	17,040	101.1	Private, BLM	BLM, Private, SITLA
1068 Lower Ferron A	372,930	8,957	41.6	Private, BLM	BLM, SITLA, Private
1069 Lower Ferron L	273,798	6,378	42.9	SITLA	SITLA, BLM
1070 Short Canyon	678.747	8,693	78	BLM	BLM
1071 Dry Wash 2	56,997	525	108.5	BLM	BLM
1072 Lower Ferron K	911,931/41,606	3,639	363.7	BLM, Private	BLM
1073 Lower Ferron E	4,232,800	25,927	163.3	BLM, SITLA	BLM, SITLA, Private
1074 Cedar Creek	539,126	6,863	78.5	Private	Private, SITLA
1075 Huntington Creek	618,285	6,357	97.2	Private	Private
1076 Blue Slate Hills 1	92,847	1,012	91.7	Private	Private
1077 Blue Slate Hills 2	273,091	3,936	69.3	Private	Private
1078 Raise Emery Dam	Additional 85,143	Additional 392	81.1	USFS	USFS
1079 Raise Spinners Dam	Additional 52,970	Additional 366	144.7	USFS	USFS
1080 Raise Julius Flat Dam	Additional 51,260/12,835	Additional 348	184.2	USFS	USFS
1083 Morris Bend	990,047	1,841	537.7	USFS	USFS
1085 South Ferron	470,020	2,561	183.5	BLM	BLM
1086 Dutch Flat 1	140,105	815	171.9	Private	SITLA, Private, BLM
1087 Dutch Flat 2	169,088	1,337	126.4	SITLA, BLM	BLM, SITLA
1088 Horn Silver 1	755,722	3,116	242.5	BLM	BLM
1089 Lower Molen Seep	362,781	22,343	16.2	BLM	BLM, SITLA
1090 Molen Tanks	91,588	2,040	44.8	BLM	BLM
1091 Red Wash	338,323	2,833	119.4	BLM	BLM, Private
1092 Horn Silver 2	348,871	18,037	19.3	BLM	BLM, SITLA
1093 North Salt Wash	128,985	3,792	34	BLM	BLM
1094 Quitchupah 1A	101,078	1,668	60.6	Private, BLM	Private, BLM

Green text=On-stream reservoir, Purple text=Off-stream reservoir, Red text=Enlargement/Rebuild

Table 5-1, Continued.

Site Number (on Fig. 5-1) & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (ac-ft)	Emb. Vol./ Res. Storage (cy)/(ac-ft)	Land Ownership At Damsite	Land Ownership of Reservoir Basin
1095 Rock Canyon	43,581/1,536	319	141.4	BLM	BLM
1096 Raise Rolfson Dam	Additional 108,705	Additional 763	142.5	USFS	USFS
1097 Raise Miller Flat Dam	Additional 242,680	Additional 4,176	58.1	USFS	USFS
1098 Henningson Dam - Rebuild	Additional 42,457	Additional 365	116.3	USFS	USFS
1099 Peacock	1,769,190	14,518	121.9	Private, BLM	Private, BLM
1103 Molen Seep B	291,540	5,354	54.5	BLM	BLM
1104 Fish Creek	311,050	635	489.8	SITLA	SITLA
1105 Otteson Hollow	358,001	1,223	292.7	SITLA	SITLA
1106 Rock Canyon Creek	284,492	13,741	20.7	BLM	BLM, Private
1107 Jorgensen	148,384	7,898	18.8	Private, BLM	Private, BLM
1108 Raise Little Madsen	Insufficient Information	Insufficient Information	Unknown	USFS	USFS

Green text=On-stream reservoir, Purple text=Off-stream reservoir, Red text=Enlargement/Rebuild

5.2.2 Preferred Site Selection

Due to the large number of sites identified, DWRe sent maps showing the locations and a table showing basic data for each site (similar to Figure 5-1 & Table 5-1) to each of the four major irrigation companies and other interested parties within the study area. Each entity was asked to identify which sites were of greatest interest to them. The 93 sites were then narrowed to 40 based on feedback from these parties. Section 2 of Appendix B provides detailed information concerning the 40 **"preferred" sites that resulted from this** step. This includes a written summary of the location, dimensions, potential storage, land ownership, geology, foundation, and other considerations for each of the forty sites, with individual maps for each.

5.2.3 Preliminary Screening

The next step was to examine all forty reservoir sites with respect to the criteria already mentioned (geological including natural hazards, geotechnical, engineering, economic, social, land ownership, environmental considerations, and embankment volume compared to reservoir storage). This

See foldout Figure 5-1

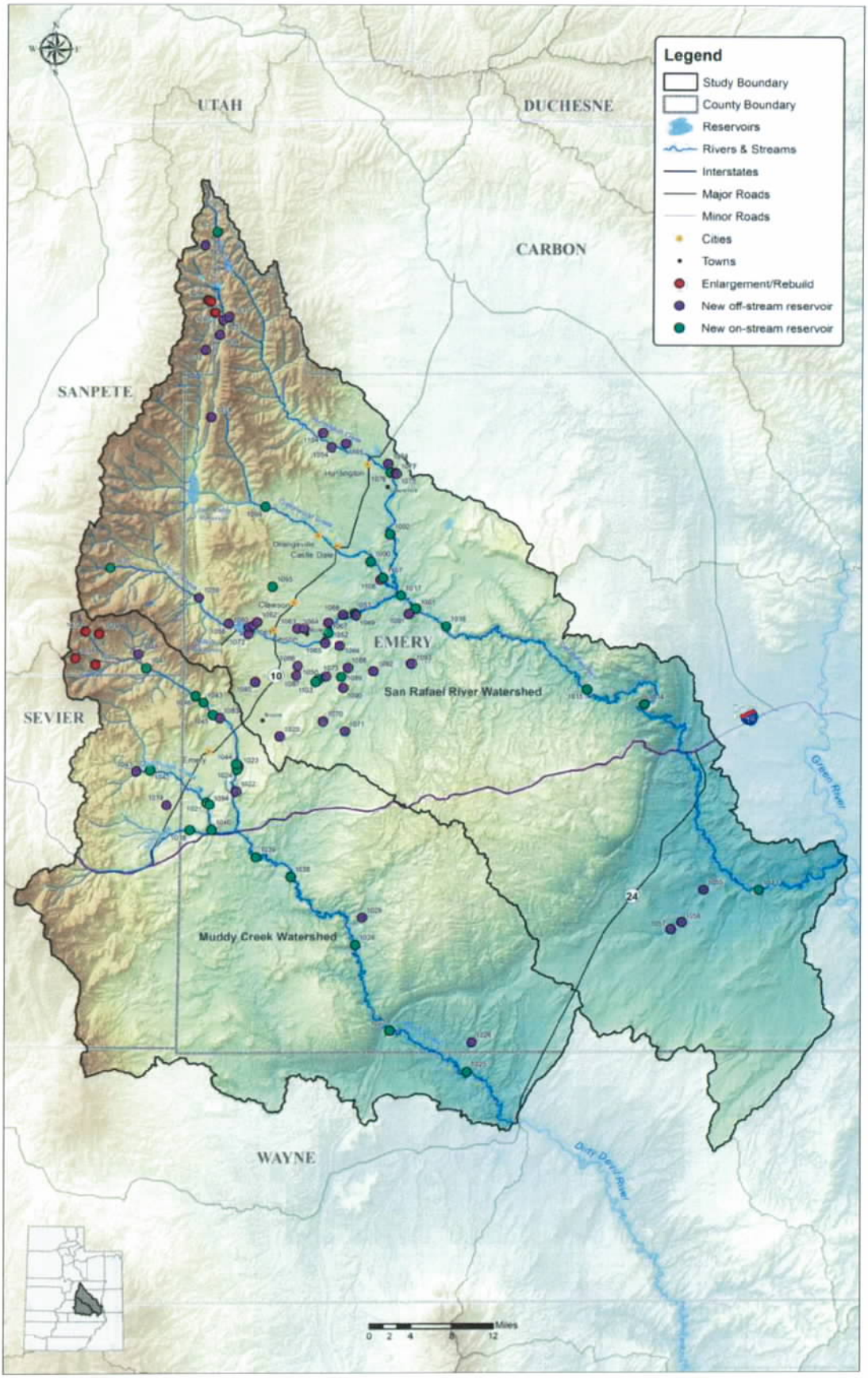

Figure 5-1, Location of all potential reservoir sites considered.

included preparing a summary of each site including a topographical map of the dam and reservoir site and a textual description of geology and other pertinent factors. Figure 5-2 shows a sample summary for the Jorgenson Reseroir site. (See Appendix B for a summary of each of the 40 sites.) This process resulted in the elimination of a number of the sites due to fatal flaws (such as having a fault in the abutment, located on or near a landslide, or being located on land administered by the U.S. Forest Service) or for having too many unfavorable characteristics to overcome, such as a lack

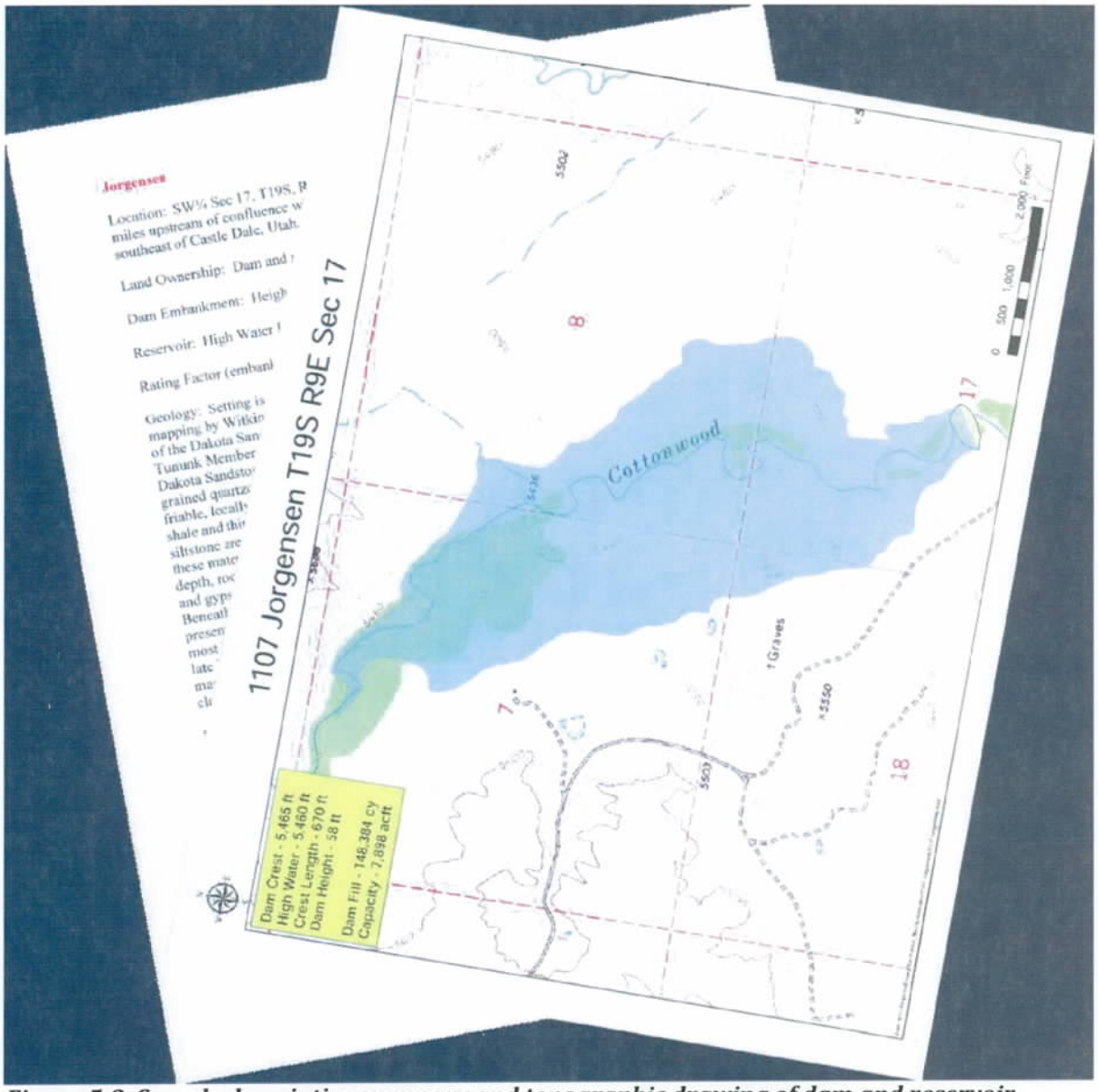

Figure 5-2, Sample descriptive summary and topographic drawing of dam and reservoir.

of available water supply, remote location relative to diversion points, too large of a dam relative to expected reservoir storage, or any combination of these and other factors. Based on this screening, DWRe eliminated 14 of the sites, leaving 28 to move into the next phase. These sites are shown in Figure 5-3.

5.2.4 Water Supply and Cursory Cost Estimate

Spinners Reservoir, located near the top of the Muddy Creek watershed.

For this step, the hydrology upstream of each dam site, whether on- or off-stream was evaluated to determine the available upstream contribution to the water supply for each reservoir. In addition, the feasibility of diversion from the nearest source as a means of filling the off channel reservoirs to maximum capacity was considered. Once the maximum reservoir storage was determined by evaluating the water supply, the dam structure was re-sized.

A cursory estimate of construction costs was developed for each of the 28 remaining sites for comparison purposes and to serve as the basis for the next level of screening. Basic data for each site is contained in Table 5-2. These sites are organized according to type of reservoir and ranked according to which sites have the most favorable embankment volume to storage volume ratio. For comparison purposes, this table also includes the same ratio for several other reservoirs in Utah that have already been built, currently are being built, or will be built shortly.

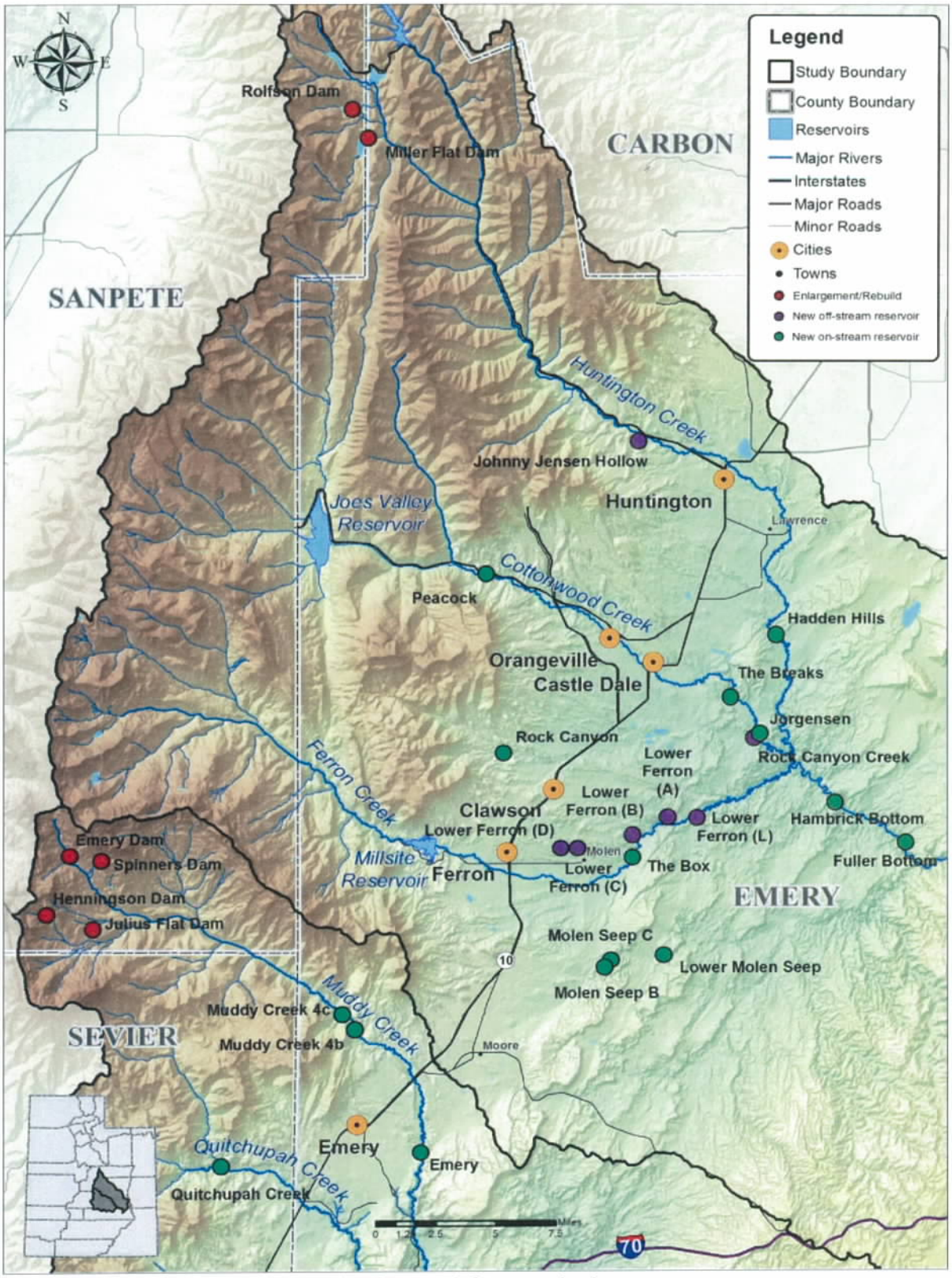

Figure 5-3, Location and name of final potential reservoir sites.

Table 5-2, Basic data for the 28 final reservoir sites.

Type or Reservoir/ Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (ac-ft)	Height of Dam/Dike (ft)	Length of Dam/Dike	Emb. Volume (cy)/Storage (ac-ft)
New On-stream Reservoir					
Fuller Bottom	81,184	8,771	55	395	9.2
Emery	158,603	11,084	90	380	14.3
Hadden Hills	95,614	6,465	45	775	14.8
The Box*	154,385	9,738	69	1,210	15.8
Jorgensen	148,384	7,898	58	670	18.8
Hambrick Bottom*	841,058	43,366	122	1,025	19.4
The Breaks	431,780	14,452	125	775	29.9
Lower Molen Seep*	77,017	1,587	56	420	48.5
Molen Seep B*	102,668	1,322	68	440	77.6
Molen Seep C*	132,827	1,268	65	660	104.8
Peacock	1,769,190	14,518	140	1,675	121.9
Muddy Creek 4c	132,740	1,043	67	520	127.3
Rock Canyon	43,581/1,536	319	48/7	365/220	141.4
Quitchupah Creek*	1,327,710	6,249	145	1,290	212.5
Muddy Creek 4b	297,385	1,265	80	930	230.3
New Off-stream Reservoir					
Rock Canyon Creek	284,492	13,741	80	855	20.7
Lower Ferron A	372,930	8,957	85	1,405	41.6
Lower Ferron L	273,798	6,378	90	615	42.9
Lower Ferron B*	1,098,520	9,682	97	2,535	113.5
Lower Ferron D	511,711	4,037	80	1,310	126.8
Lower Ferron C	464,747	3,615	68	1,375	128.6
Johnny Jensen Hollow	635,560	3,814	118	825	166.6
Enlargement/Rebuild of Existing Reservoir					
Enlarge Miller Flat Dam	242,680~	4,176~	98	2,070	58.1
Raise Emery Dam	85,143~	392~	56	1,040	81.1
Rebuild Henningson Dam	42,457~	365~	50	960	116.3
Raise Rolfson Dam	108,705~	763~	47.7	1,500	142.5
Raise Spinners Dam	52,970~	366~	81	1,615	144.7
Raise Julius Flat Dam	51,260~/12,835~	348~	62/21.8	1,110/850	184.2
Data Comparison with Other Facilities					
Joes Valley	1,290,000	61,538	-	-	20.96
Millsite	2,390,000	18,000	-	-	132.7
Adobe Wash	214,399	1,354	-	-	158.3
Jackson Flat	831,290	4,200	-	-	197.9
Clay Draw	650,000	3,200	-	-	203.1

* Original storage volume has been reduced to reflect estimated water supply available at location.
~ These numbers reflect additional embankment volume required or reservoir storage created when enlarging the existing dam.

5.2.5 Final Site Selection

For final screening of the 28 remaining sites, cursory costs developed in the previous step were reviewed based on estimates of water availability within the river system as a whole and the feasibility of delivering water to each of the proposed off-channel reservoir locations. Known demands on water in the San Rafael River/Muddy Creek system from existing diversions will limit the amount of water available for reservoir storage beyond that considered in the preceding phase. When these restrictions are taken into account, a number of the remaining sites no longer appear feasible, either from the standpoint of water availability, cost, or both. Specifically, some appear cost-prohibitive when evaluated on the basis of cost-per-acre-foot of usable storage. Table 5-3 contains a summary of the cost estimates developed for the twenty-six dam sites, ranked according to cost per acre-foot. Economics will constrain the feasibility of these sites. Based on cost-per-acre-foot, the sites are ranked in this table from the most favorable to the least favorable.

Table 5-3 also contains an estimate of the cost per acre-foot for 26 of the 28 final preferred reservoir sites. DWRe chose not to estimate the cost of the Hambrick Bottom and Fuller Bottom reservoir sites, because these sites would likely require a concrete-arch dam and would be cost prohibitive.

5.3 Water Rights Considerations

In order for any of the potential reservoirs discussed in previous sections to be built, sufficient water rights must be obtained from, or changes to existing water rights must be approved by, the State Engineer. Before approving new water rights or changes to existing water rights, the State Engineer must assess the impact these rights will have on other water users and ensure that they would not interfere with other existing rights. While obtaining new water rights is very unlikely at

Table 5-3, Cost estimates for the final 28 reservoir sites.

Type of Reservoir/ Site Name	Reservoir Storage (acft)	Emb. Volume/ Res. Storage (cy)/(acft)	Estimated Cost ($)	Estimated Cost/acft ($)	Overall Rank Based on Cost per acft
New On-stream Reservoir					
Emery	11,084	14.3	8,700,000	800	1
Jorgensen	7,898	18.8	8,900,000	1,100	3
The Breaks	14,452	29.9	16,400,000	1,100	4
Hadden Hills	6,465	14.8	8,800,000	1,400	5
The Box	9,738	15.8	14,000,000	1,400	6
Peacock	14,518	121.9	62,000,000	4,300	13
Lower Molen Seep	1,587	48.5	8,600,000	5,400	14
Quitchupah Creek	6,249	212.5	42,800,000	6,900	18
Muddy Creek 4c	1,043	127.3	7,600,000	7,200	21
Molen Seep C	1,268	104.8	11,500,000	9,100	22
Muddy Creek 4b	1,265	230.3	11,700,000	9,200	23
Molen Seep B	1,322	77.6	13,200,000	10,000	24
Rock Canyon	319	141.4	6,900,000	22,000	26
Fuller Bottom	8,771	9.2	*	*	*
Hambrick Bottom	43,366	19.4	*	*	*
New Off-stream Reservoir					
Rock Canyon Creek	13,741	20.7	14,300,000	1,000	2
Lower Ferron L	6,378	42.9	16,900,000	2,600	8
Lower Ferron A	8,957	41.6	27,900,000	3,100	10
Lower Ferron D	4,037	126.8	23,400,000	5,700	15
Lower Ferron C	3,615	128.6	21,300,000	6,000	16
Lower Ferron B	9,682	113.5	57,800,000	6,000	17
Johnny Jensen Hollow	3,814	166.6	26,200,000	6,900	19
Enlargement/Rebuild of Existing Reservoir					
Miller Flat 25' raise	9,426	58.1	20,800,000	2,200	7
Julius Flat Dam 18' raise	1,073	184.2	3,500,000	2,700	9
Rolfson Dam 12' raise	1,860	142.5	4,200,000	3,300	11
Spinners Dam 24' raise	1,041	144.7	2,300,000	4,100	12
Emery Dam 31' raise	537	217.2	3,700,000	6,900	20
Henningson Dam Rebuild	834	116.3	9,700,000	10,100	25

* Both of these sites would require a concrete dam due to the steepness of the abutments, the cost of which would be prohibitive. Thus, a cost estimate was not prepared.

this time, there are several significant water rights that have already been approved, which have not yet been perfected (see Table 5-4). It may be possible to work with the owners of these rights to use them for one or more new reservoirs.

Table 5-4, Approved but unperfected water rights within the study area.

Area / Water Right #	Priority Date	Owner	Volume (Flow)	Uses	Type	Source
San Rafael River (Area 93)						
93-1003	Feb 26, 1940	US Bureau of Reclamation - Provo Area Office	117,546 acft	IS	Surface	Cottonwood Creek
93-953	Aug 03, 1922	US Bureau of Reclamation - Provo Area Office	5,500 acft	IS	Surface	Huntington Creek
93-955	Aug 08, 1922	Huntington Cleveland Irrigation Company	3,000 acft (75 cfs)	IS	Surface	Huntington Creek
93-1140	Aug 08, 1922	Huntington Cleveland Irrigation Company	4,000 acft	I	Surface	Huntington Creek
93-954	Jul 02, 1962	US Bureau of Reclamation - Provo Area Office	54,336 acft (75 cfs)	IS	Surface	Huntington Creek
93-1131	Mar 19, 1976	State of Utah Division of Wildlife Resources	3,622 acft (5 cfs)	na	na	San Rafael River
Muddy Creek (Area 94)						
94-52	Apr 22, 1963	Consolidation Coal Company	2,400 acft	IO	Underground	Well
94-53	Apr 24, 1963	Consolidation Coal Company	2,173 acft (3 cfs)	O	Underground	Well
94-54	Apr 27, 1963	Consolidation Coal Company	3,622 acft (5 cfs)	IOS	Underground	Well
94-64	Mar 04, 1964	Consolidation Coal Company	3,622 acft 5 cfs)	O	Underground	Well
94-285	Oct 18, 1974	Consolidation Coal Company	3,622 acft (5 cfs)	OPMi	Underground	Well

Uses Key: I=Irrigation, S=Stockwatering, P=Power, Mi=Mining, O=Other.
Source: Marc Stilson, Regional Engineer, Utah Division of Water Rights, Price Area Office.

As shown in Table 5-4, three of the water rights within the San Rafael River watershed are owned by the U.S. Bureau of Reclamation and represent a significant volume of water that could potentially be stored in a new reservoir or reservoirs (117,546 acre-feet on Cottonwood Creek and 59,336 acre-feet on Huntington Creek). The Huntington-Cleveland Irrigation Company and the Utah Division of Wildlife Resources also hold significant water rights on Huntington Creek for a total of 7,000 acre-feet and 3,622 acre-feet, respectively. Although not listed in Table 5-4, the Ferron Canal and Reservoir Company has a water right for 7,000 acre-feet of storage that they have not yet

developed. In cooperation with PacifiCorp, the company is looking for a suitable location where this water can be stored.[1]

Opportunities to utilize approved water rights in the Muddy Creek watershed appear to be much more limited. The only significant approved but unperfected water rights in the Muddy Creek watershed are owned by the Consolidation Coal Company. All of these rights are for wells that would extract groundwater, for a total volume of 15,439 acre-feet. However, not shown in Table 5-4 is the water right held by the Muddy Creek Irrigation Company associated with Henningson Reservoir, which is no longer in use. It is likely that this water right could still be used if the reservoir were to be rebuilt.

[1] This comes from informal conversations with local officials and needs to be verified. This may be a part of an existing storage right in Millsite Reservoir that was not developed because Millsite Reservoir was not quite large enough, thus explaining why it doesn't appear in Table 5-4.

Section 6 – Water Quality Assessment and Improvement Plan

6.1 Background

About the middle of the 20th Century, federal and state governments began to recognize the need to monitor and control the growing problem of water pollution. In 1953, the Utah State Legislature established the Water Pollution Control Committee and the Bureau of Water Pollution Control. Later, with the passage of the federal Clean Water Act in 1972 and the federal Safe Drinking Water Act in 1974, a federal emphasis was given to preserving and improving water quality. Today, the Utah Water Quality Board and Division of Water Quality (DWQ) and the Utah Drinking Water Board and Division of Drinking Water are responsible for the protection, planning and management of water quality in the state of Utah.[1]

Section 303 of the Clean Water Act directs each state to establish water quality standards to protect beneficial uses of surface and ground water resources. The Act also requires states to monitor water quality to assess achievement of these standards. Where water quality is found to be impaired, each state must then establish a total maximum daily load (TMDL) for each pollutant that contributes to the impairment. A TMDL sets limits on pollution sources and outlines how these limits will be met through implementation of best available technologies for point sources and best management practices for nonpoint sources.[2]

[1] Utah Division of Water Resources, *Utah State Water Plan, Utah's Water Resources—Planning for the Future*, (Dept. of Natural Resources: Salt Lake City, 2001), 51.
[2] Ibid.

In 1997, DWQ conducted a water quality assessment that included the San Rafael and Muddy Creek drainages. This assessment, along with water quality data collected by the Emery Water Conservancy District (EWCD), revealed that agricultural use classifications were not being supported in several stream segments and they were subsequently listed on the Utah's 303(d) list of impaired waters. As a result of this listing, a TMDL to address Total Dissolved Solids (TDS) pollution in the San Rafael River and Muddy Creek watersheds had to be prepared. In 2004, MFG, Inc., a consulting firm hired by DWQ, completed these TMDLs under the direction of the Price-San Rafael-Muddy Rivers Watershed Council.

Section 319 of the Clean Water Act provides funding for projects that address nonpoint sources of pollution. In order to maximize the impact of 319 funds allotted to the State of Utah, DWQ has implemented a funding opportunity schedule that rotates through a different hydrologic river basin throughout the state each year. In 2015, funding for projects within the West Colorado River Basin, including the San Rafael River and Muddy Creek watersheds, will become available.

6.2 Goals and Objectives

The goal of this section is to provide a water quality improvement plan for the San Rafael River and Muddy Creek watersheds that satisfies EPA requirements. If the plan meets EPA requirements, the proposed watershed improvement projects outlined in the plan will become eligible for Section 319 funding through DWQ's rotating funding opportunities in 2015.

6.3 Required EPA Watershed Plan Elements

In order to be eligible for Section 319 funding, a watershed plan must contain certain elements outlined by the EPA. There are nine key elements required: (1) identification of the cause of impairment and pollutant sources; (2) an estimate of the load reductions expected from

management measures; (3) a description of the nonpoint source management measures that will be implemented to achieve load reductions; (4) an estimate of the amounts of technical and financial assistance needed; (5) an information and education component used to enhance public understanding of the project; (6) a schedule for implementing the nonpoint source management measures; (7) a description of interim measurable milestones; (8) a set of criteria that can be used to determine whether loading reductions are being achieved; and (9) a monitoring component to evaluate the effectiveness of the implementation efforts over time.

Several of the required elements have already been satisfied by the TMDLs that were prepared for the San Rafael River and Muddy Creek watersheds.[3] In these cases, summary information from the TMDLs is included in this report. Detailed information containing the remaining elements that were not specifically addressed in the TMDLs are also included in this section.

6.3.1 Causes of Impairment and Pollution Sources

Figure 6-1 shows the location of impaired waters in the San Rafael River and Muddy Creek watersheds. These waters are impaired due to high concentrations of TDS (over 1,200 mg/L) observed at various sampling points located throughout the watersheds.

6.3.1.1 Causes of Impairment[4]

Due to the availability of water quality data, the TMDL for the San Rafael River watershed was divided into five smaller sub-watersheds: Huntington Creek, Cottonwood Creek, Rock Canyon Creek, Ferron Creek, and the lower San Rafael River. Exceedances of the TDS criteria were noted in the middle to lower reaches of Huntington Creek, Cottonwood Creek, and Ferron Creek sub-

[3] See MFG, Inc., *Price River, San Rafael River, and Muddy Creek TMDLs for Total Dissolved Solids: West Colorado Watershed Management Unit, Utah*, prepared for the Utah Division of Water Quality, (Fort Collins: 2004). This report is available in Appendix C and online at: http://www.waterquality.utah.gov/TMDL/West_Colorado_TMDL.pdf.

[4] Ibid, 36-37, 39, 48. (Much of the content of this section is taken verbatim from this source.)

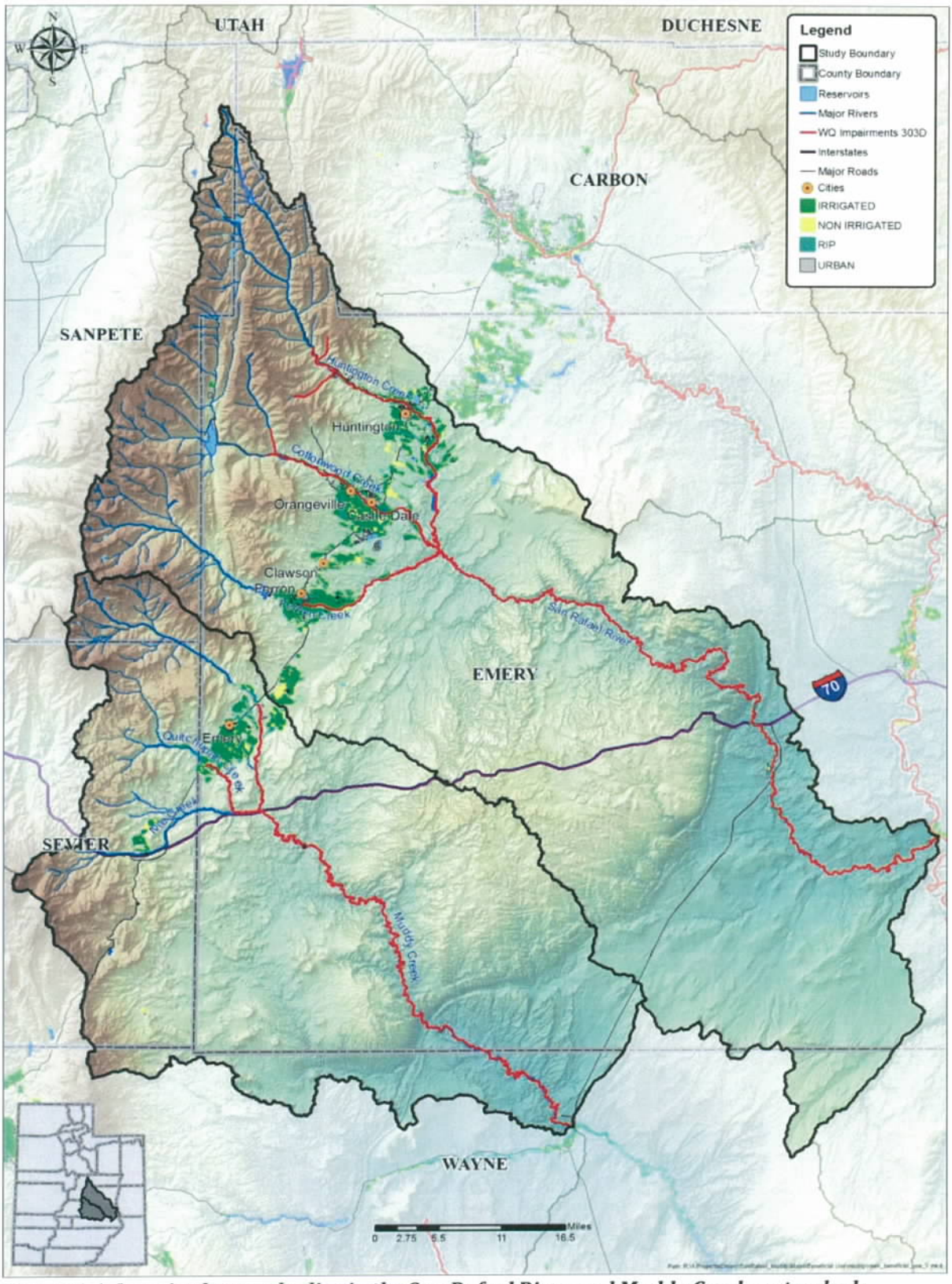

Figure 6-1, Impaired water bodies in the San Rafael River and Muddy Creek watersheds.

watersheds. Exceedances of the TDS criteria were also noted in the middle to lower reaches of the Muddy Creek watershed. Variations in water quality in all of these watersheds are attributed to land use and geologic characteristics. Land use in the upper reaches of these sub-watersheds is primarily forest, along with some power generation and coal mining in the Huntington Creek and Cottonwood Creek sub-watersheds, coal mining in the Muddy Creek watershed, and coalbed methane extraction in the Ferron Formation encompassing most of the land between the Wasatch Plateau to the west and the San Rafael Swell to the east. The middle of the Muddy Creek watershed and the middle and lower reaches of the Huntington Creek, Cottonwood Creek, and Ferron Creek sub-watersheds are dominated by agriculture use, with significant irrigation and urban activities. The natural Mancos Shale formation is also prevalent in the same areas of all these watersheds.

Measured TDS concentrations in Rock Canyon Creek sub-watershed and the lower San Rafael River sub-watershed have exceeded the TDS criterion throughout the monitored reaches of these waters. The elevated TDS concentrations in Rock Canyon Creek are attributed to the presence of Mancos Shale and land use activity in the watershed (i.e., agriculture use, with irrigation and urban activities).

Given the measured concentrations of TDS in Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek, all which drain to the San Rafael River, the measured concentrations of TDS in the San Rafael River were expected to be high. However, the mean concentration of TDS in the San Rafael River decreases in the lower reach of the river due to water inflows of lower TDS concentrations from areas lacking significant TDS sources.

In summary, the primary factors in increased TDS loads in the middle and lower reaches of the San Rafael River and Muddy Creek watersheds are from natural geological loadings, agricultural irrigation practices, and surface runoff, although more and more acres are being converted from

flood to sprinkler irrigation, eliminating most irrigation return flows. Irrigation water percolating through the soil and shale dissolves salts, principally carbonates and sulfates, and transports them to the natural drainages. Groundwater moving through the Mancos Shale formation, already affected by soils containing elevated salt levels, picks up additional salts from the shale and discharges the high TDS concentration into streams. Due to different geology and land uses, the upper portions of each of the watersheds generally have insignificant salt loadings relative to the downstream reaches. Specific non-point and point sources for each of the target locations are discussed in greater detail in the following section. Most communities are now participating in the Colorado River Basin Salinity Control Program, which will greatly reduce irrigation return flow or surface runoff and deep percolation of irrigation water thereby reducing the TDS levels in the creeks and river.

6.3.1.2 Pollution Sources[5]

The TMDLs for the San Rafael River and Muddy Creek watersheds identified both point and non-point sources of pollution that contribute TDS load to streams. However, the TMDLs determined that non-point sources of pollution are the leading causes of excessive TDS concentrations.

The most significant TDS loading are due to surface and sub-surface movement of water over the Mancos Shale geologic feature present in the area. Mancos Shale formations, dominate the middle portion of the San Rafael River and Muddy Creek watersheds. Municipal and industrial non-point sources of pollution include: urban runoff, leaky water supply lines, and erosion of disturbed soils at coal mines and leaching of coal mining spoil materials. However, these sources are generally insignificant relative to the other non-point sources of TDS concentrations in the watershed. Agriculture, which requires significant quantities of irrigation, is also the predominant land use in these areas. Groundwater flows through the Mancos Shale and surface runoff over soils derived

[5] MFG, Inc., 54, 57-59. (Much of the content of this section is taken verbatim from this source.)

from Mancos Shale results in substantial dissolution of salts and are the primary avenues by which TDS loadings are increased.

Irrigation, with its associated canal seepage and return flows is a significant contributor of TDS in the San Rafael River and Muddy Creek watersheds. TDS loading associated with flood irrigation can occur from surface flow and from seepage and subsequent subsurface movement of the water. Overland flow caused by over-irrigation can transport salts, as well as sediment, from the soil surface directly to streams. Below-ground, seepage from canals and ponds and irrigation return flows may eventually enter the groundwater and return to the stream.

Runoff events are also a significant source of the total salt load. Previous studies have estimated that 14 percent of the salt loads in the San Rafael River are related to runoff events caused by intense precipitation during thunderstorms. Similar loading has also been estimated for Muddy Creek. Additionally, overland flow of snowmelt on lower elevation sites located on saline formations can significantly increase salinity.

Surface runoff over soil derived from Mancos Shale can potentially increase TDS by transporting salt laden soil particles into nearby streams. The aridity of the San Rafael River and Muddy Creek watersheds results in a net upward movement of water, which deposits salts on the soil surface. These salts are susceptible to movement by surface runoff from natural precipitation events, snowmelt, and over-irrigation. Runoff can be exacerbated by disturbances to the soil surface, such as overgrazing and recreational activities.

Recreational activities are another potential source of TDS. The loss of vegetative cover and the loosening of soil particles associated with the recreational activities results in increased erosion potential and TDS loading into nearby streams. Streambank degradation caused by watering

animals in readily accessible streamside areas can also result in increased sediment production, and accompanying TDS loadings.

6.3.2 Estimate of Load Reductions Expected

The effectiveness of BMPs addressing non-point source pollution is difficult to predict and often times difficult to detect, even with intensive sampling. Often the only loading from these areas is during significant precipitation events, so the loading is sporadic and at times when monitoring is not possible. Implementation of the projects described in this watershed plan (Section 6.3.3) will result in improvements to water quality, but quantitative monitoring will be challenging. However, there are major irrigation efficiency projects underway throughout the study area that are part of the Colorado River Basin Salinity Control Program. Detailed estimates of salt load reductions exist for these projects; a summary of these load reductions is included in section 6.3.2.2 for reference.

6.3.2.1 Watershed Plan Projects

Load reduction estimates for the watershed improvement projects listed in this plan will be produced once detailed project plans are prepared. General criteria to monitor load reductions are discussed in Section 6.3.8.

6.3.2.2 Colorado River Basin Salinity Control Program

In addition to the nonpoint source management measures identified in this plan (see Section 6.3.3), several irrigation efficiency projects within the San Rafael River and Muddy Creek watersheds have been implemented or authorized under the Colorado River Basin Salinity Control Program (CRBSCP).

The CRBSCP was enacted by Congress in 1974 to address salinity problems in the Colorado River, specifically to meet treaty obligations made to Mexico to deliver water of a certain quality. This program has specifically targeted man-caused salinity contributions to the river, primarily through

on- and off-farm irrigation efficiency improvements (such as sprinkler systems and piping of canals and laterals) and has been instrumental in reducing salt loads in the Colorado River. The Colorado River Basin Salinity Control Forum is now looking at natural sources of TDS on rangeland. This section discusses salinity control projects within the San Rafael River and Muddy Creek watersheds and the estimated salt load reductions that have been realized to date or are projected upon completion of all projects that have been identified.

There are two units of the CRBSCP that are pertinent to this plan, the Price-San Rafael Rivers Unit and the Muddy Creek Unit. To date, NRCS has overseen on-farm projects in the Price-San Rafael Unit on 25,600 acres that have reduced salt loads by an estimated 76,000 tons per year. Planned projects on another 28,000 acres are anticipated to remove another 85,000 tons of salt per year. The total cost of all on-farm projects in the Price-San Rafael Rivers Unit is estimated to be $78.6 million for a cost of approximately $53 per ton of salt removed.[6] In the Muddy Creek Unit, there have been only a few "stand-alone" pressurized irrigation systems installed. Eventually, on-farm projects on a total of 6,050 irrigated acres are anticipated and will reduce salt loads by approximately 11,700 tons per year. The total cost of the projects in the Muddy Creek Unit is estimated to be about $12 million for a cost of approximately $128 per ton of salt removed.[7] This cost per ton figure has been challenged by local residents and the local San Rafael Conservation District because two federal agencies have suggested two different salt loading amounts. The TMDL study by EPA estimates a salt load of 26,200 tons annually attributed to agriculture whereas the Environmental Assessment prepared by NRCS and Bureau of Reclamation suggest the lower figure of 11,700 tons. The higher figure, if accepted, would reduce the cost per ton of salt removed significantly. The community of Emery has installed a pipeline to the city that will also be available

[6] Natural Resources Conservation Service, *Colorado River Basin Salinity Control Program, Price – San Rafael Rivers Unit, Monitoring and Evaluation Report, FY2010,* (U.S. Dept. of Agriculture: Roosevelt, UT, 2010), 8.
[7] Natural Resources Conservation Service, *Colorado River Basin Salinity Control Program, Muddy Creek Unit, Monitoring and Evaluation Report, FY2010,* (U.S. Dept. of Agriculture: Roosevelt, UT, 2010), 7.

to the irrigation company. This pipeline will also reduce the cost per ton of salt and make a salinity reduction irrigation project more competitive.

In addition to on-farm projects, the U. S. Bureau of Reclamation (USBR) has overseen the implementation of many off-farm improvements throughout Emery County. The projects that have been completed to date will reduce salt loads by an estimated 24,233 tons per year. Several additional projects that are underway are estimated to remove another 5,521 tons of salt per year.[8]

While CRBSCP projects will have the largest impact on reducing salt loads within the San Rafael River and Muddy Creek watersheds, opportunities to implement other nonpoint source management measures not covered by this program also exist. The following section identifies a few specific measures that this plan seeks to implement.

6.3.3 Proposed Nonpoint Source Management Measures

There are numerous management measures, or Best Management Practices (BMPs), that can be implemented throughout the San Rafael River and Muddy Creek watersheds to manage nonpoint sources of pollution. This section lists several proposed pollution prevention projects along with the associated BMPs that will be utilized. The BMPs are listed both by name and number (the number corresponds to the NRCS approved BMP listing by practice). A map showing the general location of where each management measure will be implemented is shown in Figure 6-2.

6.3.3.1 Animal Feeding Operation Improvement

The local conservation districts, in partnership with the Utah Department of Agriculture and Food, are working with livestock operators throughout the watershed to reduce the impacts of animal

[8] Personal communication with Benjamin Radcliffe, U. S. Bureau of Reclamation, Provo Office, February 3, 2012.

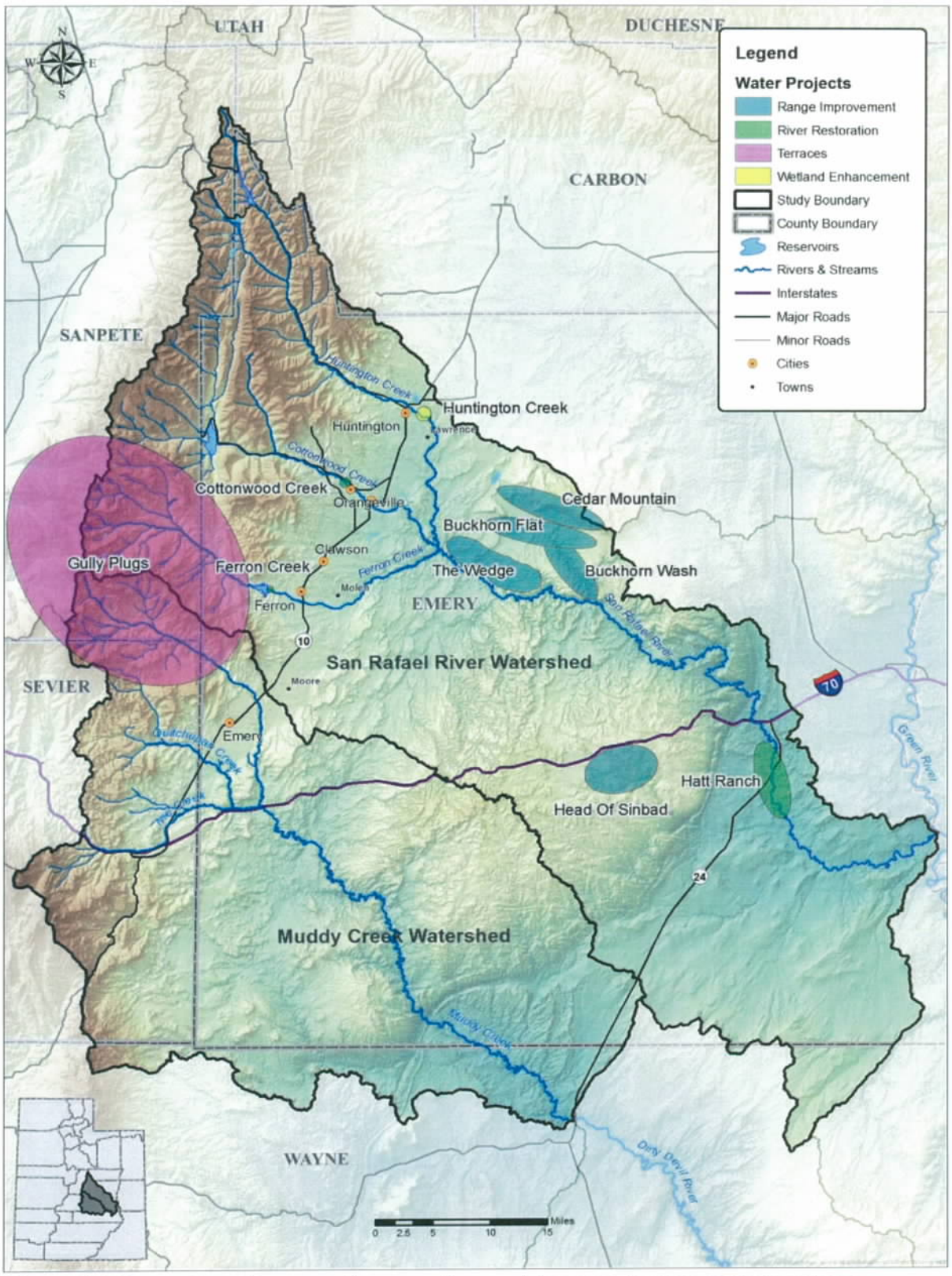

Figure 6-2, General location map of proposed nonpoint source management measures.

feeding operations on water sources. All operations have been assessed and those with contamination issues are working to eliminate the problems. If and when individual projects require outside funding, they will be identified and added to the other projects identified in this plan.

The BMPs to be utilized in these potential projects will include some or all of the following: Critical Area Planting (342), Invasive Species/Noxious Weed Control (950), Fence (382), Livestock Stream Crossing (728), Nutrient Management (590), Controlled Stream Access for Livestock Watering (730), Prescribed Grazing (528), Watering Facility (614), and Stream Habitat Improvement and Management (395).

6.3.3.2 Gully Plugs, Sediment Control

The installation of gully plugs and terracing in targeted areas of the upper reaches of the San Rafael River watershed would reduce sediment transport and decrease the rate of erosion. The Forest Service has identified areas in the upper elevations of the watershed where the gully plugs and terraces need to be installed. Some of these areas were previously terraced and trenched in the 1960s and these structures need to be rehabilitated to function properly again. Installation of these erosion and sediment

Terracing in the upper watershed above Millsite Reservoir.

control structures would decrease the amount of sediment transport throughout the watersheds and especially on Ferron Mountain above Millsite Reservoir. There are also three areas along Muddy Creek where the soil is highly erodible and prone to gully formation: Clay Spring Ridge, Greens Draw and Cowboy Hollow. The addition of sediment control structures such as gully plugs, terraces and levies would decrease sediment transport from these areas into Muddy Creek.

The BMPs to be utilized in these project areas will include the following: Water & Sediment Control Basin (638) and Terrace (600). Emery County, Ferron Canal and Reservoir Company, and other affected stakeholders should write a letter to the Forest Service encouraging them to rebuild the terraces and trenches on the Ferron and Muddy Creek watersheds.

6.3.3.3 Rangeland Improvement

Large grazing allotments are scattered throughout the San Rafael River and Muddy Creek drainages. Some livestock watering is done by ditch to pond with ditches running through Mancos shale soil layers and other saline deposits, adding to the sediment and salinity of the water. Excess water is then returned to the stream. By inserting pipeline and watering facilities, water quality would be improved. Many rangeland areas around Huntington City have already converted to pipeline and water trough systems.

One factor controlling surface erosion is the percentage of grass cover (Dadkuh and Gifford 1980). The presence of grass aids in binding soil particles together as well as slowing overland flow allowing sediment to settle out of suspension. Grass cover percentages of 50% or more minimize the amount to sediment production on rangelands. One way to improve grass cover on rangelands is through proper grazing management. There are numerous grazing allotments throughout the San Rafael Desert and along the San Rafael River like the Buckhorn Wash, as well as upland reaches like Box Flat, Horse Bench, Cedar Mountain and Head of Sinbad.

Range improvement projects near the San Rafael River will focus on management, fencing and off-stream watering facilities and in selective cases on-stream engineered watering facilities. Reducing direct animal access to the river will increase water quality by reducing sediment and nutrient loads. In upland reaches, grazing management will be the prime factor for the increase of forbs and grasses, thereby reducing the soil-water contact and runoff potentials. In some areas the addition of water retention ponds and watering facilities would increase the amount of area that could be managed, but would need a water right.

At Wildcat Knoll in the Muddy Creek drainage there are large sections of pinion pine and pinion juniper forested areas. Forbs and grasses that grow beneath such areas are minimal to nonexistent. Brush removal in a mosaic pattern, with broadcast seed mixtures afterward, would result in a significant increase of grasses and forbs. The higher amount of ground cover would result in a decrease in erosion, while increasing wildlife habitat.

The BMPs to be utilized in these projects will include the following: Range Planting (550), Brush Management (314), Watering Facility (614), Prescribed Grazing (528) Fence (382), Invasive Species/Noxious Weed Control (950) Controlled Stream Access for Livestock Watering (730), and Pipeline (516).

6.3.3.4 Sprinkler Irrigation and Salinity Control

Flood irrigation has been the method of crop and pastureland irrigation in the San Rafael River and Muddy Creek drainages for over a century. Once saturated, the salt-bearing soils produce large salt accumulations and damage previously productive agricultural land. Downstream water users of the Colorado River are then affected by the high salt content of water used for residential, commercial, industrial, and agricultural purposes.

Currently, many canal and irrigation companies in Emery County are making the transition to pressurized sprinkler irrigation systems in an effort to reduce the salt loading into the Colorado River system, improve irrigation efficiency, and increase crop yields. Through the Colorado River Basin Salinity Control Program, these companies are working with the Bureau of Reclamation, the Natural Resources Conservation Service, and the local conservation districts to help fund the systems. Installed pressurized irrigation systems are now lowering water tables, restoring cropland to productive use, and stopping salt laden water from running off fields and into the Colorado River system.

Current furrow and flood irrigation has an efficiency of approximately 25-35%. A wheel line, hand-line, or pod irrigation system average efficiency is approximately 77.5%, while a center pivot irrigation system that employs the use of 16 inch drop head would increase efficiency to 85-90%.

The Muddy Creek, Cottonwood and Huntington Creek drainages will be incorporating sprinkler systems throughout 2015 and 2016.

The BMPs to be utilized in these projects will include: Irrigation System Sprinkler (442), Irrigation Pipeline (430), Irrigation Water Management (449), Irrigation Land Leveling (464), Structure for Water Control (587), Irrigation System Tail Water Recovery (447), Forage and Biomass Planting (512), and Sediment Basin (350).

6.3.3.5 Stream Restoration

Various areas of the San Rafael River watershed have been targeted for noxious and invasive woody weed removal. On the lower reaches of the San Rafael River, at Hatt Ranch, there have been approximately 800 acres of tamarisk removal projects. These sections have since been re-vegetated. Vegetation types include Fremont Cottonwood, Coyote and Yellow Willow, and native seeding mixtures in disturbed upland areas. Increasing the native vegetation along the riparian

zone will effectively reduce sediment load into the San Rafael. While an entire re-vegetation effort might not be plausible, clump plantings and selective area reestablishment would result in eventual recruitment into other areas downstream and adjacent to the planted sections. Another section of the San Rafael River from Fullers Bottom to the Swinging Bridge has had all Russian olive trees removed. Furthermore, a bio-control beetle has been released in Southeastern Utah to help control the invasive Tamarisk tree. The beetle is now actively attacking the tamarisk trees in Emery County and especially along the San Rafael River. Revegetation of these areas is needed.

On Cottonwood Creek in Orangeville, Utah, the city has commenced stream restoration efforts. The city will remove invasive Russian olive and tamarisk from various sections owned by the city and provide ongoing removal as necessary. Native planting projects along these stretches of river would be effective in decreasing the amount of sediment entering the San Rafael River. Cottonwoods and willows will be reintroduced into the areas where the heavy invasive infestations have been removed.

Below Millsite Reservoir, on Ferron Creek, stream restoration will be vitally important. The area will be heavily disturbed in 2014 as a result of construction to bring the dam into compliance with current dam safety standards. Native plantings with cottonwood and willow would effectively reduce the potential from runoff at the disturbed site.

The BMPs to be utilized in these projects will include the following: Stream Habitat Improvement and Management (395), Tree and Shrub Establishment (612), Riparian Herbaceous Cover (390), Invasive Species/Noxious Weed Control (950), Brush Management (314), Seeding, and Re-vegetation (042).

6.3.3.6 Wetland Restoration and Enhancement

Wetlands are recognized as important features in the landscape that provide numerous beneficial services for people, fish, and wildlife. Some of these services, or functions, include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods. These beneficial services are the result of the inherent and unique natural characteristics of wetlands. Wetlands have important filtering capabilities for intercepting surface water runoff from higher dry land before the runoff reaches open water. As the runoff water passes through, the wetlands retain excess nutrients and some pollutants, and reduce sediment that would clog waterways and affect fish and amphibian egg development. Southeast of Huntington North Reservoir, near Huntington Creek, there is a section of land that will be used for wetland enhancement. Included in the 210 acre project will be weed management and the establishment of trees and shrubs.

A second location for wetland enhancement is in town of Lawrence, at a location directly on Huntington Creek. This 80 acre section of land will be an easement and permanently fenced off from livestock. Brush management will remove invasive woody biomass and intensive planting projects will increase the native species present on the property. Weed Management and control will reduce the reintroduction of invasive species. The Lawrence wetland enhancement project will increase water quality and wildlife habitat. In addition, there is a 40 acre wildlife mitigation easement that is adjacent to the project that is a result of the Huntington-Cleveland irrigation project, as well as 27 acres of wildlife habitat being maintained by Ferron Canal and Reservoir Company in the Ferron Creek drainage. Cottonwood Creek and Muddy Creek irrigation companies will do the same if pressurized irrigation systems are installed.

The BMPs to be utilized in this project will include some or all of the following: Wetland Enhancement (659), Brush Management (314), Invasive Species/Noxious Weed Control (950),

Seeding, and Re-vegetation (042), Tree and Shrub Establishment (612), Water & Sediment Control Basin (638).

6.3.4 Required Technical and Financial Assistance

Animal Feeding Operations: Nutrient management at animal feeding operations can be costly, but the desired nutrient and sediment reductions are realized immediately after implementation. Potential funding sources include: Environmental Quality Incentives Program (EQIP), landowner cost share, state revolving funds, Agriculture Resource Development Loan (ARDL), and EPA section 319 funds.

Gully Plugs, Sediment Control: Cost estimates for gully plugs are dependent on size and depth, and vary accordingly. The Ferron Ranger District has provided a range of estimates that could easily vary depending on material, labor, gully size, and depth. The estimated cost range for installation is $2,500 – $3,500 per gully plug installed. Potential funding sources include: EPA section 319, in-kind match, Emery Town, Forest Service Vegetation and Watershed funding, and Forest Service Range Betterment funding.

Rangeland Improvement: Factors including critical area seeding, piping and water developments, fencing, range treatments, brush management, and noxious weed control can vary costs drastically from site to site. However, with the inclusion of EPA section 319 funds, the cost share rates for allotment owners and private landowners decreases significantly, allowing an otherwise impossible project to become a reality. Potential funding sources include: Basin States Salinity, Grazing Improvement Program (GIP), Watershed Restoration Initiative (WRI), ARDL, and EPA section 319 funds.

Sprinkler Irrigation and Salinity Control: While Sprinkler system installation is costly it is effective at reducing TDS inputs by efficiently spreading water over the soil surface and decreasing the

amount of water needed to grow crops, effectively pushing salts back into the soil and decreasing salt runoff. Currently, the on farm sprinkler system costs approximately $57.26 per square foot. The BOR covers the off farm system, while the NRCS will can cost share with the landowner to an amount of $43.37 a square foot which is a little less than 70%. EPA section 319 funds could cover 60% of the landowners 30%. The inclusion of these funds would allow more farms to be converted to sprinkler irrigation thereby reducing the amount of salt and TDS entering the drainages. Potential Funding sources include; Bureau of Reclamation salinity funding, NRCS salinity funding, ARDL, and EPA section 319 funds.

Stream Restoration: The market for potted native plants can fluctuate. Typically the cost for planting projects in the San Rafael drainage have been around $2,500 per acre planted. This amount is not based on an entire acre of trees, rather an acre of stream bank is targeted and various smaller sections are densely planted, while other sections in the area are left untreated. This approach will be referred to as pod planting. Planting the native species into pods decreases the cost of planting projects and increases the amount of time it takes for a total habitat alteration. This approach has proven to be effective in areas along the Colorado River in Moab, Utah and along the Price River. Pod planting would be used as a revegetation approach along the San Rafael River and Cottonwood Creek. The total project cost is dependent on the amount of pods per acre and the number of acres that will be treated. The planting project below Millsite Reservoir would not be likely to use the pod method, but rather a more intensive planting procedure, thus increasing the cost to $4,000 per acre of land treatment. Unfortunately, the amount of disturbed stream acreage will not be known until the dam has been modified. Preliminary estimates are around two acres. Potential funding sources include: EPA section 319, Watershed Restoration Initiative (WRI), the State Revolving Loan Fund, and Utah Department of Natural Resources (DNR) for the Hatt Ranch Project.

Wetland Restoration: Wetland restoration is expensive due to the various associated costs (e.g. invasive woody removal, critical area seedings, plantings, native re-vegetation, and fencing). However, there is a high probability for various funding sources. Initial cost estimates for the 80 acre wetland restoration project on Huntington Creek is $300,000, while the 210 acre Lawrence project cost estimate is $400,000. Potential funding sources include Wetland Reserve Program (WRP), EQIP, Wildlife Habitat Improvement (WHIP), EPA section 319 funds, easement land value, ARDL, and landowner contributions.

6.3.5 Information and Education Plan

The information and education plan (I&E plan) described in this section is targeted not only to increase public awareness of various implementation projects, but also to increase public knowledge toward improving water quality throughout the San Rafael River drainage. The goals and objectives of the I&E plan include: public understanding of projects, residential outreach, school education program, irrigation water management, and range management.

The driving force of the education program is informing the public and helping them become more environmentally conscious. The goals and objectives of the I&E plan are as follows:

1. Public Understanding of Projects: The local San Rafael Conservation District will be used to evaluate and rank potential projects and enhance public understanding of the various water quality projects. In addition, public meetings will be used to increase public knowledge and awareness.

2. Residential Outreach: Develop a residential outreach program to educate homeowners on the BMP's for residential use of fertilizers, pesticides, used oil recycling and proper use of storm drains. Outreach products include, but are not limited to, pamphlets, brochures, radio and movie advertisements.

3. School Education Program: Use established educational programs to further the water quality education at various schools throughout the watershed.

Objective 1: Educate fourth graders using Stream Side Science (SSS). Within the San Rafael River watershed there are six elementary schools. SSS focuses on basic water quality education including: temperature, nitrate, turbidity, pH, dissolved oxygen, and macroinvertebrate water quality indicator species. The SSS program will be brought to each school and presented to the faculty in the attempt to set up a yearly water quality education day for the fourth graders at each school.

Objective 2: Educate ninth graders using the watershed education program (W.E. program). The W.E. program identifies watersheds, teaches students how to delineate a watershed and then, using a portable model, educates students on various nonpoint source and point source pollution routes throughout the watershed. The model also demonstrates how various BMP's can effectively reduce or eliminate the pollution. There are three middle schools in the watershed, the W.E. program will be presented to the faculty, in an attempt to set up permanent education days for each school.

Objective 3: Educate High School students using Advanced Stream Side Science and E. coli monitoring equipment. Using advanced components from SSS, and using state approved E. coli sampling equipment, students from the Future Farmers of America (FFA) classes will be educated in important water quality concepts. This program has already begun and will be expanded to reach all FFA classes.

Objective 4: Educate 4th graders from Carbon and Emery counties on soil erosion and watersheds by using a soil erosion trailer. This is done annually at the Forest Service Conservation Field Day.

4. Irrigation Water Management: Plan two (2) annual irrigation water management trainings per irrigation season to be held in the San Rafael area to promote improved water management with producers who have benefited from improved irrigation systems. This workshop is sponsored and conducted by the San Rafael, Green River, and Price River watershed conservation districts, Utah Association of Conservation Districts, and Utah State University Extension Service (both county agents).

5. Range Management: Plan one (1) Range Management training per funding cycle within the San Rafael River watershed to address best management practices associated with the proper management of grazing allotments and how to maximize water quality benefits with proper grazing techniques.

6. Tour and Fair Booth: The CWMA sponsors a tour and booth at the County Fair each year to help identify weed problems and implement weed control projects.

Potential funding sources for outreach, information and education include: EPA section 319, GIP (for range management courses), and Utah Watershed Coordinating Council (UWCC) mini-grants.

6.3.6 Implementation Schedule

Basin rotating funding for EPA section 319 funds becomes available to the West Colorado River area in 2015. The West Colorado River area includes the San Rafael River and Muddy Creek watersheds. In order to begin on the ground work as soon as possible in 2015, several items listed below must be completed in 2014. All project work must be completed by the end of 2016.

1. Section 106 Archeological studies: All federally funded projects must have a section 106 cultural resources evaluation performed before project work can begin. Funding must be secured for archeological studies. The State revolving fund and EPA section 319 funding can be used in small amounts during 2014 in order to pay for the cultural resource inventories. Another alternative is NRCS joint projects. With the wetland improvement project, and any other project that will use NRCS funds, the NRCS cultural resources can be completed by a trained para-archeologist (trained NRCS and Conservation District employee) under the supervisory umbrella of the NRCS State Archeologist. With either route, archeological studies can take several months to complete. In cases where projects are ready for implementation in 2015, the archeological study will be completed as early as possible.

2. Stream Alteration Section 404 Permits: These permits must be obtained several months prior to any stream restoration project. In the case of planting and revegetation projects, as long as no heavy equipment is used, the permit is not necessary. However, approval must still be obtained from the Utah Division of Water Rights. As with section 106, funding for Stream Alteration permits can be obtained prior to the funding year using the State Revolving fund or EPA section 319 grants, as well as funding from landowners. In cases where projects are ready for implementation in 2015, the Stream Alteration permit process should be completed as early as possible.

3. Encroachment Permits: Any area along a Utah Department of Transportation road or highway must have an encroachment permit. As many of the rivers in the San Rafael River watershed have highways adjacent to them, Encroachment permits are often needed. The permit includes a work plan, traffic plan, landowner agreement form, and contractor proof of insurance. These permits only last a month before extensions are

required. In this case, permits would be completed on an as needed basis, several weeks before the project.

4. Project Plans: Projects will be planned specifically, with funding amounts, landowner commitments and agreements, BMP installation practices, detailed plans of work, GIS project maps, CPA-52 requirements, district cooperative agreements, and a conservation plan.

Gully plugs will be completed at times necessary to avoid high runoff and spring runoff before the end of 2016. Project work during the drier summer months will decrease the potential for sediment runoff and enable the necessary timeframes for project work to be completed.

Range seedings will be completed in the spring or fall of 2015, stretching into 2016. All Range projects will be performed in the early spring or fall to avoid nesting avian species. In cases where project work will be completed near Sage Grouse habitat, fences will include wildlife markers, and projects will be planned in order to improve or avoid known nesting areas. All watering facilities will include wildlife escape engineering.

Sprinkler Irrigation and Salinity Control: The Cottonwood Creek and Muddy Creek Drainages will have the infrastructure for sprinkler systems installed in early 2015 after which landowners will be able to begin on-farm sprinkler projects.

Stream restoration projects involving revegetation practices will be completed in the spring or fall of 2015, stretching into 2016. Stream restoration work will be performed in the spring or fall to avoid nesting avian species of interest.

Wetland restoration projects will be performed in early spring or late fall to avoid the nesting period of avian species of interest and riparian and wetland wildlife. Planting projects have been successful in both spring and fall timeframes.

Pressurized irrigation projects have been on-going since 1997 in the watershed and will continue as scheduled.

Public understanding and outreach projects will be held on an ongoing and as needed basis. School education projects will be held according to the timetable of the school curriculum and in accordance with teacher desire and availability. Irrigation and water management courses will be held in April before the watering season begins and in October after the irrigation season is over. The range management course will be held on an as needed basis according to the availability of the interested parties.

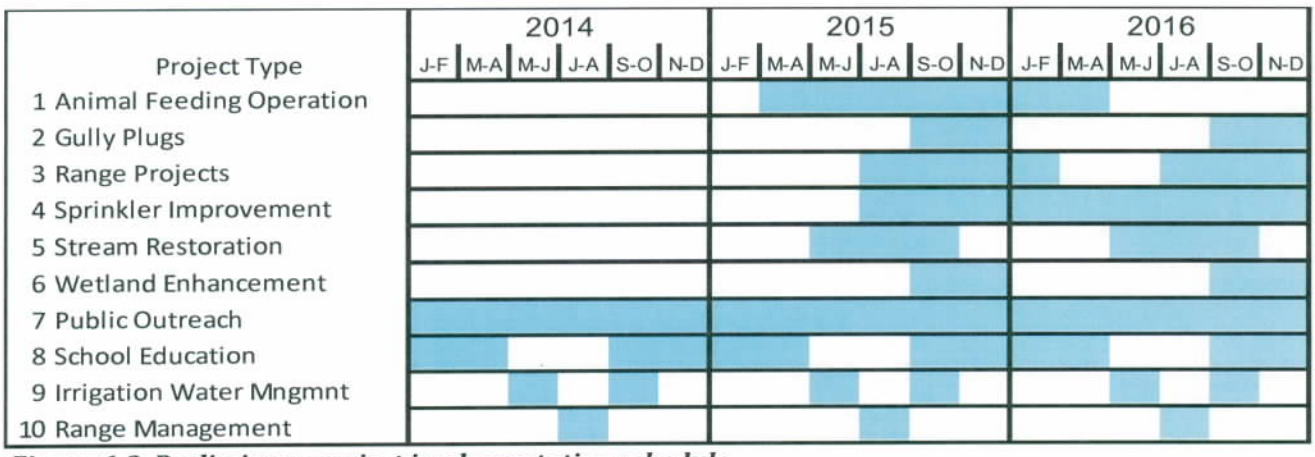

Figure 6-3, Preliminary project implementation schedule.

6.3.7 Milestones

The following measurable milestones will be used to determine whether the recommended BMPs are being implemented.

1. Identify specific project location or reach. This can be accomplished with help from local stakeholders, both agency and non-agency.
2. Establish a lead person for each project. This could be the local UACD watershed coordinator, the Division of Water Quality watershed coordinator or other agency personnel who will assume the responsibility of project manager. Contracts will likely be administered through the agency of the lead person.
3. Obtain written private landowner or agency consent depending on project location.
4. Apply for project funding to address identified work.
5. Develop a monitoring plan specific to each individual project, including explicit assignments so monitoring goals are met.
6. Complete identified project work and any required follow up reports (ex. EPA 319 final report).

6.3.8 Load Reduction Criteria

Implementation of the projects described in section 6.3.3 will result in improvements to water quality, but quantitative monitoring will be challenging. Although the primary pollutant of concern in the watershed is total dissolved solids, these projects will likely also reduce the loading of sediment, nutrients, and bacteria into the water. Methods that will be used to determine load reductions are as follows.

Animal Feeding Operations: The Utah Animal Feedlot Runoff Risk Index (UAFRRI) spreadsheet will be used to estimate load reductions from this project. The UAFRRI spreadsheet tool is used exclusively on animal feeding operations, and is effective at approximating reductions of nitrogen, phosphorus, sediment and BOD in feedlot scenarios where containment, slopes, vegetation and distance to water are a factor. Animal number, animal type, lot size, slope, days confined, distance

to water and surface type will be tallied onsite and entered into the model thus reducing variance and increasing the accuracy of the load reductions given by the model.

Sprinkler Irrigation and Salinity Control: Direct measurements using grab samples and data readers in the Ferron Creek Drainage after sprinkler implementation have shown a significant decrease in Total Dissolved Solids (TDS). Monthly water quality samples have been, and will continue to be, obtained by the Emery Water Conservancy District (EWCD). Their data as well as any additional samples by the Division of Water Quality targeting TDS concentrations will allow noticeable reductions to be observed and recorded.

Stream Restoration: For stream restoration projects, the EPA approved STEPL (spreadsheet tool for estimating pollutant load) model is effective for approximate decreases in nitrogen, phosphorus, sediment and biological oxygen demand (BOD). STEPL will be used to ascertain stream restoration effectiveness and approximate load reduction values. Soils data will be evaluated on a per-project basis, and the appropriate values will be added into the model. Slope information will be measured and averaged onsite. These factors will help reduce variance and allow for more accuracy in reduction reporting.

Rangeland Improvement and Gully Plugs: As with the stream restoration work, the STEPL model will be used to get approximate reductions.

Wetland Restoration: EPA's National Wetland Condition Assessment will be used to determine pre- and post-project condition of the two wetland areas targeted for enhancement. The amount of flow into and out of these areas is currently unknown, so no load reduction can be estimated at this point in time.

6.3.9 Monitoring

The Utah Division of Water Quality (UDWQ) in conjunction with local project sponsors will monitor the projects to ensure selected strategies are reducing pollutant loading. Effective monitoring may be quantitative (laboratory analysis of nutrient concentrations in water from specific sub-basins, or above and below project sites) or qualitative (visual observation), depending on the BMP implemented and the overall scope of the project. Although quantitative monitoring methods can document progress toward improved conditions, qualitative methods can also provide an effective measurement of implementation progress, especially for smaller scale stream restoration projects where direct impacts of pollutant reductions are minimal compared to the overall system. Other examples of effective qualitative monitoring that may be used for these projects include: photo-points, greenline transects, and relative documentation of turbidity levels. Although these methods do not provide quantitative information on the effectiveness of the projects, they do illustrate progress and can be combined with other monitoring efforts to show success of implementation activities.

Models are also an effective tool in determining approximate load reductions in situations where quantitative monitoring is unsuitable. Two examples of effective modeling tools that will be used are the Utah Animal Feedlot Runoff Risk Index (UAFRRI) spreadsheet and the EPA approved STEPL model, which were described previously in Section 6.3.8. Quantitative effectiveness monitoring is required to document actual progress toward improved water quality and will be used where appropriate. In stream monitoring is scheduled to occur periodically throughout the watershed by UDWQ and includes physical, chemical, and biological parameters. Intensive sampling of the Colorado River watershed, which includes the San Rafael River watershed, is scheduled from October 2012-October 2013 and will provide pre project data.

Section 7 – Managing Aquatic Wildlife to Avoid Future Conflict

7.1 Background

About the same time water quality became a critical state and national issue, other environmental concerns such as endangered species and the health of vital ecosystems also entered the spotlight. Just as water quality issues are a critical part of water resources planning and management, environmental issues are vital to successful future water resources management.

In 1973, the Endangered Species Act (ESA) became law. This law gives the U.S. Fish and Wildlife Service (USFWS) the power to recover and conserve all forms of plants and animals found to be threatened or in danger of extinction. The Utah Department of Natural Resources is currently engaged in cooperative efforts with local governments, private property owners and federal agencies to balance species protection with development of natural resources, including water. These efforts attempt to provide affected parties with protection against uncertainty, regulatory delays and the high cost of federal threatened or endangered species recovery programs.[1]

One such recovery program is the Upper Colorado River Endangered Fish Recovery Program. The aim of this program is to protect and recover four native Colorado River fish species that have become endangered due to human activities, while allowing for continued water development within the river system. Utah is a funding partner in this program. Strong support for this program exists from both the environmental and water communities, as it protects the fish and the interests

[1] Utah Division of Water Resources, *Utah's Water Resources—Planning for the Future*, (Dept. of Natural Resources: Salt Lake City, 2001), 55-56.

of water users. The outlook for the success is promising; the number of Colorado pikeminnow and razorback suckers found to inhabit the river has improved to the point where downlisting may be possible in the near future. However, the other two species, humback chub and bonytail have shown little response to the recovery efforts thus far.

In recent years, species conservation advocates have filed petitions to protect several other native fish species in the Colorado River system—including four native species found in portions of the San Rafael River and Muddy Creek watersheds. USFWS, in conjunction with the Utah Division of Wildlife Resources (DWR) and wildlife agencies from other states, is currently studying the status of these species to determine whether or not they warrant listing. If these species become listed, they will warrant protection under the ESA, and the impacts to current land owners and water users could be significant.

In order to avoid listing, all the Colorado River Basin states have entered into a conservation agreement to take necessary measures to preserve the species within their own states.[2] DWR is studying what needs to be done to ensure these sensitive species can maintain viable populations in Utah and concurrently working to improve critical habitat, especially along the San Rafael River. The following sections discuss these efforts.

7.2 Goals and Objectives

The goal of this section is to highlight the importance of preserving sensitive fish species within the San Rafael River and Muddy Creek watersheds. To accomplish this, this section provides a summary of the existing data and knowledge of the affected species and the habitat that is critical to their survival. This section also summarizes the habitat improvement efforts that have been

[2] See Utah Division of Wildlife Resources, *Range-wide Conservation Agreement and Strategy for Roundtail Chub (Gila robusta), Bluehead Sucker (Catostomus discobolus), Flannelmouth Sucker (Catostomus latipinnis)*, Pub. No. 06-18, (Salt Lake City, Utah: 2006). Prepared for the Colorado River Fish and Wildlife Council.

implemented and discusses future improvement efforts and other needs. It is hoped that this section will provide a basic framework for future restoration efforts and help lay a strong foundation of cooperation with the land owners and water users within the affected watersheds.

7.3 Endangered Species Use of the San Rafael River

Three of the four endangered species in the Upper Colorado River Basin mentioned previously are found in the San Rafael River. All life stages of these species are believed to utilize the river, however, only spring time movement of these fish into the San Rafael has been documented. Between 2008 and 2011 USU operated two solar-powered, full-duplex (134kHz), PIT-tag antennas capable of passively detecting passage of tagged fish. The first antenna was installed at Chaffin Ranch, located approximately 1-1/4 mile upstream from the confluence with the Green River. Later, a second antenna was installed at Hatts Ranch approximately 39 miles upstream from the confluence with the Green River (Budy et al).

These PIT-tag antennas detected significant movement of endangered fishes of the Upper Colorado River Basin, including Colorado pikeminnow, razorback sucker, and bonytail. Many of the endangered individuals were initially tagged or released (from propagation facilities) in large river systems such as the Green, White, and Colorado Rivers, and were subsequently detected in the San Rafael River. When combining flannelmouth sucker movement with the endangered species of the Colorado River Basin, USU researchers found that both upstream and downstream movement peaked in May and early June, coinciding with the historic and contemporary spring runoff. The endangered fish of the Colorado River Basin typically spend most of their lives in large rivers (e.g., Colorado and Green rivers). However these fish use smaller tributaries, including the San Rafael River, for spawning and rearing. Spring time detections of Colorado pikeminnow at both the

Chaffin and Hatts Ranch antennas suggests that this species is still attempting to use the San Rafael as spawning habitat (Budy et al).

7.4 Species of Concern

There are four native and endemic species of concern that inhabit portions of the San Rafael River and Muddy Creek watersheds: the flannelmouth sucker, roundtail chub, bluehead sucker, and Colorado River cutthroat trout. The first three species primarily inhabit the lower reaches of the San Rafael River (only two of which are found in Muddy Creek), while the Colorado River cutthroat trout inhabits only the upper portions of select watersheds in the San Rafael River drainage. A brief summary of the efforts to conserve these four species is provided in this section.

7.4.1 The Three Species

The flannelmouth sucker, roundtail chub, and bluehead sucker, hereafter referred to **as the 'three species,'** are generally managed as a unit because they have several common characteristics and share similar habitats. All three species have

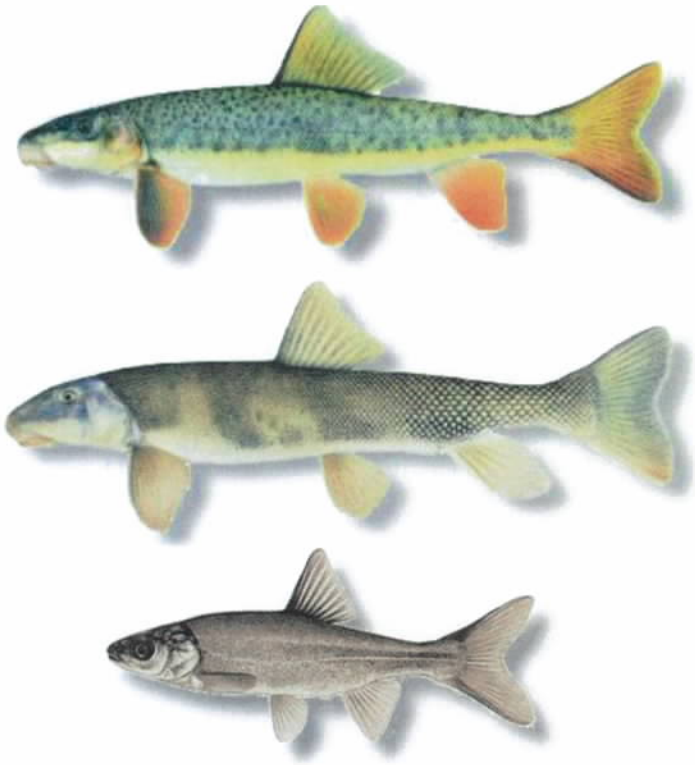

Figure 7-1, Artistic rendering of flannelmouth sucker, bluehead sucker, and roundtail chub.

declined dramatically in both distribution and abundance throughout the Colorado River Basin, and are believed to currently occupy only about 50% of their historic range. The main reasons for the decline in population are habitat degradation, fragmentation, and interactions with non-native fish.[3]

Habitat for the three species has been degraded primarily by human activities; chief among these is the construction of on-stream impoundments and subsequent storage and diversion of water for irrigation. These hydrologic modifications have greatly altered the natural flow of tributary streams from a dynamic regime with large annual changes in flow and temperature to one that is mostly static.

Prior to water alterations (dams, irrigation projects) the hydrograph was characterized by large snow melt driven spring flood events and fall monsoonal events that carry high sediment loads and shaped new channels. The formation of complex habitat is dependent on these flood events.[4] Within this relatively small basin, there are many water impoundments and diversions that impact the natural flow of the San Rafael River. As a result, complex habitat is not formed and the river is either dewatered or reduced to a barely wetted channel during portions of the year, particularly the lowermost 40 miles. The river ecosystem has been impacted throughout the years from the effects of water withdrawals, the invasion of non-native species such as tamarisk (*Tamarix ramosisima*), and other anthropogenic perturbations. The extensive invasion of tamarisk has resulted in the replacement of much of the native vegetation along the riparian zone, which is contributing to the dewatering problem on the river. In addition, tamarisk trap sediment that can result in a narrow and deep river channel, reducing the rivers capacity to carry flood waters.[5] The bank stabilizing

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[3] Budy et. al., *Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah*, (Utah State University, Logan, Utah: 2009), vii.
[4] Fortney, S. T., J. Schmidt, D. J. Dean, *Establishing the geomorphic context for wetland and riverine restoration of the San Rafael River*, (Intermountain Center for River Rehabilitation and Restoration Department of Watershed Sciences Utah State University Logan, Utah: 2011).
[5] Fortney et. al., 2011.

effects of the tamarisk prevent floodplain access and limit the creation of complex habitat, such as split channels, backwaters, pools, and riffles.

Alteration of the natural hydrograph has also impacted the spawning behavior of native fish species. The three species migrate for spawning on the ascending limb of the hydrograph; the endangered fishes of the Colorado River system spawn on the descending limb. Therefore, reductions in the spring peak due to upstream storage remove the cue for spawning activity.

Ironically, one reason the three species still inhabit the San Rafael River is the existence of the Hatt Ranch diversion dam. This dam is a low-head structure built atop a natural elevation drop in the river approximately 37 miles upstream of its confluence with the Green River. The dam forms a barrier preventing both endangered fish species as well as predatory and competitive non-native fish species present in the Colorado River system from migrating upstream into the watershed. Although this barrier has helped preserve the three species within the upper reaches of San Rafael River, it has also contributed to fragmentation of the fish population and ultimately its decline as it allows fish to make their way downstream into the Green River, but not migrate back up the river during spawning season. Thus, the three species maintain two separate source populations, one in the Green River and another in the San Rafael River above Hatt Diversion.[6]

The three species were first identified for potential listing in the mid-1980s and early-1990s. However, only the roundtail chub in the lower Colorado River Basin was petitioned for listing as threatened or endangered under the ESA in 2005. A 90-day finding issued by the USFWS found there was substantial reason to list the species, but later in 2006 issued a 12-month finding that said listing was not warranted.[7] In July of 2009, USFWS issued another 12-month finding that said listing was warranted, but the species was precluded from listing "by higher priority actions to

[6] Budy et. al., vii.
[7] For more information, see USFWS's species profile: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E02Z

amend the Lists of Endangered and Threatened Wildlife and Plants."[8] Federal agencies managing lands that provide habitat for the three species have designated them as sensitive species, and each state within these areas has given them special management designation. A multi-agency agreement also provides oversight for management of the three species. Recently, wildlife officials in Utah, Wyoming, and Colorado have received GRAMA requests pertaining to all three species and many officials believe this means a formal petition to list one or more of them under the ESA is imminent.

7.4.2 Colorado River Cutthroat Trout

Historically, Colorado River cutthroat trout inhabited portions of the Colorado River drainage in Wyoming, Colorado, Utah, Arizona, and New Mexico, probably including portions of larger streams, such as the Green, Yampa, White, Colorado, and San Juan rivers. However, habitat alteration and widespread introductions of non-native salmonids over the last century have served to limit current distributions to isolated headwater streams and lakes, representing approximately only about 14% of its historic range. Most remaining populations have been found in streams with a gradient above 4%, average daily flows below 30 cfs, and elevations above 7,500 ft.[9,10] Within the study area, a pure strain of Colorado River cutthroat trout is found in Scad Valley

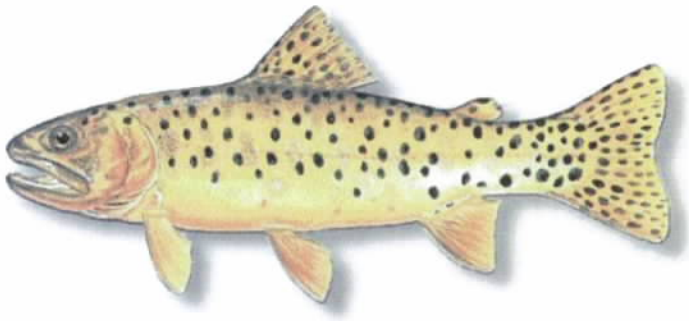

Figure 7-2, Artistic rendering of Colorado River cutthroat trout.

[8] Federal Register / Vol. 74, No. 128 / Tuesday, July 7, 2009 / Proposed Rules, p. 32352. Retrieved from the Gov. Printing Office's website: http://www.gpo.gov/fdsys/pkg/FR-2009-07-07/pdf/E9-15828.pdf#page=1 [October 13, 2011].

[9] Colorado River Cutthroat Trout Conservation Team. *Conservation agreement for Colorado River cutthroat trout (Oncorhynchus clarkii pleuriticus) in the States of Colorado, Utah, and Wyoming.* (Colorado Division of Wildlife, Fort Collins: 2006), 2.

Creek, a tributary to the Left Fork of Huntington Creek and Duck Fork Reservoir in the Ferron Creek drainage.

In the past, habitat alteration from mining, agriculture, and water development contributed to the extirpation or reduction of large numbers of Colorado River cutthroat trout. However, introductions and invasions of non-native trout are likely responsible for recent declines and represent the major impediment to restoration of this fish. Many populations remain vulnerable to this threat because barriers to ongoing invasions are absent or because existing barriers are ineffective at preventing non-native fish from invading the population. The barriers themselves also pose a threat because most populations are restricted to short, headwater stream segments. The lack of connectivity to other populations makes them vulnerable to extirpation from fire, post-fire debris torrents, or floods, and loss of genetic variability and the potential for evolving in response to changing environmental conditions.[11]

Colorado River cutthroat trout were first petitioned for listing as threatened or endangered under the ESA in December 1999, and the U.S. Fish and Wildlife Service recently issued a 12-month finding that it did not warrant listing. The U.S. Forest Service in Regions 2 and 4 has designated the Colorado River cutthroat trout as a sensitive species; the Bureau of Land Management has accorded it a similar status; and Colorado, Utah, and Wyoming have given it a special management designation. A multi-agency agreement also provides oversight for management of this subspecies.[12]

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[10] Young, Michael K., *Colorado River cutthroat trout: a technical conservation assessment.* [Online]. Gen. Tech. Rep. RMRS-GTR-207-WWW. (USDA Forest Service, Rocky Mountain Station, Fort Collins, CO: 2008). Available at: http://www.fs.fed.us/rm/pubs/rmrs_GTR-207-WWW.pdf [March 2008].
[11] Ibid, i.
[12] Ibid.

7.5 Existing Wildlife Management and Habitat Improvement Efforts

DWR is engaged in numerous wildlife conservation activities throughout the San Rafael River and Muddy Creek watersheds. For purposes of this report, only the activities pertinent to the conservation of the sensitive fish species discussed previously are addressed in this section.

7.5.1 Three Species Restoration Efforts

San Rafael River at Fuller Bottom.

In 1994, PacifiCorp (formerly Utah Power and Light Co.) donated several properties located along the San Rafael River and their accompanying water rights and grazing permits to DWR.[13] These properties are located at or near Hambrick Bottom, Fuller Bottom, Hatt Ranch, Frenchmans Wash, and Chaffin Ranch as shown in Figure 7-3. The transfer agreement between PacifiCorp and DWR requires DWR to hold title to the property in perpetuity and to maintain the property water rights to avoid forfeiture or abandonment. The agreement also requires DWR not to demand PacifiCorp limit use of, or abstain from using, or release from storage, water it owns or controls for any reason, including to improve the quality or mitigate the chemical or biological condition of the water making up the property water rights.[14] In addition to these requirements, the agreement also states that DWR shall not initiate, prosecute, maintain or voluntarily aid any

[13] Utah Division of Wildlife Resources, *Upper San Rafael River Wildlife Management Area Habitat Management Plan*, (Dept. of Natural Resources, Salt Lake City: 2011), 1.

[14] For more details, see the "Agreement" between the Utah Department of Natural Resources, Utah Division of Wildlife Resources, and PacifiCorp, dated May 3, 1994.

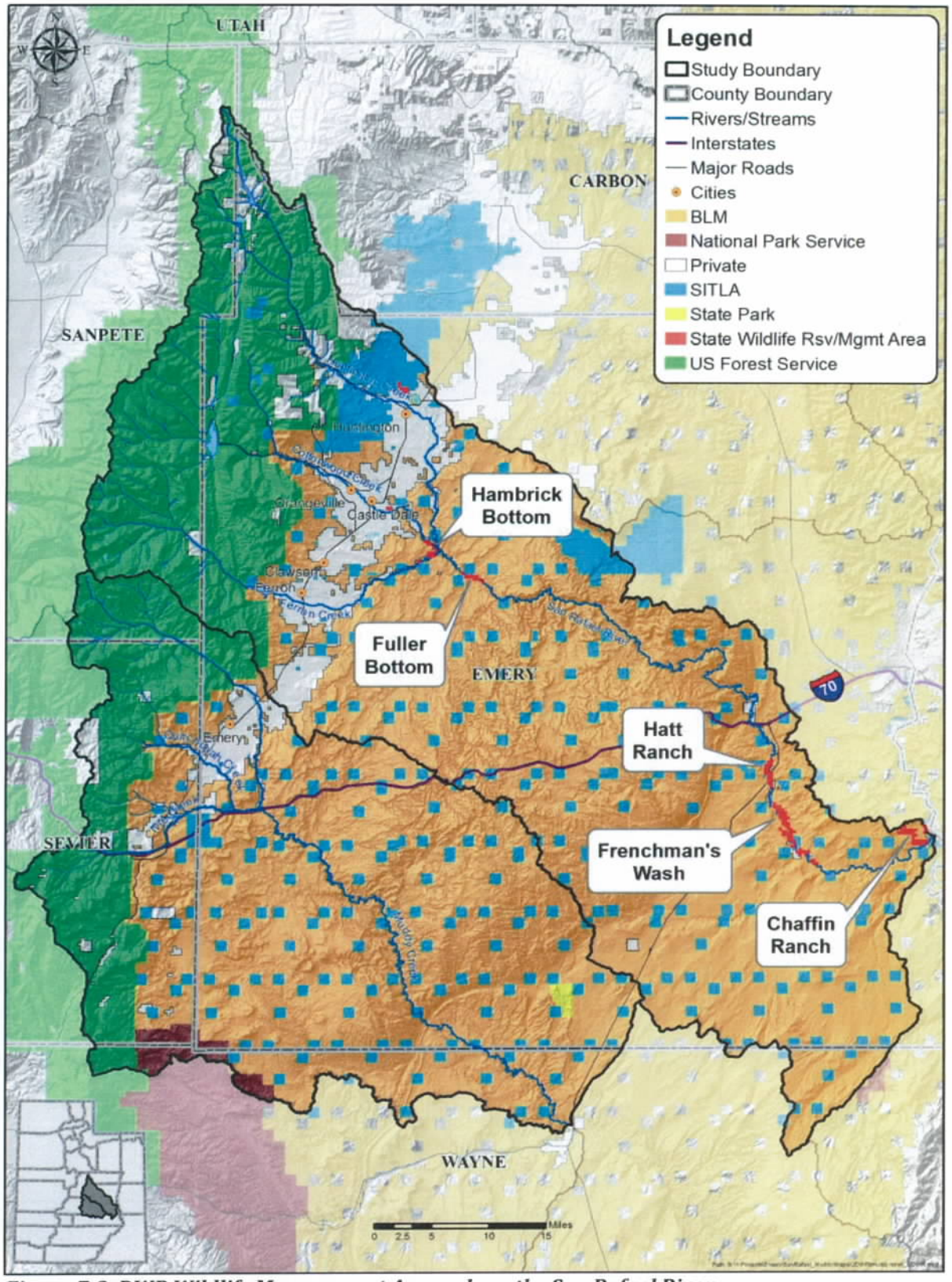


Figure 7-3, DWR Wildlife Management Areas along the San Rafael River.

action against PacifiCorp claiming impairment of the water quality or quantity associated with these water rights. A similar agreement is also in place between the three upstream irrigation companies and DWR.

Because of their proximity to the San Rafael River, and the diversity of wildlife and habitat that exists at these locations, the properties donated by PacifiCorp have subsequently become the focal point of DWR's efforts to improve habitat for the three species in the San Rafael River. The following sections discuss these efforts.

7.5.1.1 Upper San Rafael River Wildlife Management Area

The Upper San Rafael River Wildlife Management Area (WMA) includes the Hambrick Bottom and Fuller Bottom properties located west of the San Rafael Swell. The Hambrick Bottom property includes 485 acres located near the point where Huntington Creek, Cottonwood Creek, and Ferron Creek converge forming the San Rafael River, approximately 4-1/2 miles east of Castle Dale. The Fuller Bottom property includes 454 acres located another 2-1/2 miles downstream, just west of where the river enters San Rafael Swell.[15]

DWR has converted most of the water rights associated with the two properties, which were originally approved for irrigation of up to 331 acres, to instream flow water rights.[16] These include two certified rights on Ferron and Cottonwood creeks at Hambrick Bottom for a total flow of 1.973 cfs and two water rights at Fuller Bottom for an additional flow of 5.0 cfs. The Hambrick Bottom water rights have priority dates of 1973, while the Fuller Bottom rights have priority dates of 1959. The conversion of these water rights to instream flows means that "the water will be allowed to

[15] Ibid, 1.

[16] DWR and the Div. of State Parks are the only entities in Utah allowed to hold instream flow water rights.

remain in the San Rafael River where it will benefit fish and wildlife without jeopardizing the water rights."[17]

In addition to the river flow water rights, Utah Power & Light (UP&L) filed applications with the State Engineer to use groundwater at Fuller Bottom to provide emergency cooling water for the Hunter Power Plant. UP&L subsequently drilled three test wells and three observation wells. One of the test wells produced an artesian flow of 20 gpm with the capability to produce a sustained 100 gpm if pumped. While none of these groundwater water rights were ultimately certified and put to use, DWR could potentially install the necessary appurtenances and put them to use in the future.[18]

The Upper San Rafael River WMA provides valuable habitat for the three fish species. It is also potential habitat for a number of other "sensitive" or federally listed species including: Yellow-billed Cuckoo, Southwestern Willow Flycatcher, Mexican Spotted Owl, Peregrine Falcon, Northern River Otter, and perhaps other reptiles, amphibians, or bats.[19]

Aquatic habitat conditions in the Upper San Rafael River WMA are directly tied to flows in Cottonwood, Ferron, and Huntington creeks. Before settlement, these streams had high spring runoff that peaked for a few weeks in late May or early June. This, combined with late summer monsoonal storms that produced periodic flood events of a shorter duration, created a diversity of aquatic habitat ideal for the endemic fish species. Since settlement, spring season flows have been greatly diminished as they have been largely diverted into reservoirs for storage for use later in the irrigation season. However, due to irrigation throughout the summer, flows in the river have been sustained for a much longer period than normal. Settlement has had much less of an impact on

[17] Utah Division of Wildlife Resources, 2011, 6.
[18] Ibid.
[19] Ibid, 7.

Tamarisk removal and burning near Hatt Ranch. (Photos courtesy of Utah Division of Wildlife Resources.)

flows produced by monsoonal storms, which continue to provide important but less substantial benefits to aquatic habitat.[20]

Fish population surveys show that the aquatic habitat at the Upper San Rafael River WMA is important habitat for the three species. DWR's habitat management plan for this WMA emphasizes conservation and improvement of habitat for these species.

7.5.1.2 Hatt Ranch, Frenchman Wash, and Chaffin Ranch

The degraded river channel resulting from water withdrawals and tamarisk invasion is most noticeable in the river below the Hatt Ranch Diversion. This section of the river is a sink for the three species,[21] meaning that fewer fish are resident in this section of river than enter from either the upstream or Green River source populations. Creating more complex in stream habitat is the goal of a cooperative project begun in 2008 by the DWR and the Natural Resource Conservation Service, with additional funding from the Utah Watershed Restoration Initiative. Thus far, this project has removed approximately 1,000 acres of tamarisk along a 15 mile stretch of river bordering the three DWR properties in the lower river basin, Hatt Ranch, Frenchmen's Wash and

[20] Ibid, 8-9.

[21] Budy, P., Bottcher J., Thiede G. P., *Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah*, USGS Utah Cooperative Fish and Wildlife Research Unit, (Department of Watershed Sciences Utah State University, Logan, Utah: 2010), 84322-5210.

View of habitat improvements at Hatt Ranch. While Tamarisk has been removed and the area reseeded west of the San Rafael River (left), Tamarisk has not been removed to the east (right), providing a vivid image of the improvements that have been achieved so far. (Photos by Scott McGettigan.)

Chaffin Ranch. Projects to re-establish native vegetation within the treatment areas are ongoing. Thus far, 534 acres have been re-seeded.

Tamarisk removal on the DWR properties in the lower basin has resulted in a mosaic of treated areas interspersed with untreated sections managed by the Bureau of Land Management. This mosaic provides the opportunity for studying the effects of large scale tamarisk removal on stream morphology. Impacts of tamarisk removal were aided in 2011 with an unusually high snowpack and subsequent runoff. On the ground surveys in 2011 documented some impacts, and an aerial survey to assess changes in the entire lower basin was completed in the winter of 2011-2012. It is believed that this is the first time that the effects of tamarisk removal on channel morphology have been investigated at this scale.

7.5.2 Colorado River Cutthroat Trout Recovery Efforts[22]

DWR is presently working towards reintroduction of the Colorado River cutthroat trout into the Ferron Creek drainage above Millsite Reservoir. In the fall of 2011, DWR treated Ferron Reservoir with rotenone to remove all fish inhabiting the reservoir to remove potential hybridizing or competing species. The treatment was repeated in June 2012, and Colorado River cutthroat trout, sterile rainbow trout, and sterile brook trout were restocked in July. The streams below the

[22] Paul Birdsey, personal communication on October 13, 2011. Updated by Justin Hart, September 10, 2012.

reservoir all the way to just a few miles of Ferron Creek above Millsite Reservoir will eventually be treated with chemical to remove all non-native species and restocked with native Colorado River cutthroat trout to aid in the range wide restoration efforts.

Ferron Creek was chosen as the site to establish a sustainable population because it has 47 miles of contiguous and interconnected streams that will help ensure that the population won't be extirpated due to some catastrophic natural or man-caused event such as a wildfire, etc., and there is only one land owner, the U.S. Forest Service. As part of the recovery efforts, DWR will need to construct a fish barrier of some sort on Ferron Creek above Millsite Reservoir to prevent the migration of non-native species that will remain in the reservoir. DWR has expressed a willingness to partner with water users to identify a site for the barrier that may also be able to benefit water users.

7.6 Additional Needs/Recommendations

In addition to this study, which will provide stakeholders in the San Rafael River and Muddy Creek watersheds with valuable new modeling and water management tools, two other studies are underway to answer other important questions within the watershed. These include a study of the minimum flows required in the lower San Rafael to sustain the three species and a reach gain/loss study that will identify what affect upstream water releases will have on lower San Rafael River flows. Funding for these studies came from a Community Impact Board grant as well as cash contributions from Emery County, U.S. Bureau of Land Management, Emery Water Conservancy District, PacifiCorp, and DWR.

Once all studies are completed, water and wildlife managers hope to have all the tools necessary to better understand and manage the river system to provide the maximum benefits to wildlife as well

as water users. A brief summary of the purpose of these studies is included in the following sections.

7.6.1 Minimum Flow Requirements for the San Rafael River

This study began in the summer of 2011 and is being conducted by researchers at Utah State University. The purpose of the study is to describe the relationship between river flow and available habitat of the San Rafael River from its exit out of the lower Black Box all the way to the confluence with the Green River. Once this relationship is established, the amount of "useable habitat" that will be available for each of the three species at various river flows will be available and will be used to help determine what minimum flows would be required to provide adequate habitat for all life stages of the three species. The life stages to be considered include spawning, early rearing, juvenile and adult and the suitability of habitat at various flows will be based largely on substrate, depth, current velocity, and cover availability.

The study was scheduled to be completed by June 2012. However, due to the lack of high flows , required measurements were not obtainable. Thus, the completion of this study has been delayed until the full range of required measurements are obtained.

7.6.2 Lower San Rafael Reach Gain/Loss Study

This study began in the summer of 2011 and was conducted by researchers at Utah State University. The purpose of the study was to establish the flow gains and/or losses throughout the lower San Rafael River from Interstate 70 to the confluence with the Green River. This was accomplished by placing discharge transects every few miles across the river and collecting flow data monthly from August to November, 2011. A basic understanding of the gains and losses through this section of the river will help stakeholders better estimate how much water would need

to be released upstream to provide adequate flows during critical periods in the lower San Rafael River.

The study was completed in May 2012, but the results were not available to the authors of this report prior to publication. Once the results become available, a copy of the study can be obtained from the Emery Water Conservancy District.

UTAH DIVISION OF WATER RESOURCES

San Rafael River and Muddy Creek Simulations

RiverWare Model Design and Approach

Scott McGettigan

October 2012

This document outlines the steps taken to create the San Rafael River, and Muddy Creek RiverWare models. It contains specifics on where data and information was obtained, and how it was used to construct the models in RiverWare software. This report also briefly covers some basic results from simulations.

Table of Contents

Project Introduction 5

Area Description 5

System Description 6

San Rafael 6

Huntington Creek 6

Cottonwood Creek 6

Ferron Creek 6

Muddy Creek 6

Water Supply Analysis 7

Stream Gages 7

Correlations 8

Huntington Creek Synthetic Stream-flow Construction 9

Muddy Creek Synthetic Stream-flow Construction 12

San Pitch Diversions 12

Water Users 13

Irrigation Companies 13

HCIC 14

CCCIC 14

FCRC 15

MCIC 16

Power Company 16

Huntington Plant 16

Hunter Plant 17

Land Use and Irrigation Demand Analysis 18

Land Use Analysis 18

Irrigation Demand 20

Water Rights and Operational Practices 21

Huntington Creek 21

Cottonwood Creek 22

Ferron Creek 23

Muddy Creek 23

Hunter Plant 23
RiverWare Development 24
RiverWare Description 24
Framework Construction 25
Basic RiverWare Concepts 26
Object Descriptions and Inputs 27
Model Rules 29
Basic RPL Concepts 29
Muddy Creek 30
San Rafael Rules 30
Modeling and Results 33
Calibration and Initial Conditions 33
River Commissioner Reports 33
Historical Stream-flow Records 34
Historical Storage Records 35
Reservoir Scenarios 35
Raise Rolfson Reservoir 36
Raise Miller Flat Reservoir 37
Rock Canyon Creek Reservoir 38
Raise Spinners Reservoir 40
Emery – New On-stream Reservoir 42
Conclusion and Recommendations 43
Appendix 44
Summary Tables and Charts of Model Results Under Existing Conditions 44
Monthly Stream-gage Records and Correlation Summaries 46
Streamstats Output 51
San Rafael Model Object Reports 63
Cleveland Reservoir 63
Electric Lake 63
Huntington North Reservoir 65
Huntington Reservoir 66
Joe's Valley Reservoir 67

Miller Flat Reservoir 68
Millsite Reservoir 70
Rock Creek Reservoir (Potential Reservoir) 70
Rolfson Reservoir 71
CCCIC Data 73
Electric Lake Data 73
FCRC Data 74
HCIC Diversion Data 74
HCIC Res Data 75
Hunter Plant Data 75
Huntington North Data 76
Huntington Plan Data 77
Joe's Valley Data 77
Lower Canal Data 77
Millsite Data 77
Model Data 78
Paradise Ditch Data 78
Muddy Creek Object Reports 78
Emery Reservoir 78
Henningsons Reservoir 80
Julius Flat Reservoir 81
Spinners Reservoir 83
MCIC Data 84
Reservoir Data 85
Water Rights Priority Schedules 86
Hunter Plant Demand (Courtesy of PacifiCorp Hunter Plant) 90
San Rafael River Model Rules 95
Muddy Creek Model Rules 102
Additional Appendix Items 103

Project Introduction

The Utah Division of Water Resources (DWRe) was commissioned by the Emery County Public Lands Council and Water Resources Subcommittee to provide a study, funded by Natural Resources Conservation Service (NRCS), of the San Rafael River and Muddy Creek watersheds. This study was to involve, among other things, an analysis of the water supply for agricultural purposes, power facilities, and wildlife interests within the watersheds. The primary purpose in creating these models was to provide a tool for simulating scenarios of new reservoirs and or management practices that could enhance the use of water within the watersheds.

Area Description

The San Rafael River and Muddy Creek watersheds are located adjacent to each other in the Northwest corner of the West Colorado River Basin. Most of the water originates in the mountains of the Wasatch Plateau in the Western most part of the watersheds. This water typically accumulates as snow during the winter and comes in the form of runoff in the spring and early summer. The Eastern area of the watersheds is the lowlands were all streams make their way to eventually join with the Colorado River. A map of both the San Rafael River and Muddy Creek can be found in Figure 1.

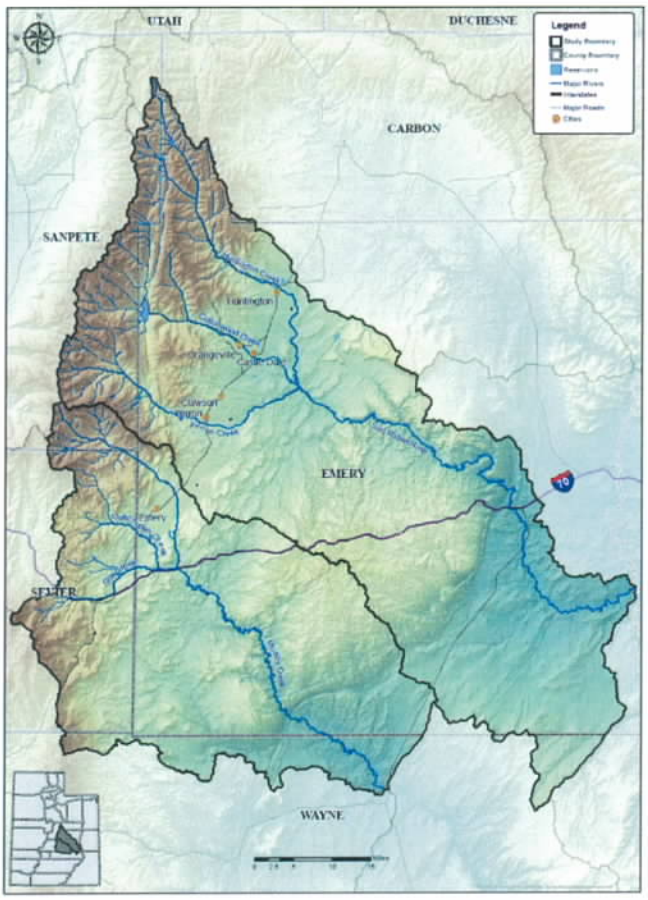


Figure 1 - San Rafael River Base Map

System Description

San Rafael

The San Rafael River flows through the heart of the watershed, and is tributary to the Green River. There are three major tributaries that feed the San Rafael River, and all converge at nearly the same location. These tributaries are Huntington Creek, Cottonwood Creek, and Ferron Creek. Each of these systems will be discussed individually.

Huntington Creek

Huntington Creek is the Northern-most stream and is the primary source of water for irrigation in and around the towns of Elmo, Cleveland, Huntington, and Lawrence. Water consumed for power production at PacifiCorp's Huntington Plant also comes from this stream.

The headwaters for the Huntington Creek originate at two stems high in Huntington Canyon, which are referred to as the Left Hand Fork (LHF), and the Right Hand Fork (RHF), the Right Hand Fork being the most Northerly of the two. Near the tops of both these stems are reservoirs that capture a portion of the runoff produced in the individual watersheds. The LHF has four reservoirs that are owned and operated by the Huntington Cleveland Irrigation Company (HCIC), while the RHF has one reservoir which is owned and operated by PacifiCorp.

Cottonwood Creek

The next major stream South of Huntington Creek is Cottonwood Creek. The bulk of water that flows in Cottonwood Creek comes from a tributary called Seely Creek. The Seely Creek drainage is home to the United States Bureau of Reclamation's (USBR) Joe's Valley Reservoir. Joe's Valley is the only notable reservoir currently in this particular drainage. The greater percentage of water use from Cottonwood Creek drainage is down in the valley communities, Orangeville and Castledale, but there is a small percentage used up-stream from Joe's Valley Reservoir. Cottonwood Creek Consolidated Irrigation Company (CCCIC) is the major irrigation company that delivers water to users in this area.

Ferron Creek

The last major stream that is tributary to the San Rafael River is Ferron Creek, and is South of Cottonwood Creek. Millsite Reservoir is the largest in the Ferron drainage and is near the bottom of the drainage. There are also two smaller reservoirs higher in the drainage; Duck and Ferron Reservoirs.

The three water users on the Ferron Creek drainage are PacifiCorp's Hunter Plant, Ferron Canal and Reservoir Company (FCRC), and Paradise Ditch. Millsite Reservoir is owned and operated by FCRC, and serves FCRC and PacifiCorp. The towns of Ferron, Molen, and Clawson are where the agricultural use from this stream occurs.

Muddy Creek

The Muddy Creek watershed is smaller by comparison to the San Rafael. This drainage is the next in line just South of Ferron Creek. This creek does not feed into the Green River, but is tributary to the Dirty Devil River, which is tributary to the Colorado River. There are currently three active reservoirs in the

Muddy Creek drainage. All three reservoirs are owned and operated by the Muddy Creek Irrigation Company (MCIC).

Water Supply Analysis

Stream Gages

In the San Rafael and Muddy Creek watersheds there are a number of United States Geologic Survey (USGS) daily stream-flow gages. A map of these the stream-gages can be seen in Figure 2. Most of these gages have not been active for long durations, but there is a small number that cover long enough periods that they proved useful in water supply analysis. Table 1 shows details of these stream-gages.

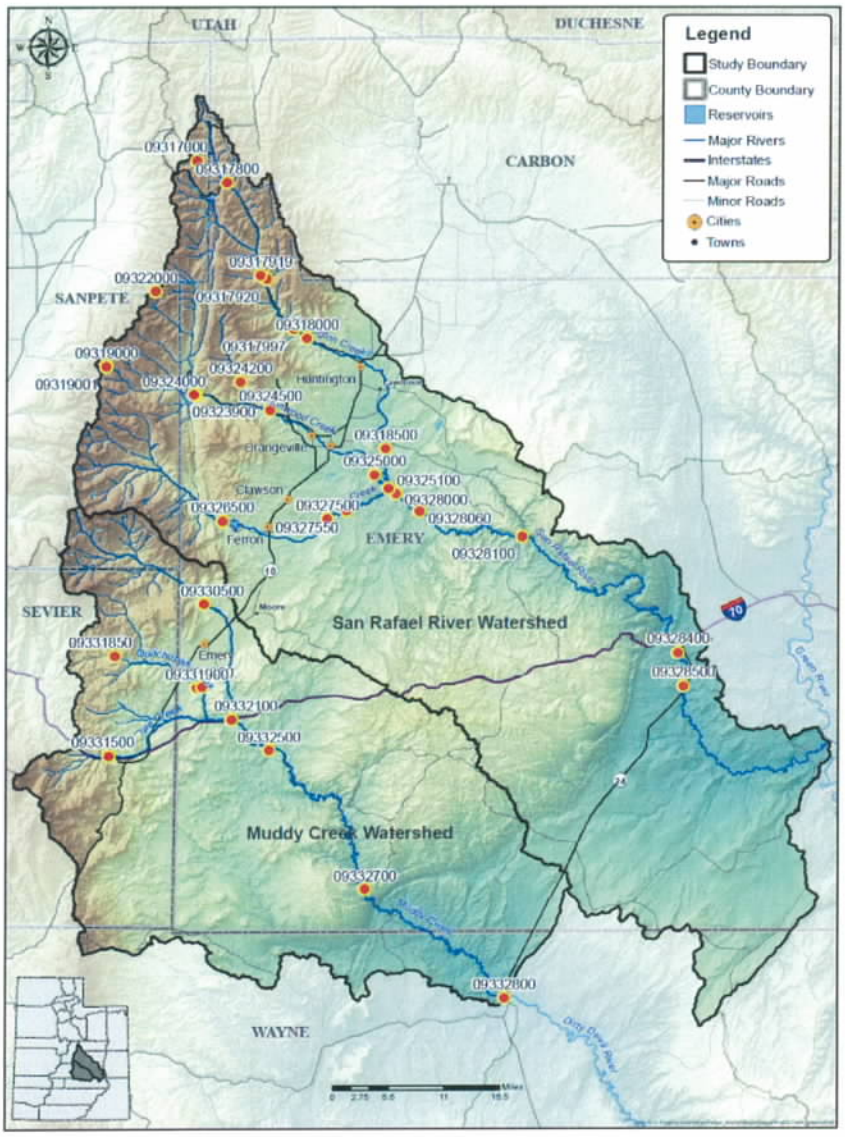


Figure 2 - Stream-gages in San Rafael and Muddy Creek Watersheds

Table 1 - Selected Stream-gages from San Rafael River and Muddy Creek Drainages

Gage Name	Gage No.	Years
Ferron Creek Near Ferron UT	09326500	1911-1922, 1947-Present
Huntington Cree Near Huntington UT	09318000	1909-1974, 1976-1979
Muddy Creek Near Emery UT	09330500	1910-1915, 1949-Present

All the stream-gages that have been kept on Cottonwood Creek are below Joe's Valley Reservoir. To avoid the effects of reservoir operation on the gages it was necessary to use the USBR data on reservoir inflow, which covers the period 1989-Present. The three stream-gages in Table 1, along with USBR data on Joe's Valley, were the basis for the water supply analysis. The monthly summary data for these gages is available in the appendix.

The Ferron Creek gage is located directly above Millsite Reservoir, but below the small reservoirs high in the drainage. Because these reservoirs were turned over to the Utah Division of Wildlife Resources (DWR), they are no longer operated as irrigation reservoirs, and should not affect natural flow. Their behavior is similar to a natural lake.

The Muddy Creek gage is located near the mouth of the canyon and the reservoirs are located much higher in the drainage. These reservoirs, however, are much smaller in comparison to any of the reservoirs currently in operation in the San Rafael drainage. It is assumed that the operations of these reservoirs have a nominal effect on the natural flow of the river, and thus has little effect on the gage.

Correlations

To fill in gaps and extend stream-flow records it was necessary to correlate some of the stream-gages that have incomplete records with gages having all the necessary years covered. A number of techniques and methods were used to accomplish this, which will be explained in the paragraphs that follow.

The reservoirs high in the Huntington drainage, already mentioned, have operational practices that can affect the daily flows during the irrigation season. Most of these reservoirs were constructed or enlarged after 1948. To minimize how these reservoirs influenced the data for the Huntington Creek gage, the record was extended from 1948 onward using the Ferron Creek gage. This was a monthly correlation using DWRe's Corra program. The resulting correlation coefficients can be seen in Table 2. A full summary of the results of this, and any other correlations mentioned in this report, can be found in the appendix.

Table 2 - Correlation Coefficients for Huntington Creek Gaged Stream-flow

Correlated Gage	Base Station Gage	Correlation Coefficients												
		Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
09318000	09326500	0.595	0.521	0.552	0.69	0.282	0.681	0.728	0.94	0.979	0.824	0.792	0.849	0.968

Data on Joe's Valley inflows only go back to 1988, therefore it was necessary to extend this record through correlation as well. Reservoir inflow data from the USBR, however, has negative and empty inflow values. Before any processing was done on this record, these errors were corrected. All negative and empty values were replaced with linear interpolation. With the corrected data a linear correlation was done with the Ferron Creek gage as the base station. The corresponding data, as well as the coefficient and equation can be found in Figure 3.

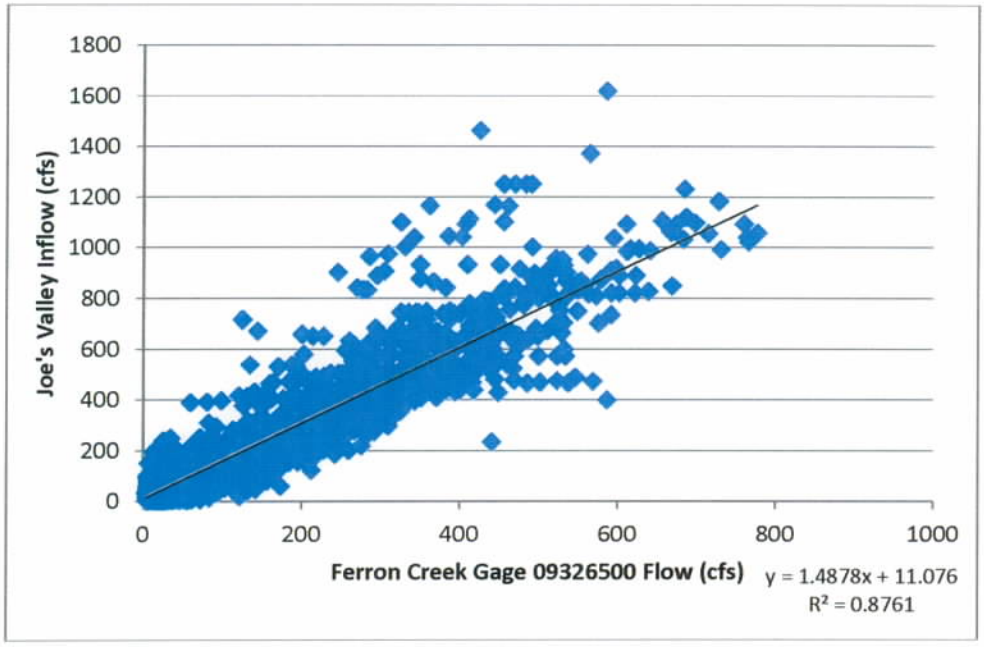


Figure 3 - Joe's Valley Reservoir Correlation

Huntington Creek Synthetic Stream-flow Construction

Most of the reservoirs in the San Rafael watershed do not have daily inflow records back to 1949. The two largest reservoirs, Millsite and Joe's Valley, do have inflow records, but the Huntington Creek reservoirs do not. Emery Water Conservancy District (EWCD) does have reservoir outflow, and elevation data back to 2006 that could be used to back-calculate inflow, but 5 years is not a long enough period to do a reliable correlation, and there were many gaps in the data. Because of lack of inflow data, synthetic stream-flows were developed based on the stream-flow records that were extended. This stream-flow construction was done through using a mean annual runoff estimation tool called Streamstats. The USGS has developed Streamstats as a web based application that is capable of calculating an estimated average annual flow for any un-gaged site in the State of Utah. This application uses regional regression equations based on the parameters of area, and precipitation for the un-gaged watershed to estimate these flows.

As a first step in creating these synthetic stream flows, average annual flow estimates were calculated, using Streamstats, for each reservoir watershed in the model, as well as flows for significant tributaries,

and the San Rafael watershed. A list of all these sites, and the results of their Streamstats calculations, can be found in Table 3. As an example there is also a map of the San Rafael drainage and its detailed output information in Figure 4 and Figure 5. The entirety of the Streamstats maps and outputs can be found in the appendix. Because the reservoirs are contained in the RHF, LHF, the reach gains had to be calculated as the difference between the totals for the watersheds and their reservoirs. These results are highlighted in blue.

Table 3 - Streamstats Results for Huntington Creek

Watershed	Est Average Annual Flow (cfs)	Fraction of Gage
Huntington Creek	49.5	1.000
LHF	19.7	0.398
RHF	16.7	0.337
Huntington Res	2.51	0.051
Cleveland Res	3.28	0.066
Rolfson Res	1.74	0.035
Miller Flat Res	4.95	0.100
Electric Lake	11.5	0.232
Reach Gain LHF	9.73	0.197
Reach Gain RHF	5.2	0.105
Reach Gain Huntington Creek	13.1	0.265

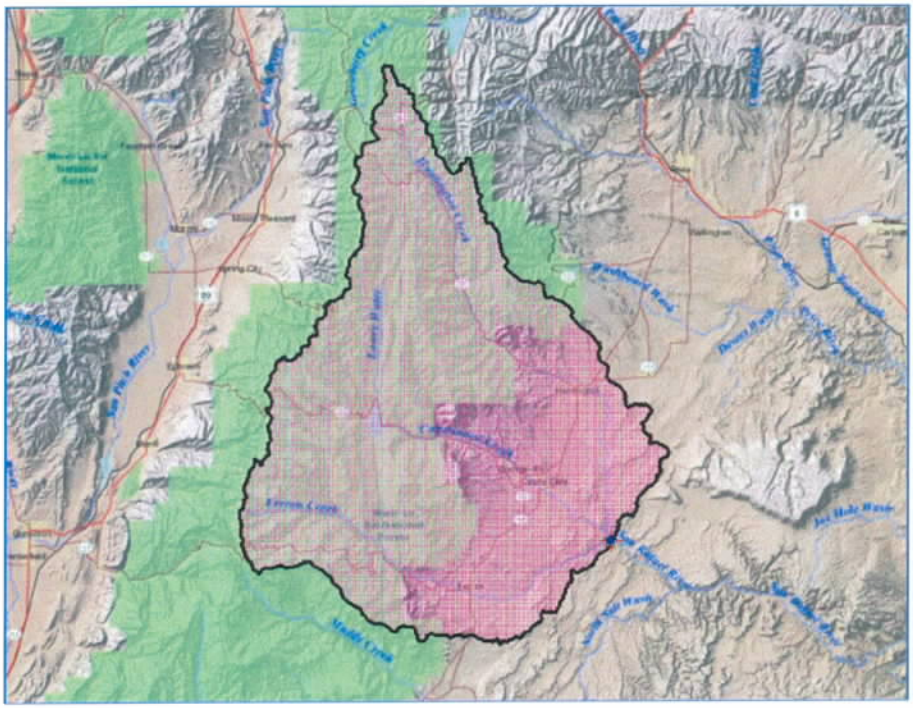


Figure 4 - Map of Delineated San Rafael Watershed from Streamstats

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:28:09 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.1474 (39 08 51)
NAD27 Longitude: -110.9106 (-110 54 38)
NAD83 Latitude: 39.1474 (39 08 51)
NAD83 Longitude: -110.9113 (-110 54 41)
Drainage Area: 925 mi2

Peak Flows Basin Characteristics

100% Region 6 (925 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	925 (above max value 532)	0.87	532
Mean Basin Elevation (feet)	7840	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow SIRDB 5230 Regions 3 and 5 (925 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	925 (above max value 450)	1.98	450
Mean Basin Elevation (feet)	7840	5960	9570
Percent Forest (percent)	30.1	8.26	90.4
Percent Nat Herb Upland from NLCD1992 (percent)	12.8	0.21	19
Mean Annual Precipitation (inches)	17.4 (below min value 19.1)	19.1	31.7
Mean January Precipitation (inches)	1.96	1.65	3.25
Mean February Precipitation (inches)	1.86	1.67	3.11
Mean September Precipitation (inches)	1.59	1.4	2.11
Mean October Precipitation (inches)	1.74	1.71	2.78
Mean November Precipitation (inches)	1.75	1.7	3.23
Mean December Precipitation (inches)	1.55	1.45	2.83

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	1170		1.4		
PK5	2270		3		
PK10	3170		5.1		
PK25	4670		8.4		
PK50	5980		11		
PK100	8190		13		
PK200	9050		14		
PK500	11500		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	158				

Figure 5 - Streamstats Summary for San Rafael Watershed

Using these estimated flows to develop fractions it was possible to distribute the totals from the correlated gage flows to each of the particular sub-drainages. The correlated daily flows from the Huntington Creek gage were all distributed as inflow to each of these sub-drainages based on their fraction of the Streamstats estimate at the gaged locations. The percentages for each area can be found in Table 4.

In addition to developing these fractions from the Streamstats estimates, the fractions on the LHF were also modified. Miller Flat Reservoir, which does have some reliable years of outflows from a weir kept by PacifiCorp, was used to correct all of the estimated distributed flows to match the gaged outflows. The results of this adjustment can also be found in Table 4.

Table 4 - Distribution and Adjusted Percentages for Huntington Creek Sub-drainages

	Huntington Res	Cleveland Res	Rolfson Res	Miller Flat Res	Electric Lake	Reach Gain LHF	Reach Gain RHF	Reach Gain Huntington Creek	Total
Distribution Percentages	5.1%	1.6%	3.5%	10.0%	23.2%	19.7%	10.5%	26.5%	100.0%
Distribution Percentages Adjusted	5.8%	1.8%	4.0%	11.4%	23.2%	16.8%	10.5%	26.5%	100.0%

Muddy Creek Synthetic Stream-flow Construction

There is no data available in any form on the operations of the reservoirs in the Muddy Creek drainage. Because of this lack of data, it was necessary to do similar process to that done on Huntington Creek to develop daily inflows into each of the reservoirs. For this drainage, however, the method of estimating average annual flows for each of the individual sub-drainages was slightly different. Instead of using Streamstats, DWRe's Area Altitude tools, extensions in Arc GIS software, was the approach to determining these flows. Originally this was the preferred method of DWRe, but as it has become increasingly difficult to use these outdated tools, it was necessary to switch to Streamstats to do the Huntington Creek drainage. Since these estimates are used as percentages, it is expected that the two different approaches should result in minimal differences. The estimated flows by the Area Altitude tools for Muddy Creek can be seen in Table 5.

Table 5 - Area Altitude Results for Muddy Creek

Watershed	Est Average Annual Supply (ac-ft)	Fraction of Gage
Muddy Creek	31200	1.000
North Fork Muddy Creek	734	0.024
Emery Res	302	0.010
Spinners Res	492	0.016
Henningson Res	408	0.013
Reach Gain Fish Creek	3122	0.100
Julius Flat Res	416	0.013
Reach Gain Muddy Creek	25726	0.825

San Pitch Diversions

There are a number of trans-basin diversions in the Huntington, and Cottonwood drainages that divert water West over the ridge to the San Pitch watershed. Although gaging has been done at varying times on these diversions, to simplify this water supply analysis it will be assumed that these diversions will continue to be operated as they have in the past, and thereby not require incorporation into the analysis.

Water Users

Irrigation Companies

Most of the irrigation in the two watersheds is handled by irrigation companies. These irrigation companies are distributers to smaller water users who have stock in the company. Each of these irrigation companies will be discussed individually as to the role they play in their watersheds. Information on the details of major diversions, reservoirs, and their connectivity came from a combination of research and conversations with local stake holders who have an extensive knowledge about the systems in the area.

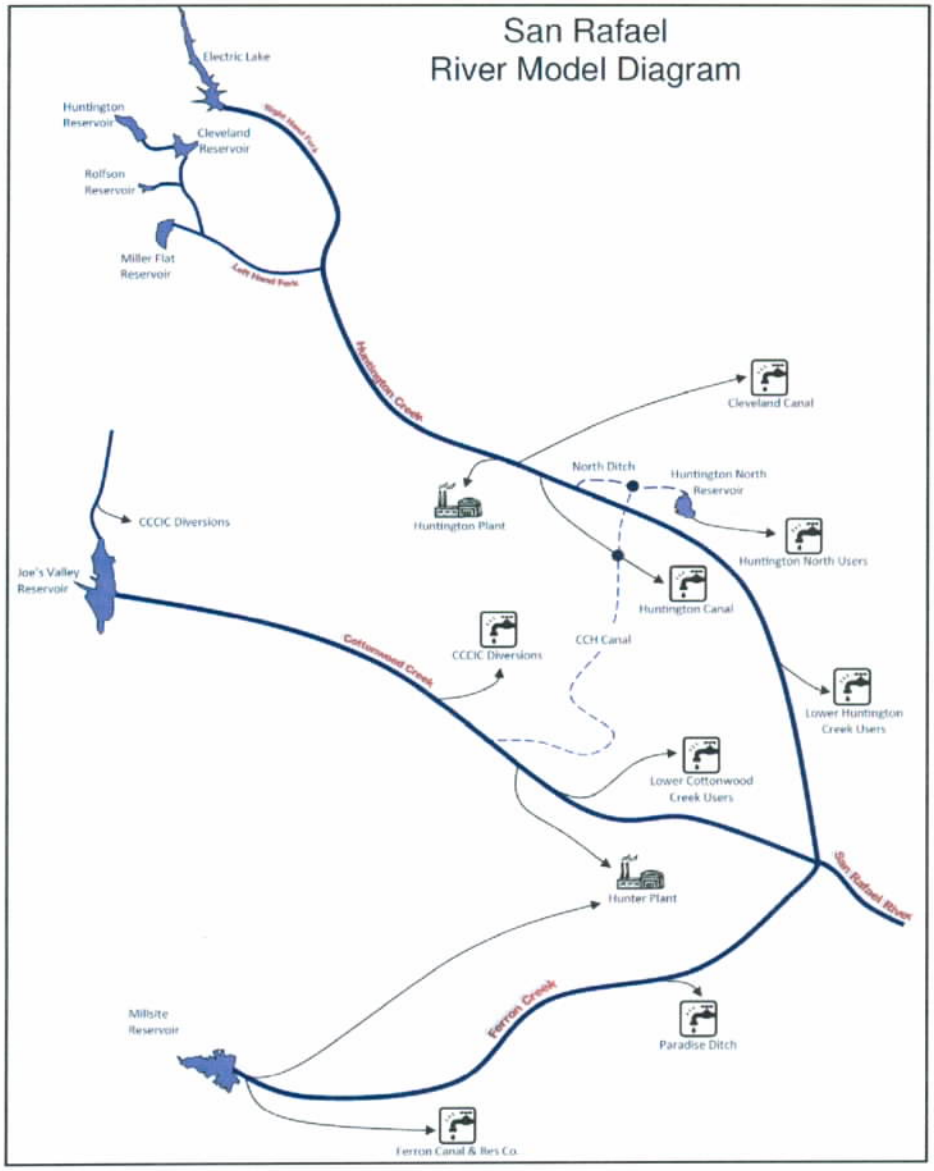


Figure 6 - San Rafael River System Diagram

HCIC

This irrigation company is a combination of two irrigation companies that operate major canals within the Huntington Creek drainage. It should be noted, however, much of the system is being converted to pipe over the next few years, and the descriptions of the service areas that follow are based on the system as it will be in the future.

As mentioned above, HCIC has four reservoirs in the LHF drainage. These reservoirs are: Huntington, Cleveland, Rolfson, and Miller Flat. Huntington and Cleveland are a system of reservoirs where all of Huntington's releases are diverted into Cleveland reservoir. Huntington and Cleveland Reservoirs have approximately 5620 ac-ft, and 5340 ac-ft of storage capacity, respectively, at the spillway crest. Rolfson is a relatively small reservoir with about 500 ac-ft of storage at the spillway crest. Miller Flat has a storage capacity of approximately 5250 ac-ft at the spillway crest[1]. For more details on these and other reservoirs mentioned in this report, such as stage-area-capacity curves, refer to the appendix.

As seen in Figure 6, which is a useful reference for this discussion of water users, the first major diversion down-stream from these reservoirs is the Huntington Plant diversion. The next is a series of diversions for HCIC which starts with the Cleveland Canal (120 cfs physical capacity), followed by the Huntington Canal (90 cfs physical capacity), and the North Ditch (100 cfs physical capacity). The North Ditch also delivers water to the Huntington North Reservoir, which has a capacity of 5420 ac-ft. There are number of smaller canals further down-stream which have their own private water rights. These diversions include Avery Canal, Brasher Canal, and Jeff Canal. The Avery Ditch users, however, are the only users that have rights in HCIC along with a private right. Huntington Canal delivers only to users on the South side of Huntington Creek, while Cleveland Canal delivers mostly to users North of Huntington Creek. North Ditch delivers to users on both sides of Huntington Creek.

Another notable source of water for HCIC is the Cottonwood Creek Huntington Canal (CCH Canal). The CCH Canal transports project water stored in Joe's Valley Reservoir to the Huntington Creek drainage. EWCD, which operates the canal, as well as Huntington North Reservoir, has the ability to deliver water to either Huntington Canal or Huntington North as they see fit.

A significant portion of the land served by the Cleveland Canal, and the North Ditch is actually in the Price River drainage. Because of this not all of the return flow (a fraction of non-depleted water) from HCIC diversions flows into the San Rafael. Through GIS analysis it was determined that 73% of the Cleveland area's return flow goes to the Price drainage, and 38% of the North Ditch area's return flow goes to the Price drainage. The remainder of this return flow is expected to make its way to the San Rafael.

CCCIC

Like HCIC, CCCIC was also formed from group of smaller irrigation companies, hence the name "Consolidated". Also like HCIC, CCCIC is the major distributor of agricultural water to the area. And

[1] Division of Water Rights has different values for Rolfson and Miller Flat. Johansen and Tuttle Engineering surveyed these two reservoirs in 2002, and the values presented are based on these survey results. The surveyed SAC is available in the appendix.

again, like HCIC, CCCIC is also in the process of converting its canal system to pipe, although, CCCIC is not as far along in the process. The same approach of describing the system in a future context is being applied when discussing CCCIC.

As mentioned above, Joe's Valley is the only reservoir which serves the Cottonwood Creek users. The reservoir has a capacity of approximately 62,000 ac-ft at the spillway crest. Since there were multiple benefactors from this project the reservoir has been divided into separate "pools" for each entity's use. One of these "pools" belongs to CCCIC, which is the only storage the company has on the stream. These "pools", as well as other Joe's Valley Reservoir details, are discussed more fully in the Water Rights and Operational Practices section. Details on Joe's Valley Reservoir can be found in the appendix.

The CCCIC diversions are the first down-stream from Joe's Valley Reservoir, followed by the CCH Canal, and PacifiCorp's Hunter Plant diversion. The smaller ditches that are not part of CCCIC are still fed through CCCIC's distribution system, but are further down. These smaller ditches include: Mill Ditch, Wilberg Ditch, and Wilson Ditch. Figure 6 shows a simplified view of the Cottonwood Creek system that is more representative of the model. For a more detailed breakdown of Cottonwood Creek refer to the map of the area in the appendix.

The lower Cottonwood Creek users, Mill, Wilberg, and Wilson Ditch are in a position in the system to receive a significant portion of their demand from return flow. All return flow in this particular drainage is expected to flow into the San Rafael.

FCRC

As the major irrigation company on the Ferron Creek, FCRC serves the majority of the irrigated land in the drainage, the main exception being Paradise Ranch, which has its own private right.

Millsite Reservoir is the only storage that is available to the irrigation company. The capacity of the reservoir at the spillway crest is 18,500 ac-ft. This reservoir was constructed by the NRCS in the 1970s and is currently undergoing an extensive upgrade which is in the final stages of Phase III design. The project will result in a new spillway configuration and increased storage. These improvements on the dam will alter reservoir dimensions from the original construction, however, the model does not currently reflect these changes. Also, as will be discussed in further sections there are multiple pools in this reservoir as well.

There is only one major diversion for FCRC which is directly downstream from Millsite reservoir. This diversion has a physical capacity of approximately 250 cfs and serves all irrigating members of the company. There are also two 50 cfs capacity pipelines tied directly into the reservoir. The only other diversion on Ferron Creek is Paradise Ranch's. Like the other smaller water users in the area, this diversion is in a position to receive return flow from the upstream users.

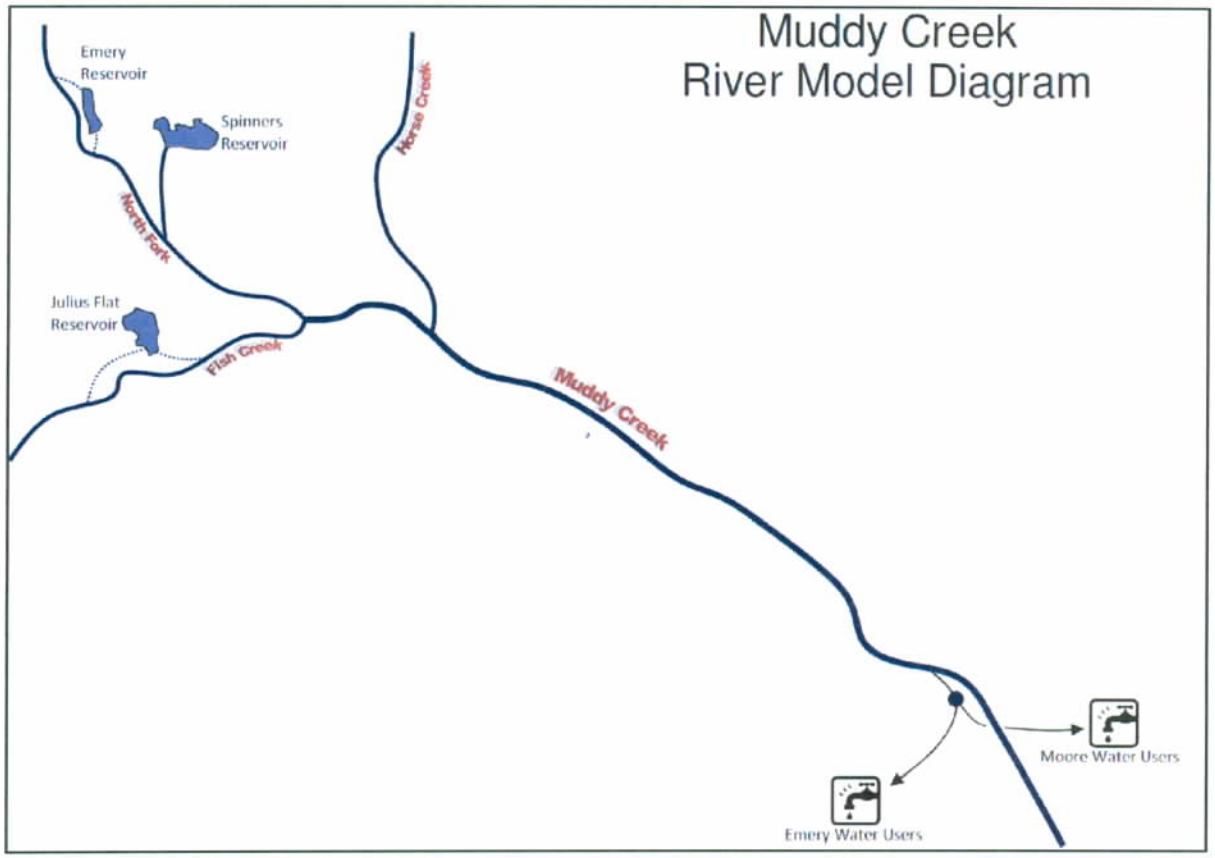


Figure 7 - Muddy Creek River System Diagram

MCIC

The only water user on Muddy Creek is MCIC. MCIC has one major diversion that is divided for the towns of Emery and Moore. Most of the land area served is on the West side of Muddy Creek in the town of Emery, but almost 100% of Moore is served by pipe compared to less than 10% on the Emery side.

As mentioned earlier, there are a few small reservoirs used by MCIC. These reservoirs are so small in comparison to the total volume of water produced by the watershed their benefit is minute. These reservoirs are Emery, Julius Flat, and Spinners. Emery and Julius Flat Reservoirs are both off-stream, while Spinners is on a tributary. There are two diversions for each of these off stream reservoirs, and each has a normal capacity of 10 cfs, but due to sedimentation and debris one of the Emery Reservoir diversions is not functioning. Emery Reservoir has a capacity of 145 ac-ft, Spinners has a capacity of 600 ac-ft, and Julius Flat has a capacity of 700 ac-ft – all approximates at the spillway crest.

Power Company

Huntington Plant

PacifiCorp has two coal-fired power plants in the San Rafael watershed and each has a unique role in the individual communities in which they reside. The first of these two, completed in 1974, is the

Huntington Plant, which is near the town of Huntington a short ways up Huntington Canyon. This plant is not the largest water user on Huntington Creek, but because of its facilities, holdings in irrigation companies, and position on the creek, it has a significant impact on all other users.

The only reservoir that PacifiCorp owns in the watershed is Electric Lake up the LHF, which also is the largest at 31,200 ac-ft of storage at the spillway crest. This reservoir along with rights owned HCIC, and their own rights on the stream, are the sources of water for this power plant. It has been discovered since the construction of Electric Lake that there is significant seepage loss in the reservoir. The rate of loss has been estimated to be 12 cfs and not return to the creek, but makes its way into the Price drainage.

The Huntington Plant diversion is the first major diversion on Huntington Creek and has a physical capacity of 27 cfs. Water from this diversion is used almost exclusively for power production, and as such is essentially one-hundred percent depleted. Any effluent that remains is used to irrigate a few small parcels of land exactly to evapotranspiration (ET), so no return flow results.

Based on water records from the River Commissioner Report, and input directly from PacifiCorp, it is estimated that the average annual demand for the Huntington Plant is 11,000 ac-ft a year. And this is the estimate that was used in the model.

Hunter Plant

The Hunter Plant was completed in 1978 and, like the Huntington plant, has a substantial impact on water related matters in the area. This plant is located nearly halfway between Cottonwood and Ferron Creeks outside the community of Castledale. Because of its positioning this plant is able to divert from both Cottonwood and Ferron Creek, making for a more reliable supply of water that a coal-fired plant depends on.

Like the Huntington Plant, the Hunter Plant also has acquired rights in the local irrigation company, that company being CCCIC. Also available to the plant are pools in the two reservoirs on Cottonwood and Ferron Creek already mentioned. These pools are used to serve the Hunter Plant when other supplies are not available.

There is a single diversion on both Cottonwood Creek and Ferron Creek for the Hunter Plant with capacities of 24 cfs, and 34 cfs respectively. These diversions ultimately feed into the company's small regulating pond called Snowball Pond, and from there is used for power production. On the Cottonwood Creek there are issues with diversion inefficiencies. The problem with this diversion is that it relies on pumping, and frequently this pump fails for a period of time until it is put back on-line. As a result, during this time water that may have been called for is forfeited and continues down the creek.

Because of the inefficiency issues, average annual water usage by the Hunter Plant was a trickier to determine than the Huntington Plant. There are records from PacifiCorp, however, that show the amount of water called for on the Cottonwood Creek side versus the actual diverted amount. This information was used to estimate that the average annual demand of the plant can be estimated at 19,000 ac-ft.

The Hunter Plant also has a similar operation to the Huntington Plant, using effluent to irrigate some company parcels, in which they ensure that there is one-hundred percent depletion on the water diverted.

Land Use and Irrigation Demand Analysis

Land Use Analysis

For the last 12 years DWRe has had an ongoing land use program in which each river basin is surveyed every six years, giving a snap-shot view of how land was used for that particular year[2]. This data is collected in a GIS format and is useful in making estimates on water use within the surveyed basins. The most recent land use survey for the Southeast Colorado River Basin was 2011, and data obtained from that year are what was used in acreage totals.

Figure 8 show a map of the areas served by each of the irrigation companies, for the San Rafael and Muddy Creek watersheds. This information was provided to DWRe, by various contacts within the irrigation companies, and the irrigated acreage identified by the land use surveys. By overlaying the company boundaries with the data from surveys, and employing GIS techniques, it was possible to identify the acreage totals for each service area. A breakdown of totals for each company and private ditch can be found in Table 6.

Table 6 - Land Use Acreage Totals from 2011 Field Survey

CREEK/CANAL	Land Area Served
	(acres)
Huntington Creek Total	**20500**
Cleveland Canal	12530
Huntington Canal	2360
North Ditch	4940
Avery/HCIC	270
Jeffs	270
Brasher	130
Cottonwood Creek Total	**10710**
CCCIC	9960
Wilson Ditch	300
Wilberg Ditch	40
Mill Ditch	410
Ferron Creek Total	**8970**
FCRC	8760
Paradise Ditch	210
Muddy Creek Total	**7280**
Moore	2830
Emery	4450

[2] Land use data has been collected at various times since 1968, but 2000 is when the cycle of every 6 years was established.

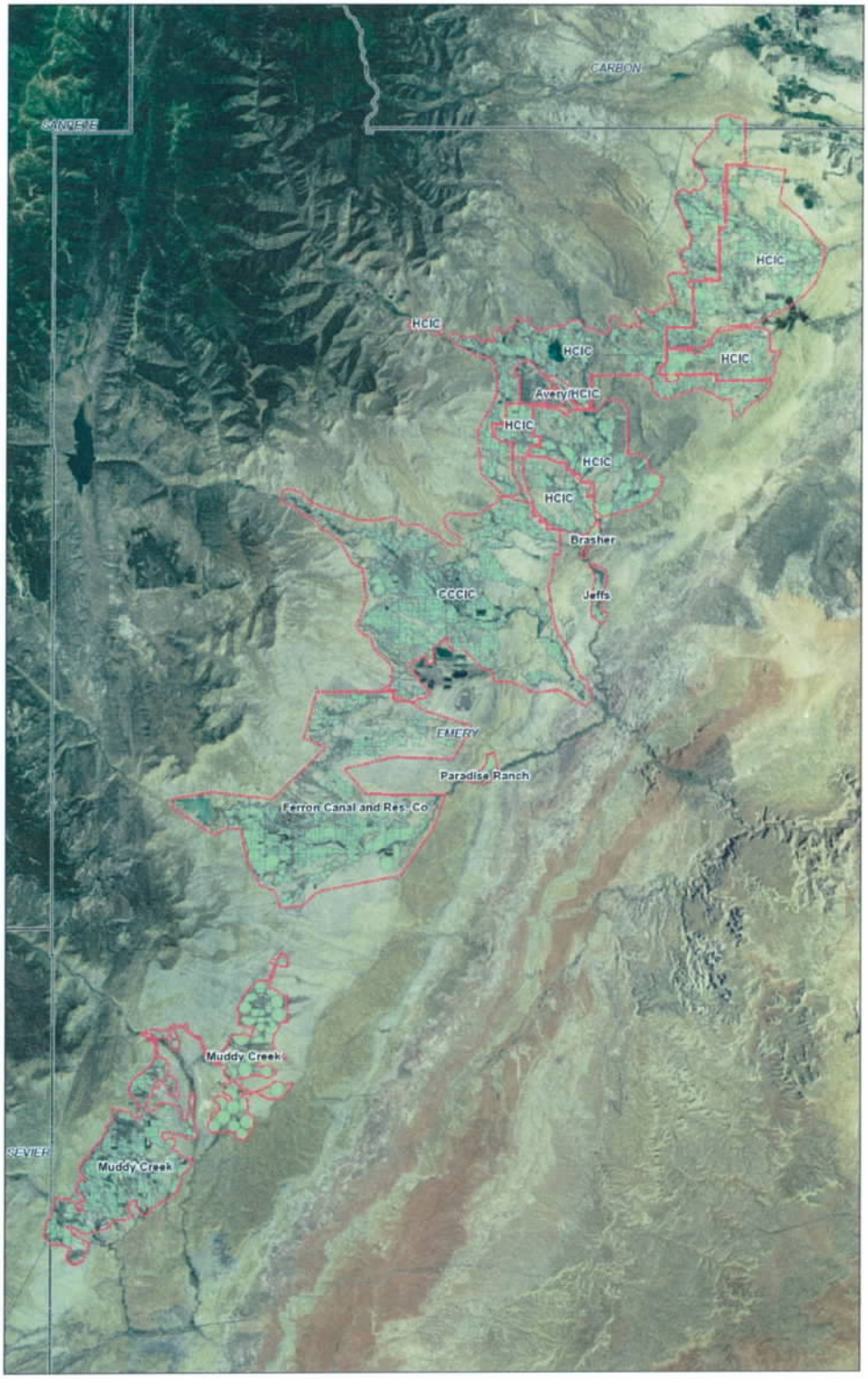


Figure 8 - Map of Service Areas and Land Use Surveyed Fields

Irrigation Demand

The crop acreage, presented in the Land Use Analysis section, along with irrigation demands based on evapotranspiration (ET) rates were used to calculate demand. ET rates were taken from the "Consumptive Use of Irrigated Crops in Utah" report by Robert Hill. Using a modified Blaney-Criddle equation Hill developed many various parameters related to crops and evaporation for a number of sites in the State of Utah. Required irrigation values from the Castledale and Ferron sites were used in both models. Table 7 shows monthly ET values for an alfalfa crop type at these two sites. The alfalfa rate was used as the conservative estimate for all the crop irrigation in both models.

Table 7 - Estimated Irrigation Required Based on 30 Year Averages

	Net Irrigation Required (in)											
Site Name	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
Castledale	0	0	0	0.09	4.98	6.55	7.78	6.25	3.92	0.71	0	0
Ferron	0	0	0	0.05	4.87	6.18	7.84	6.02	3.51	0.68	0	0

In order to account for the secondary demand, and to avoid making challenging adjustments to the models, a method of equivalent acres was used to account for this type of water use. The basic concept of this method is to take the average recorded use by each of the secondary systems and develop an equivalent amount of acres to add to each of the major service areas of the canal companies. A round estimate of 30 inches of annual irrigation for alfalfa was used to develop these acre amounts. The following Table 8 and Table 9 show the results of these calculations.

Table 8 - Equivalent Secondary Acreage

Community	**Annual Secondary Use (2010)**	**Equivalent Land Area**
	(ac-ft)	(acres)
Castle Dale	924	369.6
Orangeville	934	373.6
Clawson	139	55.6
Cleveland	373	149.2
Elmo	302	120.8
Ferron	1408	563.2
Huntington	919	367.6
Emery	325	130

Table 9 - Adjusted Total Acres Based on Equivalent Acres

Modeled Diversions	Crop Land Area (2011)	Combined Equivalent Land Area	Total Area
	(acres)	(acres)	(acres)
CCCIC	9960	740	10700
Cleveland Canal	12500	270	12770
Huntington Canal	2360	370	2730
FCRC	8750	620	9370
Emery	4450	130	4580

Water Rights and Operational Practices

Each of the individual drainages within the San Rafael and Muddy Creek watersheds have their own unique aspects on how water rights influence the operational practices of water users. This section will describe the details of these operations for each stream separately. Much of the material in this section was dependent on information obtained from Utah Division of Water Rights (DWRi). The Price office of DWRi is to thank for providing distribution schedules for each of the streams. These schedules are available in full in the appendix, but only individual details will be referenced from them in this section.

Huntington Creek

The highest priority water rights on Huntington Creek are direct flow rights owned by HCIC. These first-priority rights total 352.25 cfs, which is a significant amount in comparison to the annual flow of the river. After these rights are a series of HCIC storage rights and private rights for the smaller canals mentioned earlier. Because of the advantageous rights of HCIC, PacifiCorp found it beneficial to acquire stock in HCIC, and now own 33 percent of the rights in the company, all of which are considered first class.

Partial ownership of PacifiCorp in HCIC has motivated what has been termed as a "gentleman's agreement" between the two parties. To ensure that both the power and irrigation company are, to some degree, satisfied, PacifiCorp has agreed not to call off of the LHF. This mutual understanding means that the Huntington Plant does not have any access to the storage or direct flows up the LHF, and must rely solely on Electric Lake for storage.

As expected, Huntington Plant requires water year-round to generate power. One of the operating policies of the plant during the non-irrigation season is to set Electric Lake at a constant release of 12 cfs. Through the winter months the plant's use is also tracked, and is credited toward Huntington North in Electric Lake. This arrangement is due to the fact that the right to fill Huntington North, which is during the winter, is higher priority than PacifiCorp's individual diversion right.

Because a portion of HCIC and PacifiCorp storage rights are junior in priority to a few of the lower canals, HCIC (and PacifiCorp) are not allowed to fill their reservoirs completely if the lower canals are not satisfied.

Most of the other operations on Huntington Creek generally function as would be expected. Water is called for by each user as it is needed and available. If there is not enough direct flow, then reservoir storage is called for. Water from storage for HCIC could come from either their own reservoirs or from Joe's Valley through the CCH Canal. A couple of notes to make: Huntington North Reservoir is essentially operated as a regulating pond, and Miller Flat and Rolfson Reservoirs are usually set to a more constant outflow during the irrigation season, while Huntington and Cleveland Reservoir releases are adjusted to accommodate for varying demand.

Cottonwood Creek

Like Huntington Creek, the irrigation company has the largest fraction of water rights on the stream, and most of these rights are relatively high priority, however, there is one very notable difference in how the Joe's Valley Project has affected water rights and operations. With the introduction of the Joe's Valley Project came an agreement between CCCIC and the USBR. CCCIC was given a portion of the new storage and in turn they agreed to limit their early season (April-June) irrigation to 15,200 ac-ft.

As has been mentioned earlier, Joe's Valley has been divided into pools of storage for each party whom the reservoir was intended to benefit. There are pools for the CCCIC, PacifiCorp's Hunter Plant, HCIC, and smaller pools for Huntington, Castledale, and Orangeville Cities. Table 10 shows a breakdown of each of these pools and their volumes. The capacity of Joe's Valley was designed to provide two years of storage for each pool. It's also important to note that PacifiCorp is the only water user that is allowed carry-over of storage from year to year.

Table 10 - Joe's Valley Reservoir Pool Breakdown

Water Users	1-Year Pool (ac-ft)
CCCIC	4761
PacifiCorp	8576
Castledale City	55
Orangeville City	45
HCIC	11324
Huntington City	189
Total	***24950***
2-Year Total	**49900**

Similar circumstances to the HCIC and Huntington Plant relationship exist between CCCIC and the Hunter Plant. As a result PacifiCorp has also acquired rights in CCCIC at 27% of total shares—all first–class shares. PacifiCorp's rights in the company, however, only apply to direct-flow, consequently the Hunter Plant has no access to CCCIC's 4761 ac-ft pool in Joe's Valley.

As with the Huntington Creek, the smaller water users do not have storage on the system, and must rely on their direct flow rights. These private rights range in priority and many of them are actually above the reservoir. The ones that are below the reservoir all have higher priority than the USBR right for Joe's Valley storage.

Ferron Creek

The highest priority right on Ferron Creek is not FCRC, but rather Paradise Ditch. This is a small direct flow right and allows for a fairly reliable supply for the ditch. The remainder of direct-flow rights are all owned by FCRC. This situation again has influenced PacifiCorp to obtain rights in the major irrigation company to use at the Hunter Plant. PacifiCorp has 37% of FCRC rights and this includes storage allotted to the irrigation company in Millsite Reservoir.

Like Joe's Valley, Millsite Reservoir has been divided into pools as well. There are essentially only two active pools in the reservoir: PacifiCorp's pool, which is7000 ac-ft, and FCRC's pool which is the remainder of capacity–9500 ac-ft when the reservoir spills. There also is a DWR pool of 2000 ac-ft kept in the reservoir as fish habitat.

At the beginning of the irrigation season the storage in the reservoir is divided preliminarily for each entity's use. After the reservoir spills, which it typically does, the reservoir is officially divided for the remainder of the season. Unlike FCRC, PacifiCorp's pool is guaranteed throughout the entire irrigation season, but is usually never called for till late in the season. Any flows into the reservoir after Millsite spills, which are greater than the paradise ditch right, are divided and distributed based on these storage rights described.

Muddy Creek

Because there is only one water user on Muddy Creek, MCIC, there are no intercompany water right challenges to deal with. Rather, water rights are handled on an intra-company level. No operational practices of this nature have been reviewed or modeled for the Muddy Creek.

There is one operational practice to make note of with regards to MCIC's diversion. As a general practice 80% of this diversion is distributed to the Emery side and the remaining 20% to the Moore side[3]. This method of splitting likely developed from the discrepancy in land area and amount of sprinkler irrigation between the two sides.

Hunter Plant

Due to its unique use of two watersheds and efficiency issues, the Hunter plant has some nuances in operational practices that should be discussed. The Hunter Plant typically calls for water in this manner, starting at the beginning of the irrigation season: first from shares in the CCCIC, as these shares are mostly limited to the April through June period, then during the same period from shares in FCRC as needed. And then as these supplies dwindle later in the season storage from pools in both Joe's Valley and Millsite are called for though the winter until next season. The historical pattern of water calls over the last 5 years is shown in Table 11. This table also shows how the efficiency issues have affected the way water is called for. During the winter Millsite storage is more heavily relied on rather than Joe's Valley, because pump trips are more frequent with low flows in Cottonwood Creek. This information was obtained from a Hunter Plant contact and the complete information is available in the appendix.

[3] Although this practice has been conveyed by those with knowledge of the area, it has been difficult to duplicate with the model, and seems unlikely based on land use survey results.

Table 11 - Historical Demand Pattern for Hunter Plant

Hunter Plant Average Demand Pattern Apr 2007 - Mar 2012					
	COTTONWOOD CREEK		MILLSITE		
MONTH	PRIMARY	PROJECT	PRIMARY	LEASED	*TOTALS*
APR	812	986	603	0	2400
MAY	1246	0	869	0	2114
JUN	1200	0	563	0	1763
JUL	1097	48	624	0	1770
AUG	819	540	640	0	1999
SEP	376	676	640	0	1692
OCT	16	1181	543	81	1821
NOV	0	1001	0	686	1686
DEC	0	739	0	785	1525
JAN	0	129	0	985	1114
FEB	0	75	0	900	974
MAR	0	155	0	697	852
TOTALS	5566	5531	4481	4133	19711

According to the results in the previous table, on average, the Hunter Plant uses an annual amount of almost 20,000 ac-ft. But because these amounts don't take into consideration the inefficiencies in pumping on the Cottonwood, it's difficult to gauge how much the annual demand is from these numbers alone.

RiverWare Development

RiverWare Description

RiverWare is a software package developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) housed at the University of Colorado. The primary sponsors of CADSWES are: the USBR, Tennessee Valley Water Authority, and U.S. Army Corps of Engineers. RiverWare is the flagship product of CADSWES. This package provides an efficient and relatively simple approach to modeling river systems. Whereas it has been common practice to develop river models in complex computer languages and run them in less-than-user-friendly environments, RiverWare operates in a familiar windows user interface. This interface makes for less coding, and enhances the ability to design, change, and run river models.

There are many features of RiverWare. Some of these features include basic simulation, rule based simulation, and accounting simulation, just to name a few. The rule based approach was chosen for development of the two models described in this report. This approach allows for the writing of relatively small pieces of code, called 'rules', that dictate how the river system is operated.

Framework Construction

Much of the river systems framework has been illustrated in early section figures, but a screen shot of the actual RiverWare connectivity is shown in Figure 9 and Figure 10. As may be apparent from these images, the San Rafael model is significantly more complex than the Muddy Creek model. The entire frame work will not be explained, because it follows very closely to what has already been described, and the details could be quite extensive, but several peculiarities will be mentioned.

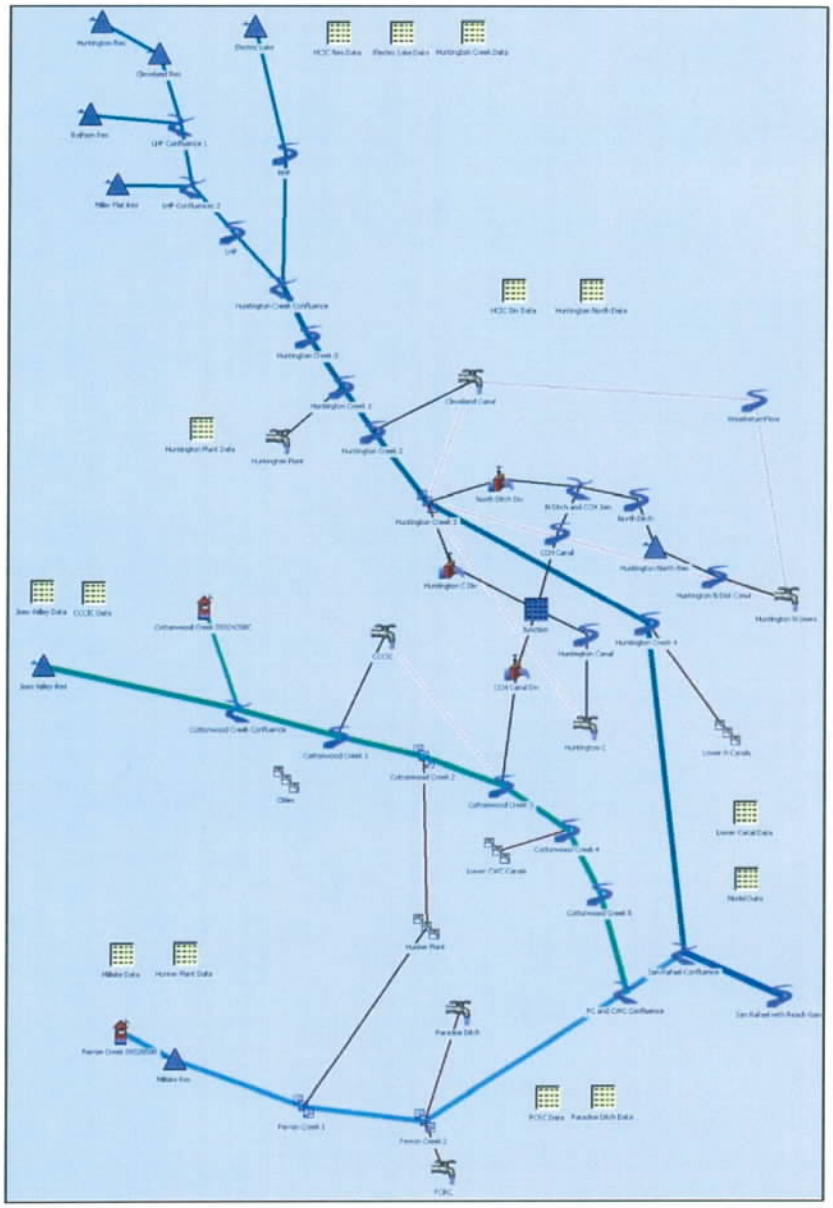


Figure 9 - San Rafael Model RiverWare Screenshot

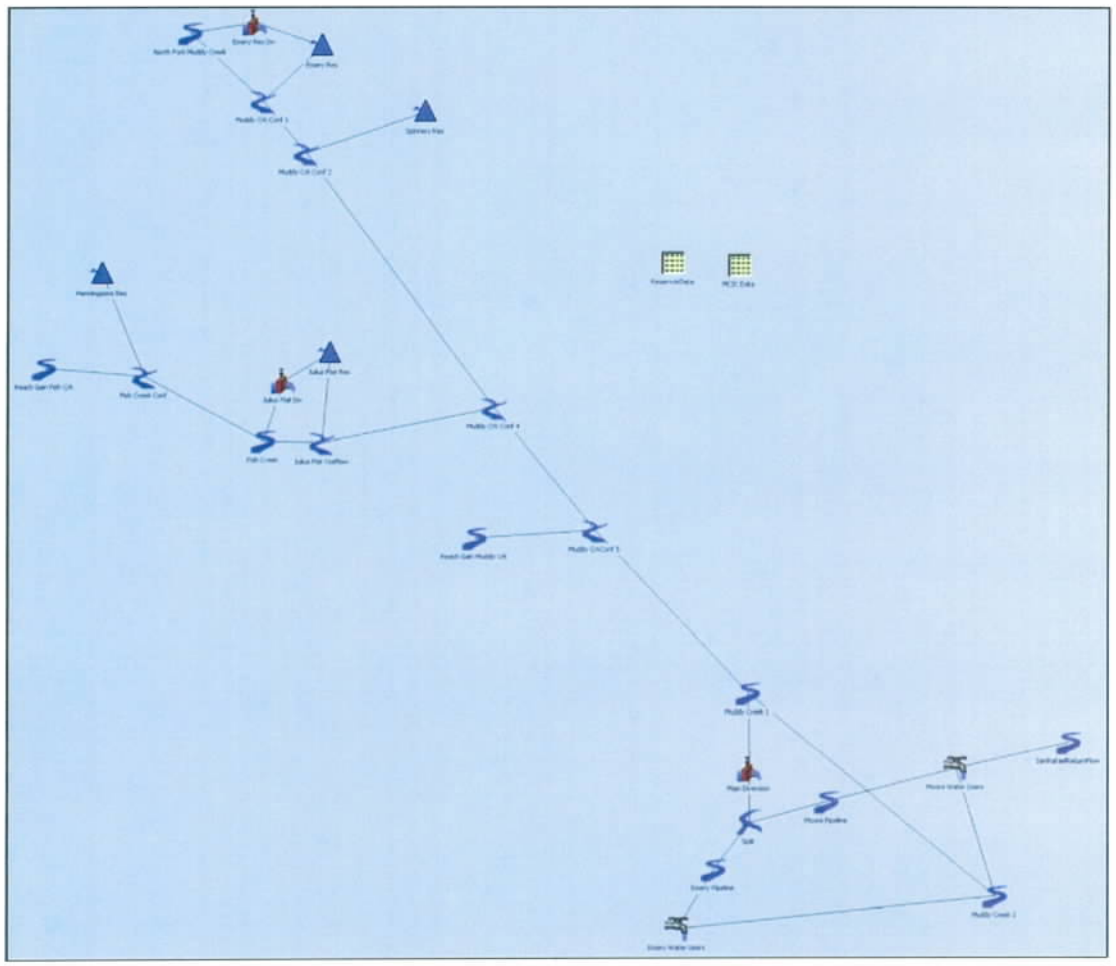
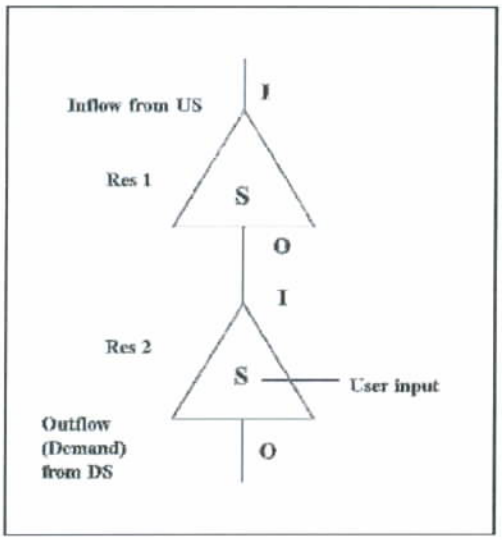


Figure 10 - Muddy Creek Model RiverWare Screenshot

Basic RiverWare Concepts

In order to describe the steps taken to construct the San Rafael and Muddy Creek framework in RiverWare it is necessary that the reader has, at least, a minimal understanding of the software and the terms used. RiverWare uses a system of objects, and slots to construct models. Objects generally represent something physical like a reservoir, or a reach. Slots are contained within an object and represent attributes of an object e.g. inflow, elevation-volume table, or return flow fraction. If two objects share data these slots are linked from one object to another to pass values needed to solve objects at each time-step of the model period. And an object cannot solve unless it has the necessary information in its required slots. The following figure from CADSWES training illustrates this concept.



- **Objects solve when they have required knowns and unknowns**
- **Link Propagate Values**

  $S_t = S_{t-1} + I_t - O_t$

  $I_t = S_t + O_t - S_{t-1}$
- **Exactly determined system**

Figure 11 - Basic Example of RiverWare Slots and Objects (From CADSWES Introduction Training manual)

Many objects in RiverWare are designed with the potential to start the flow of water through the model. User input is where the values begin propagating, either up-stream or down-stream, allowing objects to solve. Initialization routines, which run before any time-steps, can also set the user input values to begin the process of propagating values.

In the two models of this report water supply is where flow begins. The water supply slots are located in different objects and slots throughout the models. Part of the water supply is contained within the reservoir objects as inflow and or local-inflow slots. Reach objects also include reach gains of the water supply—in the local-inflow slots. And a stream-gage contains the remainder of the water supply for the San Rafael model.

Object Descriptions and Inputs

The following sub-sections describe the various RiverWare Objects used in the San Rafael and Muddy Creek Models. In addition, there are brief explanations of how these objects were used and what data was used in them.

Reservoir Objects

Reservoirs may be the most complicated objects in RiverWare. There are many methods and slots associated with these objects. The following describes some of the more important notes to make regarding reservoirs in these models.

There are actually four types of reservoirs in RiverWare: Storage, Sloped Power, Level Power, and Pumped Storage, but the only one used in the two models is Storage. The basic concepts of solving for unknowns for reservoirs based on given knowns applies in Storage Reservoir calculations. Equation 1 is the general reservoir equation.

Equation 1

$$S_t = S_{t-1} + I_t - O_t$$

Inflows and outflows are typically the knowns for each time-step. Inflow is calculated from a combination of on-stream inflows, hydrological in flows, and any diversions into the reservoir. Outflows are a combination of releases, spills, and diversions. Also accounted for as outflows are evaporation and seepage. Storage is then calculated using Equation 1. Using this method, of course, requires storage is known at the initialization time-step for the entire simulation period.

Most reservoir parameters input into these objects were obtained from either the DWRi Dam Safety website, or directly from contacts at EWCD. Reservoir evaporation coefficients were taken from the "Consumptive Use of Irrigated Crops in Utah" report by Robert Hill. Estimates for reservoir evaporation were extrapolated based on the sites in Hill's report.

Water User Objects

In RiverWare, Water Users come in two forms. One is the basic Water User Object that contains attributes normally associated with a water user, such as diversion requested, efficiencies, or acreage. The slots available are dependent on the methods chosen for the object. Most of the methods on these objects use the Irrigated Acreage method, with the exception of the power plants and a few of the smaller water users. These other objects use methods that require the exact demand to be input. The second type of Water User object is called an Aggregate Diversion, which is, simply put, many Water User Objects contained within one. This type of object is the one used for the Hunter Plant to represent different aspects of their water calls. Those aspects being the four main sources for the plant already mentioned. Aggregate Diversions were also used to group the smaller users and cities into a more visually manageable object.

Data Objects

There are many Data Objects, which are RiverWare's miscellaneous object, used for storing data or running calculations not readily available in predefined objects. In the models being discussed they serve to store information such as waters rights data or dead pools for reservoirs, and one is even used as a junction object for dealing with the CCH Canal and Huntington Canal intersection.

Reach and Diversion Objects

Reach and Diversion Objects in this model are fairly straightforward and no complicated methods are applied to them. There are no lags and very few local-inflows, but there are a number of return flows. These return-flow links are identified by dashed lines. Diversions are very simple in that there is a diversion requested and if it's available, and legal according the rules written for the diversion, water is diverted.

Object Reports were generated for each Reservoir and Data Object in both models. These Object Reports are all available in the appendix. These reports should be used for any parameters or details relating to objects that are not described in the above explanations.

Model Rules

In this section, first we will introduce a few of the basics regarding rulebased simulation. And following these explanations will be a listed description for each rule in the Muddy Creek, and San Rafael Models. These descriptions will be brief, and the complete rules are viewable in the appendix. There are also initialization rules for each model that will not be discussed, but they are also available in the appendix. As this model is intended to be used for planning, it should be noted that rules for both models should be considered fluid, and will be modified as different scenarios are applied.

Basic RPL Concepts

RPL stands for RiverWare Policy Language. This is the language by which operation of a RiverWare rulebased model is controlled. Its form and structure is very similar to other computer languages, but a great deal simpler because necessities like dimensioning variables or linking and compiling code are not required. This style of code simply controls the operating *policies* defined by the developer. Figure 12 shows an example piece of code from the Muddy Creek Model. This rule will, if it is August, September, October in the simulation run, release the minimum of 15 cfs and max available from Julius Flat Reservoir for the current time-step.

```
Rule: Julius Flat Release
Priority: 1
Description:

  IF ( GetMonthAsString ( @"t" ) == "August" OR GetMonthAsString ( @"t" ) == "September" OR GetMonthAsString ( @"t" ) == "October" ) THEN
     Julius Flat Res.Release [ ] = MinItem ( { 15.00000000 "cfs" ,
                                               GetMaxOutflowGivenInflow ( % "Julius Flat Res" ,
                                                                          Julius Flat Res.Inflow [ ] ,
                                                                          @"t" ) ,
                                               MaxOutflow ( % "Julius Flat Res" ,
                                                            ReservoirData.Julius Flat Dead Pool [ ] ) } )
  ELSE
     Julius Flat Res.Release [ ] = 0.00000000 "cfs"
  ENDIF

  Execute Only When:

    TRUE
```

Figure 12 - Example Rule from Muddy Creek Model

In the upper left corner of the rule in Figure 12 is a priority number. This is another important aspect of how rulebased simulation works in RiverWare. Every rule written for a particular model has a priority number. This number not only represents priority, but order of rule execution. Rules are "fired" starting from the lowest priority to the highest priority at every time-step. If a slot solved for by a lower priority rule is then resolved by a higher priority rule, then the slot is set to the result of the higher rule, thus maintaining the hierarchy intended by this process. Often times in these models many of the rules are not even capable of being in conflict with one another.

Essentially, rulebased simulation is intended to progress forward based on results from rules being fired. Objects in the model will solve as the rules provide the necessary inputs. It is possible for simulations to complete without objects solving at every time-step, however, every rule fires at every time-step. A rule may not fire successfully, hence objects may not solve, but every rule will fire. A rule not firing

successfully could happen for a number of reasons, but the main reason is usually that it doesn't have all the necessary slot information on the right-hand-side of the rule. To avoid this pitfall, care must be taken to ensure that rules are placed at the correct priority in relation to each other, thus ensuring the order of firing is in harmony with results that are expected at higher priorities.

Muddy Creek

Priority 10 – Main Diversion: Sets the main diversion request, to be divided, to the sum of both the Moore and Emery areas.

Priority 9 – Diversion Split Percentage: Currently inactive rule, but is available to split the diversion for the areas by a percentage.

Priority 8 – Diversion Spilt Request: Splits the diversion based on diversions requested.

Priority 7 – Diversion Spilt Land Area: Currently an inactive rule, but is available to split the diversion based on land area.

Priority 6 – Julius Flat Diversion: Sets the diversion to Julius Flat Reservoir based on time of year and spilling condition of the reservoir.

Priority 5 – Emery Res Diversion: Sets the diversion to Emery Reservoir based on time of year and spilling condition.

Priority 4 – Henningsons Res Release: This reservoir is currently inactive so this rule releases water as it comes into the reservoir.

Priority 3 – Spinners Res Release: Releases 15 cfs from Spinners Reservoir based on time of year, and availability of water.

Priority 2 – Emery Res Release: Releases 15 cfs from Emery Reservoir based on time of year, and availability of water.

Priority 1 – Julius Flat Release: Releases 15 cfs from Julius Flat Reservoir based on time of year, and availability of water.

San Rafael Rules

Initialization Policy Group

Priority 50-41 – Initialization of Reservoir Releases: All reservoir releases are set to either the minimum release or zero

Priority 40-37 – Reservoir Pool Initializations: All pools in Millsite and Joe's Valley Reservoirs are set to their end of irrigation season estimates.

Priority 36 – Huntington North Fill Shortage: Used to track water use of the Huntington Plant during the winter months to be credited to Huntington North Reservoir.

Priority 35 – Junction: Divides the water from CCH Canal to North Ditch and Huntington Canal based on input percentages.

Ferron Creek Policy Group

Priority 34 – Paradise Ditch: If the diversion requested by Paradise Ditch is shorted, Millsite release is increased to meet the demand. Also, bypasses are set on Reach Objects to ensure these additional releases flow to the water user.

Priority 33 – Distribute Inflows: Increases and divides additional releases of Millsite to account for inflows after the reservoir has been filled.

Priority 32 – FCRC: Releases water from FCRC's pool if they are short and water is available in the pool. Also, bypasses are set to ensure the additional water released flows to FCRC.

Priority 31 – FCRC-PacifiCorp: Releases water from PacifiCorp's FCRC pool if they are short and water is available.

Cottonwood Creek Policy Group

Priority 30 – Direct Flow Releases-Inflows: Releases direct flow rights to CCCIC and Lower CWC Canals from Joe's Valley based on inflows into the reservoir.

Priority 29 – CCCIC Storage Releases: If there is not enough water for CCCIC from direct flow, then additional water is released from CCCIC's Joe's Valley pool, if it is available, and the current time-step is between July and October.

Priority 28-25 – Lower Cottonwood Creek Canals: Releases water from Joe's Valley and sets bypasses on upstream reaches to ensure that the lower canal rights are satisfied.

Priority 24 – Hunter Plant-Joe's Valley Storage Releases: Releases additional water to Hunter Plant from PacifiCorp's Joe's Valley pool to meet its demand from Cottonwood Creek. Accounts for pumping inefficiencies, and sets any necessary diversion bypasses as well.

Priority 23 – Hunter Plant-Millsite Storage Releases: Releases additional water to Hunter Plant from PacifiCorp's Millsite pool to meet its demand from Ferron Creek.

Priority 22 – CCH Storage Releases: Releases project water from the CCH pool in Joe's Valley for the HCIC areas at a specified amount for each month during the irrigation season.

Priority 21-20 – City Releases: These rules release project water from the smaller city pools in Joe's Valley and set necessary bypasses.

Priority 19 – Track CCCIC Rights: Simple rule to track rights shortages for CCCIC.

Priority 18 – Joe's Valley Min Release: Ensures that Joe's Valley releases meet the minimum required.

Huntington Creek Policy Group

Priority 15 – Huntington Canal Diversion: Sets diversion requested for the Huntington Canal diversion to remainder of demand after CCH supply is applied. Also limits diversion based on HCIC water right.

Priority 14 – North Ditch Diversion: Sets North Ditch's diversion requested. During irrigation season diversion requested is set to supply the areas served by Huntington North with direct flow rights. Also, water is diverted to account for Huntington Plant's uses during the winter.

Priority 13 – Huntington North Pass Through: Allows direct flow rights to be released from Huntington North to the areas served by the reservoir to meet demand not satisfied by the CCH Canal.

Priority 12 – Huntington North-Electric Lake: Increases Electric Lake's releases to account for Huntington North's fill shortage during early irrigation season, and sets necessary bypasses.

Priority 11 – Huntington Plant Bypass: Restricts the Huntington Plant from calling for water from the LHF during the irrigation season.

Priority 10 – Huntington Plant: Releases water from Electric Lake to fill what would be shortages at the Huntington Plant.

Priority 9-6 – HCIC Reservoir Releases: Releases water, if available, from Huntington or Cleveland Reservoirs to supplement demand for HCIC canals not satisfied by direct flow rights, and or CCH Canal.

Priority 5 – Lower Huntington Canals-Rolfson: Not currently an active rule.

Priority 4 – Lower Huntington Canals-Electric Lake: Releases water from Electric Lake so as to not infringe upon Lower Canal rights.

Priority 3 – HCIC Bypasses: Not currently an active rule.

Priority 2 – Huntington North: Releases water, if available, from Huntington North Reservoir to supplement demand for Huntington North served areas not satisfied by direct flow or CCH canal.

Priority 1 – Min Release: Capable of ensuring a min flow is met for Huntington Creek (currently no min releases are required).

Modeling and Results

Calibration and Initial Conditions

With this framework in place and these operating policies contained within rules, the models are prepared to produce results. A post calibration summary table representing on-the-ground conditions for each model is available in the appendix. These tables show a detailed breakdown of each water user, diversion, reservoir and a number of other potentially useful summaries.

Before the rules were fully completed, the first task in running simulations was to calibrate these models and compare gaged sites with results produced by the models. These calibration simulations refined the rules and inputs to produce the more accurate results in comparison with real world measurements. Effective calibration points for the models are somewhat challenging to come by, because of the lack of long term USGS stream-gages in the area, but other sources were used to adjust and test the accuracy of the models. The following sub-sections outline the calibration methods used to modify the early versions of policies and framework.

River Commissioner Reports

DWRi employs a River Commissioner over many of the regulated streams in the State of Utah. This commissioner's purpose is to safeguard the water rights of all users in their particular stream by overseeing certain aspects of the delivery systems. As part of his or her job each commissioner produces an annual accounting of water usage presented in a report. For the areas of interest there is a commissioner over the Huntington Creek, and Cottonwood Creek. Their reports were used as a guide for calibrating the San Rafael Model. Table 12 and Table 13 list comparisons between the values from the reports with the averages produced by the model in its final calibrated state.

Table 12 - Calibration with Cottonwood Creek River Commissioner Report

Water Users	Reported Uses (ac-ft)								Simulated Uses (ac-ft)
	2005	2006	2007	2008	2009	2010	2011	Average	Average (1950-2009)
CCCIC Direct Flow Uses*	36430	36757	20043	34719	28785	24625	43916	**32182**	**25509**
CCCIC Storage Uses*	4971	4399	4864	4646	4749	5084	2786	**4500**	**4761**
Mill	2453	2162	1812	3121	3142	2249	3000	**2563**	**2563**
Wilberg	352	297	189	264	419	336	395	**322**	**322**
Wilsonville	2348	3096	2056	2599	2329	1642	4000	**2581**	**1096**
*River Commissioner Report shows all uses separate, uses bellow Joe's Valley were summed to give these values.									

Table 13 - Calibration with Huntington Creek River Commissioner Report

Water Users	Reported Uses (ac-ft)							Simulated Uses (ac-ft)
	2006	2007	2008	2009	2010	2011	Average	Average (1950-2009)
Total HCIC Diversions	46919	32183	42789	43032	32607	47440	**40828**	**41720**
Cleveland Canal	29616	24106	28231	28326	19364	24871	**25752**	**29888**
Huntington Canal	12046	6080	10424	9720	7274	12308	**9642**	**4002**

North Ditch	5257	1997	4134	4986	5969	10261	**5434**	**7830**
Huntington Plant	10270	11737	10522	10922	10600	9069	**10520**	**11000**
Lower Canals								
Avery Ditch	356	127	309	300	236	250	**263**	**309**
Brasher Ditch	212	99	120	192	241	283	**191**	**331**
Jeffs Ditch	2336	1105	1471	1998	1756	1885	**1759**	**2722**

Because of many factors these analysis are only beneficial to a degree. In performing this calibration the River Commissioner Reports are represented by handful of years, which makes comparisons with the 60 year modeled period only somewhat valuable. It is also apparent from the commissioner reports that the water diverted from year to year by each canal company can vary widely and simulated averages can easily fall within the range of possibility. As has been discussed in previous sections, in coming years the distribution systems of HCIC, and CCCIC are being altered with its upgrades, and the model has been designed to mirror such. These changes are clearly reflected in the simulated results for HCIC differing significantly from the reported values. Keeping these points in mind, when comparing results, the total for the company most heavily considered.

Historical Stream-flow Records

In the section discussing water supply there is a map (Figure 2) showing stream-gages in the two watersheds. To assess the accuracy of the model some of these gages are useful by comparing simulated flows with measured historical flows. This exercise provides a reasonably useful resource in evaluating the model's behavior. The comparison with gage USGS 09328000 can be seen in Figure 13 and Figure 14. What typically appears to be the case for most of the years is that peak flows are relatively similar in pattern, while simulated late summer and fall flows tend to be lower. This phenomenon could be explained by the fact that irrigation methods have changed through the years and that there is less return flow than there once was.

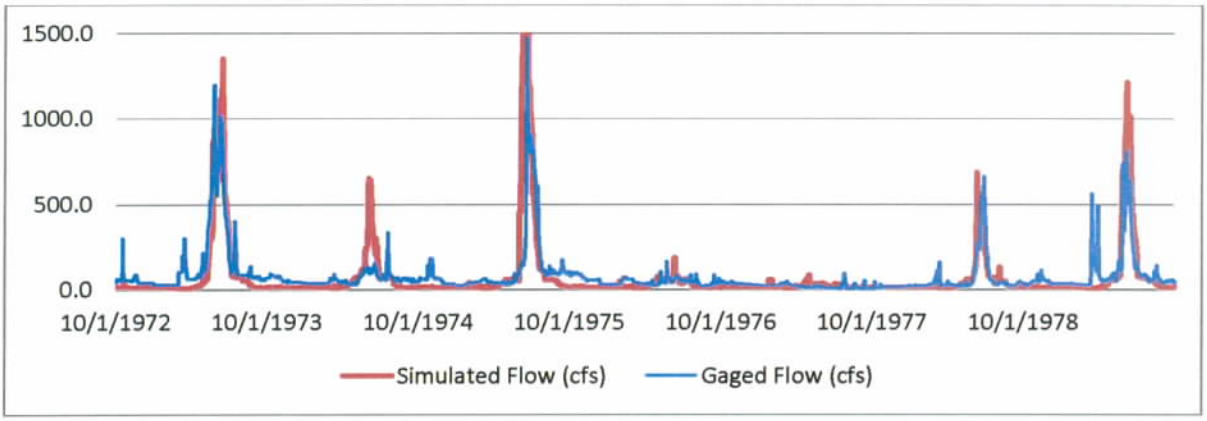


Figure 13 - USGS 09328000 and Simulated Stream-flow Comparison 1972-1979

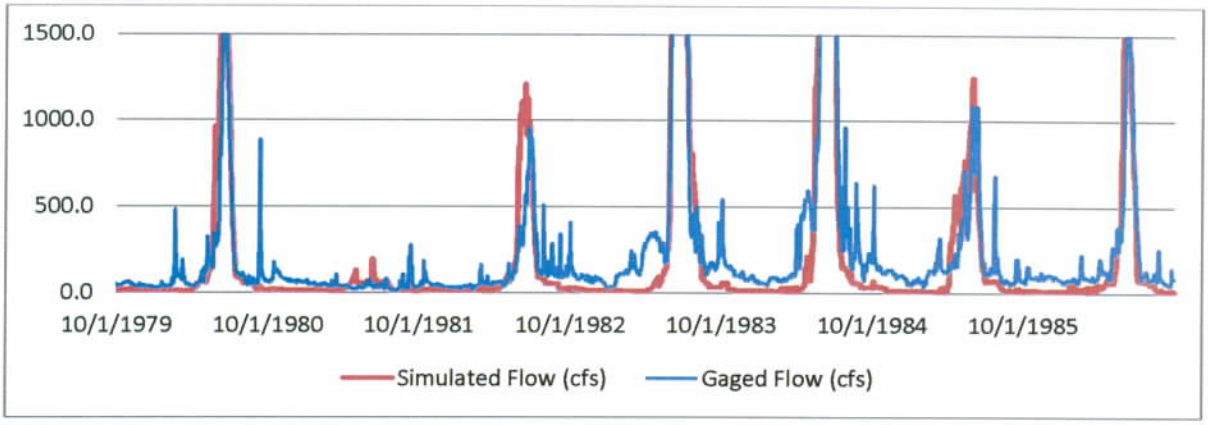


Figure 14 - USGS 09328000 and Simulated Stream-flow Comparison 1979-1986

Historical Storage Records

Another suitable comparison to use in calibration is storage records for reservoirs. True reservoir storage can indicate if the operational criteria coded into the program is reasonable. The largest reservoir in any of the drainages, Joe's Valley, has the longest available record to compare simulated results with. Figure 15 shows this comparison and it follows fairly close to what has historically been the storage pattern. One note to make is that the simulated results tend to have lower peaks and higher valleys. This peculiarity could indicate that the water users on Cottonwood Creek attempt to delay watering slightly longer than the model is representing.

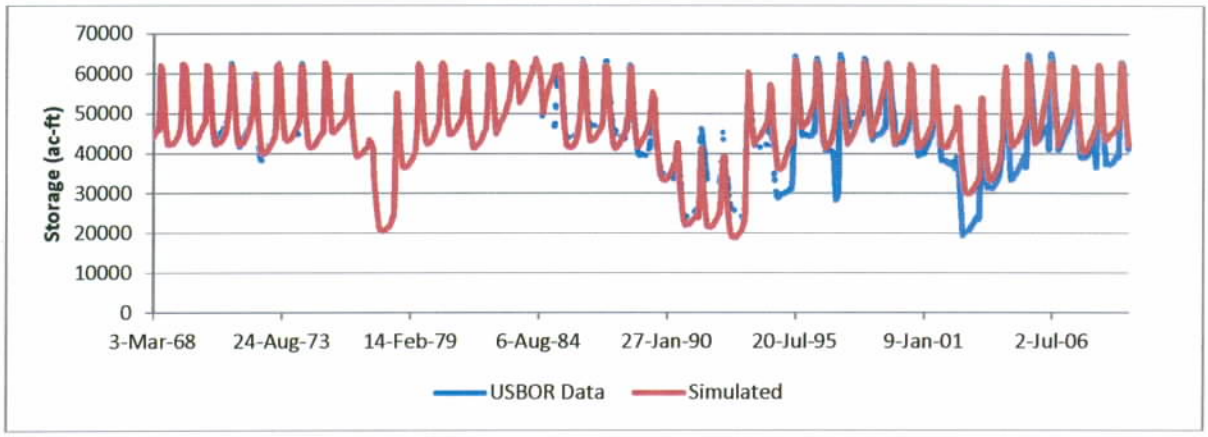


Figure 15 - Joe's Valley USBOR Records and Simulated Storage Comparison

Reservoir Scenarios

Presented in this section are a number of example scenarios of new or modified reservoirs in the models. These scenarios are mainly intended to demonstrate the abilities of the model in providing details on the effectiveness of a particular reservoir plan, but regardless of these purposes the information may still be useful for preliminary decision making. Two scenarios for each model are presented in the following sections. All of the reservoirs modeled came from the list of potential reservoirs provided by stakeholders and narrowed down by members of DWRe's Geology staff.

Raise Rolfson Reservoir

This scenario involves the raising Rolfson Reservoir's dam crest 10 ft, and spillway crest 8 ft. These changes result in new elevation-volume, elevation-area, and spillway tables. No additional inflow is planned for this scenario at this time. The results for this simulation are presented in Table 14. The results show what may be a common theme in the Huntington Creek drainage, and that is that there is very little additional yield in relation to increases in storage from any of these potential sites. Figure 16 also show a max annual storage frequency curve, which represents the statistical likelihood of the reservoir reaching a particular level of storage. A yield-capacity analysis was done to show the potential return on storage for dam raises lower than 10 ft. Figure 17 shows a graph of the results for these simulations.

Table 14 - Raise Rolfson Scenario Results

	Average Annual Values (ac-ft)	
	Existing Conditions	***Reservoir Scenario***
HCIC Diversions	41721	41951
Storage Capacity	504	1010
Evaporation	50	73
Outflow	2875	2863
Increase in Yield		232
Increase in Storage		506
Storage:Yield Ratio		Approximately 2:1

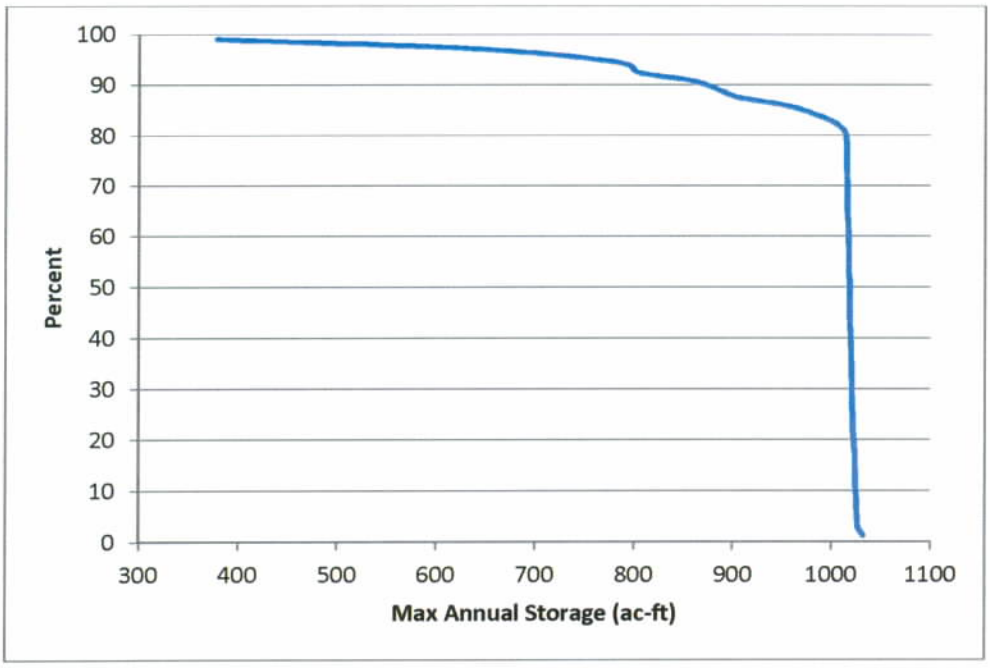


Figure 16 - Max Exceedence Frequency in Percent of Years for Rolfson Reservoir Raised 10 ft

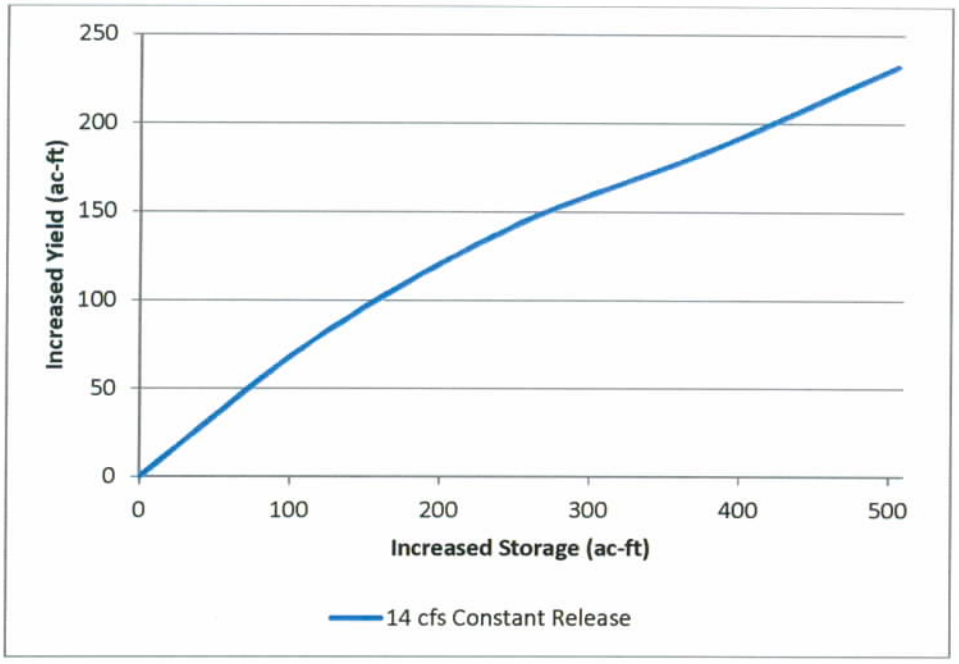


Figure 17 - Rolfson Reservoir Yield-capacity Curve

Raise Miller Flat Reservoir

There are two essential aspects of this scenario to make note of: First is the apparent raising of Miller Flat Reservoir's dam crest by 25 ft, and raising the spillway crest 20 ft, but there is also the additional water supply aspect. Staker Canyon, an adjacent canyon to the North of the Miller Flat drainage, would be diverted to add to the inflows of the reservoir during the filling months. Water supply from this particular canyon was determined using the same methods outlined in the Water Supply section, and specifics on the results can be found in the appendix. Also, the constant release for Miller Flat remained at 40 cfs, and the diversion capacity at Staker Canyon was set to 20 cfs. The results of this scenario, as well as a max annual storage frequency curve, can be found in Table 15 and Figure 18 respectively. A yield-capacity analysis was also done to show the potential return on storage for dam raises lower than 25 ft. Figure 19 shows a graph of the results for these simulations.

Table 15 - Raise Miller Flat Scenario Results

	Average Annual Values (ac-ft)	
	Existing Conditions	***Reservoir Scenario***
HCIC Diversions	41721	42655
Storage Capacity	5250	9440
Evaporation	183	238
Outflow	8214	9792
Increase in Yield		934
Increase in Storage		4190
Storage:Yield Ratio		Approximately 3:1

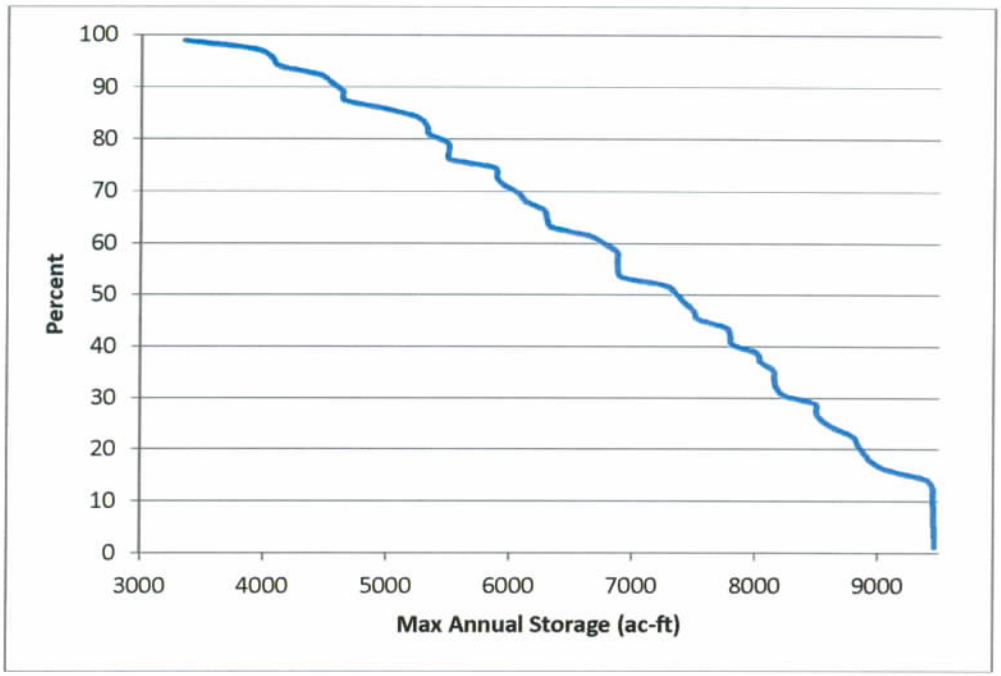


Figure 18 - Max Exceedence Frequency in Percent of Years for Miller Flat Reservoir Raised 25 ft

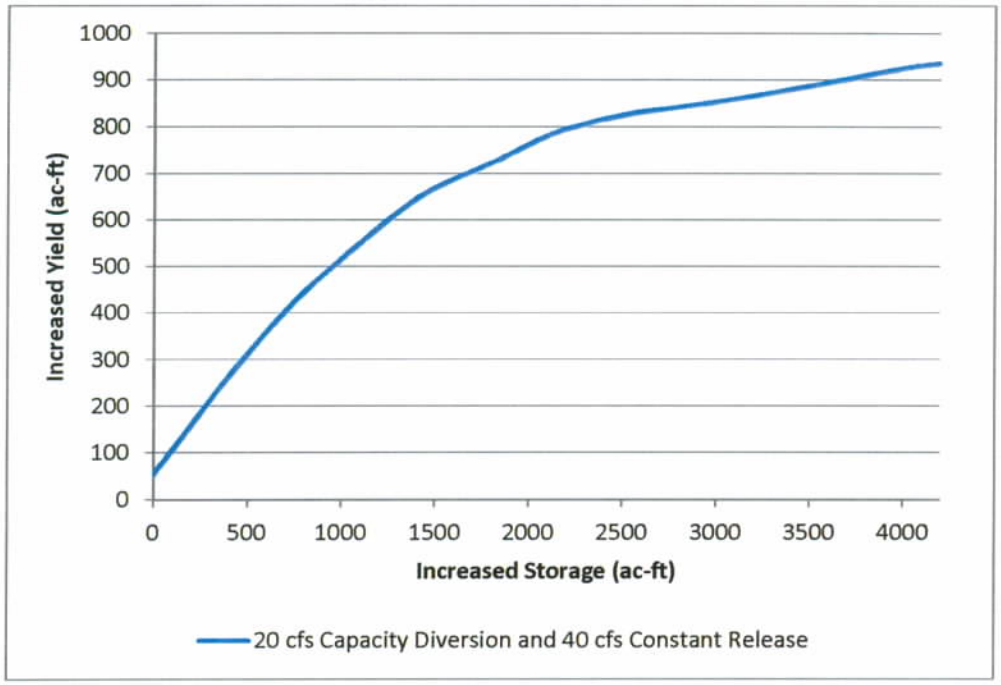


Figure 19 - Miller Flat Reservoir Yield-capacity Curve

Rock Canyon Creek Reservoir

This is a new off-stream reservoir located on a tributary to Cottonwood Creek that joins near the bottom of the watershed. To make this option more feasible, an additional diversion would take water from

Cottonwood Creek to supply the reservoir. Because this reservoir is so low in the watershed there is no current irrigation demand in this area. In order to examine the effectiveness of this scenario it was necessary to apply a fictitious demand of 2000 irrigated acres to this stream. The value 2000 acres was simply an arbitrary number that appeared to fit the water supply and size of the reservoir. The diversion, which would also be significantly downstream, was given a capacity of 100 cfs. As with most scenarios that include an additional diversion, just the diversion alone gives an initial boost to yield. The new reservoir also increases yield at nearly a one to one rate for lower capacities, but starts to tapper of toward the max possibility. The following Table 16 and Figure 20 show the results of this scenario. Figure 21 gives the results of a yield-capacity analysis.

Table 16 - Rock Canyon Creek Reservoir Scenario Results

	Average Annual Value (ac-ft)	
	Existing Conditions	***Reservoir Scenario***
New User Diversions	2337	7243
Storage Capacity	NA	13741
Evaporation	NA	1762
Outflow	NA	7333
Increase in Yield		4906
Increase in Storage		13741
Storage:Yeild Ratio		Approximately 3:1

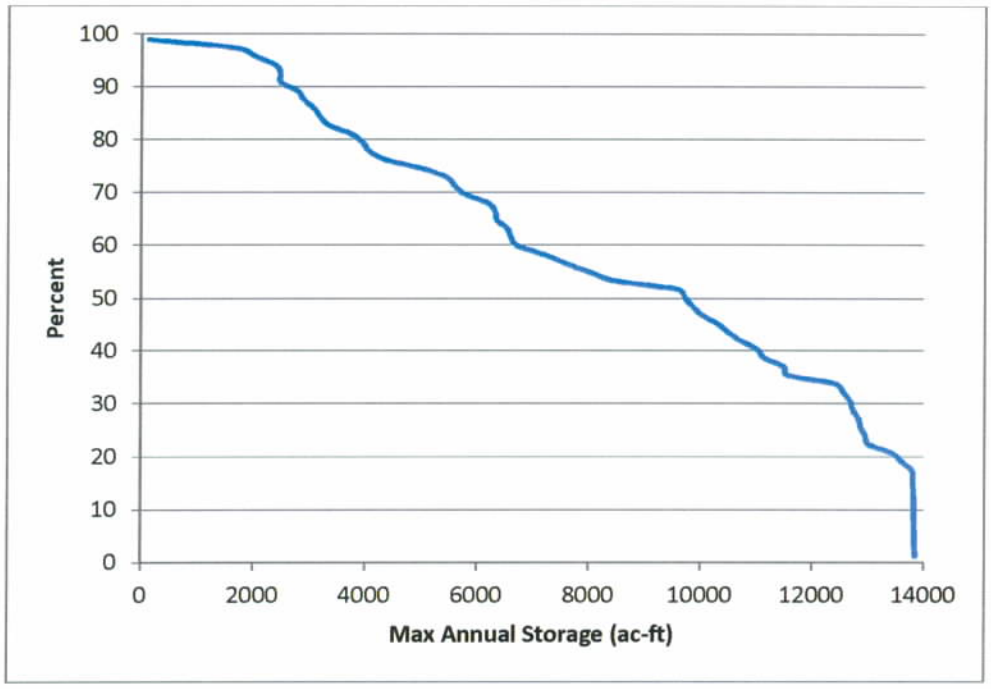


Figure 20 - Max Exceedence Frequency in Percent of Years for Rock Canyon Creek Reservoir

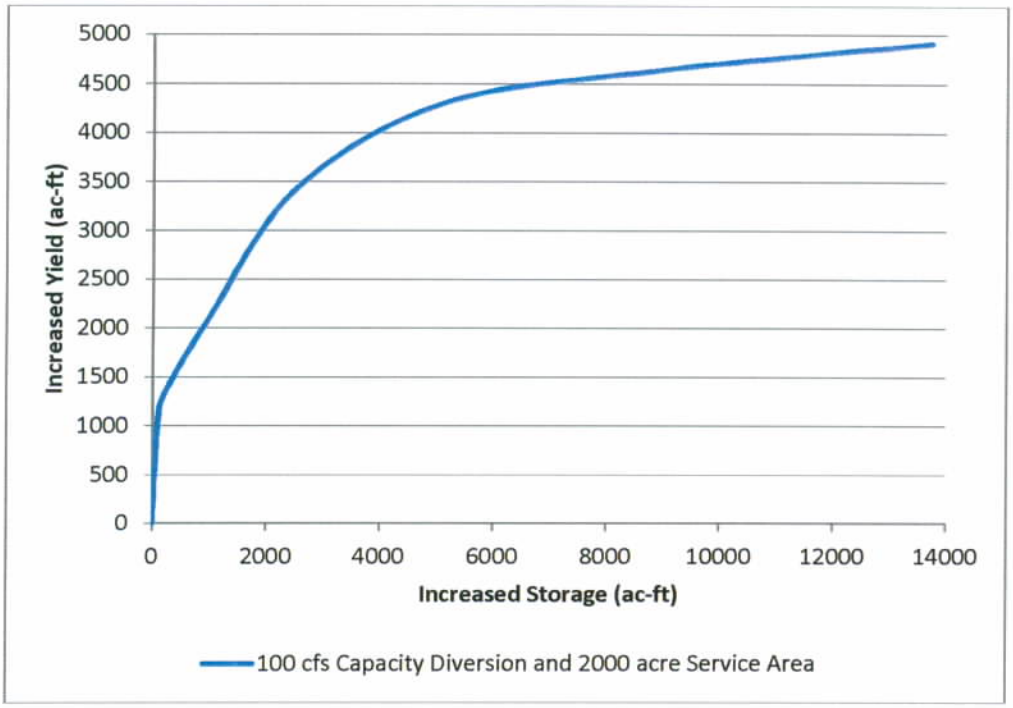


Figure 21 - Yield-Capacity Curve for Rock Canyon Creek Reservoir

Raise Spinners Reservoir

Like other scenarios, raising Spinners Reservoir involves two aspects: increasing the height of the dam and spillway crests 24 ft, and diverting Horse Creek into the reservoir. A diversion capacity of 20 cfs was applied to the Horse Creek diversion. The results of this scenario underscore the current problem with Spinners Reservoir–the issue being it doesn't annually fill. To make raising Spinners a more viable option for more storage in the Muddy Creek drainage it was suggested to divert water from another drainage. It is apparent from the results, however, that the combination of diverting and raising the reservoir is not what ultimately produces additional yield. On the other hand, just the diversion from Horse Creek alone could be a simple way to ensure Spinners Reservoir fills and increase yield. The following Table 17and Figure 22 show the results of this scenario. Figure 23 gives the results of a yield-capacity analysis done for dam raises 24 ft and less.

Table 17 - Raise Spinners Reservoir Scenario Results

	Average Annual Value (ac-ft)	
	Existing Conditions	***Reservoir Scenario***
MCIC Diversions	17843	18082
Storage Capacity	638	1041
Evaporation	17	31
Outflow	425	804
Increase in Yield		239
Increase in Storage		403
Storage:Yeild Ratio		Approximately 2:1

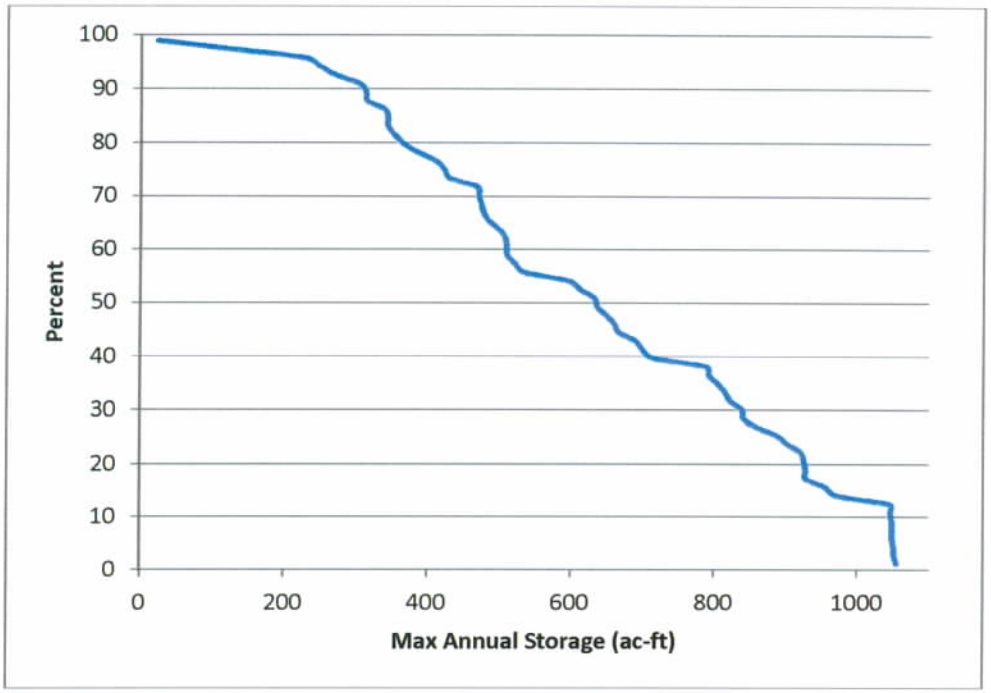


Figure 22 - Max Exceedence Frequency in Percent of Years for Spinners Reservoir

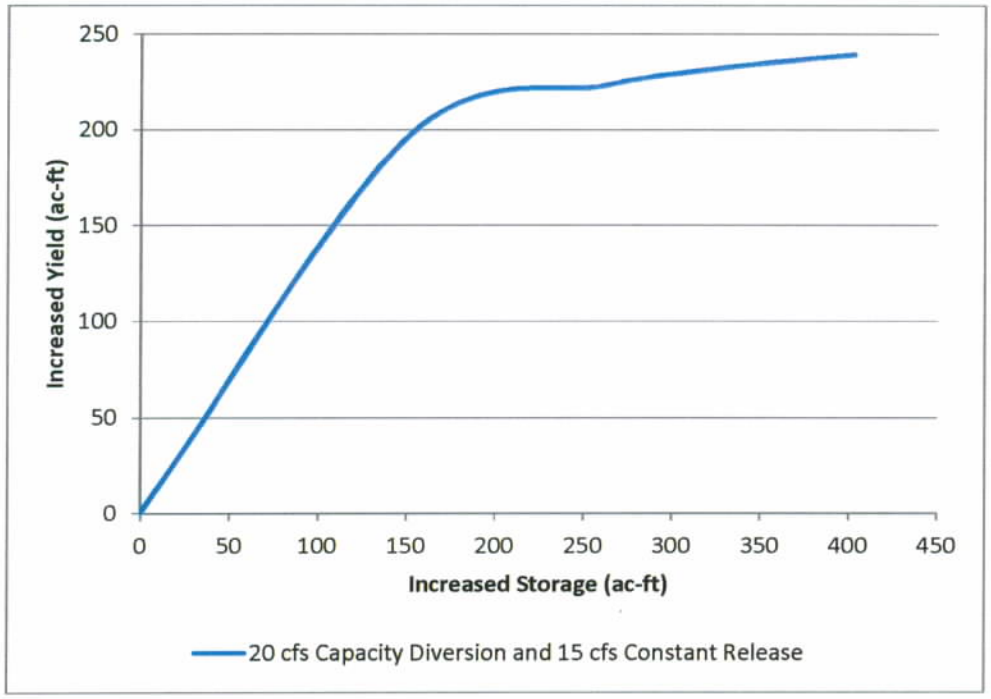


Figure 23 - Spinners Reservoir Yield-capacity Curve

Emery – New On-stream Reservoir

This potential reservoir would be located well below the main diversion on Muddy Creek, and its likely uses would, of course, be limited by its positioning in the watershed. For this scenario instead of investigating this reservoir as an irrigation supply, it will be treated as a base-flow supply. Supposing there is interest in maintaining a base flow on the Muddy Creek, this reservoir could facilitate in meeting this flow during times when stream-flow is exceptionally low. A target base-flow of 20 cfs was selected as an arbitrary flow to test, but does not represent any official base-flow desired by stakeholders. Results from this type of application of a potential reservoir require somewhat different presentation than an irrigation analysis. Figure 24 shows a graph of how the downstream flow of the river is effected by a new reservoir. Figure 25 is a graph of the frequency of filling, similar to other scenarios already discussed. From Figure 24 you can observe that, on average, the modeled base flow without the reservoir is around 9.5 cfs, while with the reservoir it is about 14 cfs, thus maintaining a 3.5 cfs higher base flow.

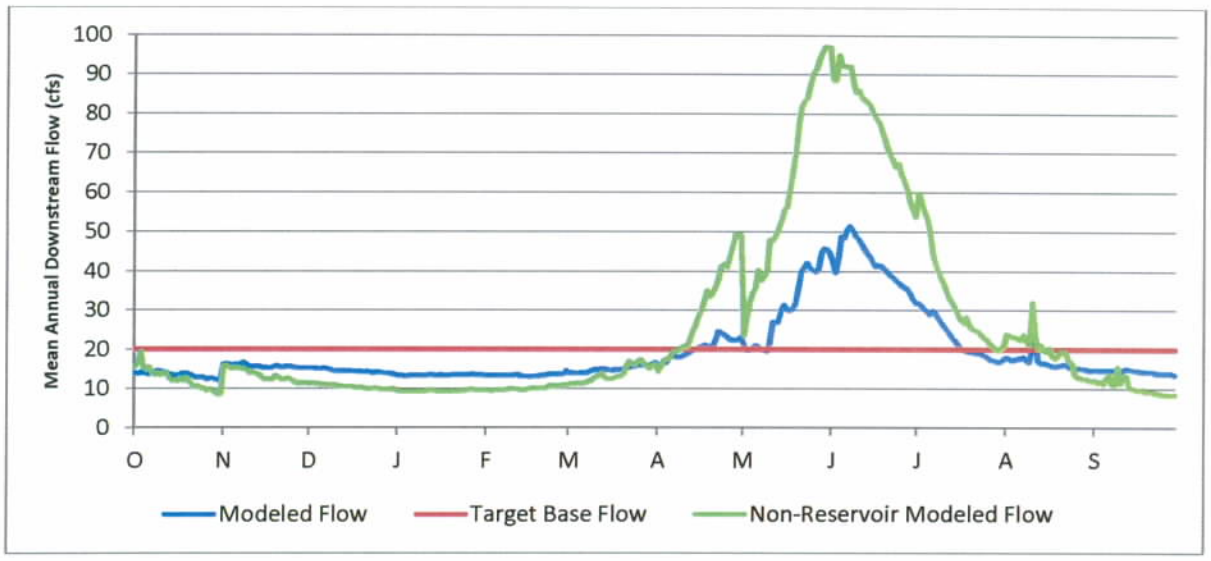


Figure 24 - Average Annual Flow Downstream from Emery Reservoir (New)

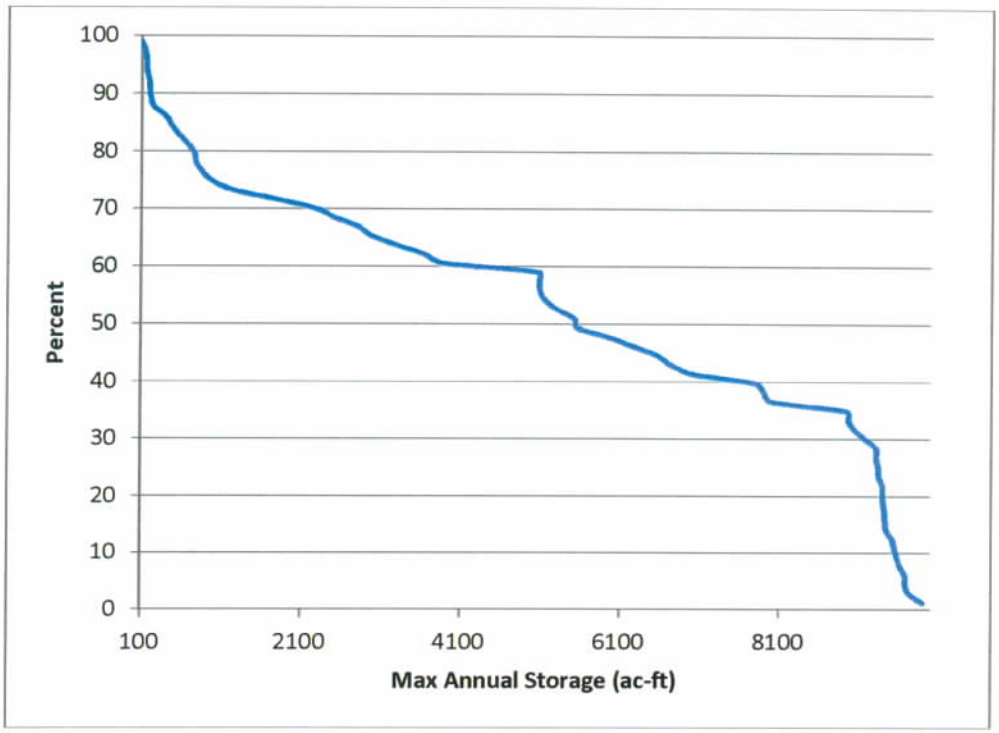


Figure 25 - Max Exceedence Frequency in Percent of Years for Emery Reservoir (New)

Conclusion and Recommendations

The work undertaken to produce these river models has resulted in two working RiverWare models that are available at the disposal of stakeholders. These products provide a relatively accurate baseline to start from in representing the Muddy Creek and San Rafael River Basins.

As the purpose of this report is to detail the development of the San Rafael River and Muddy Creek Models, no official recommendations regarding potential reservoirs are going to be offered. However, the results from the scenarios presented are just a glimpse into the benefits of these models. There are many possibilities other than reservoir scenarios that could be explored. Alternate operational practices, diversion improvements, or demand adjustments are just a few of the variations that could be examined by either of the models. It is therefore recommended that these models be considered a valuable tool in any future decisions pertaining to the San Rafael and or Muddy Creek watersheds.

It is anticipated that the San Rafael River and Muddy Creek models will remain in the care of DWRe. Any maintaining or additional development would be the duty of DWRe. Scenarios to be explored may come at the recommendation of stake holders, but these changes and simulation runs would be implemented by DWRe.

Appendix

Summary Tables and Charts of Model Results Under Existing Conditions

SUMMARY DATA FOR SAN RAFAEL MODEL — *Scenario: Existing Conditions* — 8/16/2012 7:40 AM

Diversions and Water Users

	Mean Annual Diversion (acre-ft)	Mean Annual Shortage (acre-ft)	Mean Annual Shortage %
HUNTINGTON CREEK			
Huntington Plant	11000	0	0%
Cleveland Canal Diversion	29888	6924	19%
Huntington Canal Users	8537	1796	17%
Huntington Canal Diversior	4002		
North Ditch Diversion	7830		
Huntington North Users	14057	4642	25%
Lower Huntington Canals	3363	474	12%
Avery Canal	309	1	0%
Jeffs Canal	2722	313	10%
Brasher Canal	331	161	33%
HCIC TOTAL DIVERSIONS	41721		
TOTAL USE (Including CCH)	66845	13836	17%
COTTONWOOD CREEK			
CCCIC	80270	10231	25%
Class 1	25142		
Class 2	4213		
Class 3	915		
Class 4	0		
Hunter Plant (CCCIC)	5720		
Hunter Plant (Joe's Valley)	3838	0	0%
CCH Canal	11338	57	0%
Lower CWC Canals	3981	805	17%
Mill Ditch	2563	113	4%
Willberg Ditch Class 1	121	31	20%
Willberg Ditch Class 2	201	153	43%
Wilsonville Ditch	1096	509	32%
Cities (Joe's Valley)	100	0	0%
Castledale	55	0	0%
Orangeville	45	0	0%
TOTAL	55247	11093	17%
FERRON CREEK			
Hunter Plant (Millsite)	4920		
Hunter Plant (FCRC)	4373		
FCRC	24155	9988	29%
Paradise Ditch	716	38	5%
TOTAL	34164	10027	23%

Reservoirs

	Mean Annual Outflow (acre-ft)	Mean Annual Evaporation (acre-ft)
HUNTINGTON CREEK		
Electric Lake	7635	556
Huntington Res	4144	146
Cleveland Res	5404	120
Rolfson Res	2875	50
Miller Flat Res	8214	183
Huntington North	14159	953
New Reservoir		
COTTONWOOD CREEK		
Joe's Valley Res	74168	3271
New Reservoir		
FERRON CREEK		
Millsite Res	47764	1950
New Reservoir		

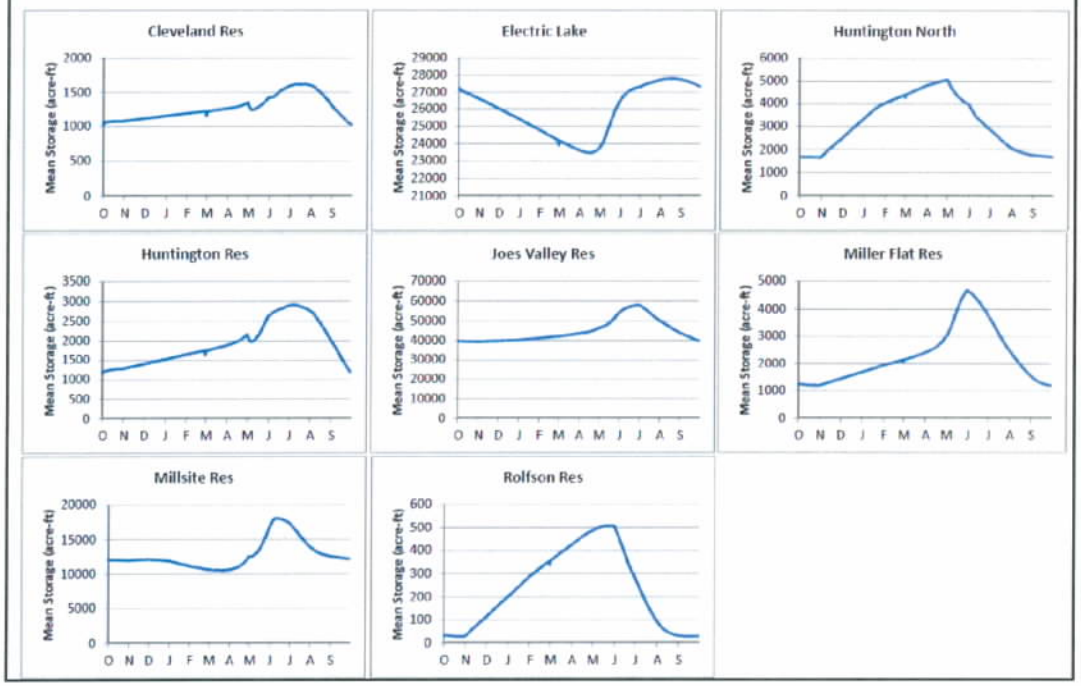
Other Summaries

	Mean Annual Flow (cfs)	Mean Annual Flow (acre-ft)
DOWN STREAM FLOWS		
Huntington Creek	22	15849
Cottonwood Creek	37	26685
Ferron Creek	26	18819
TOTAL	85	61352
Non-Diverted Huntington	16.8	12135
Non-Diverted Cottonwood	26	18625
Non-Diverted Ferron	13.0	9440
San Rafael w/Reach Gain	85	61342
OTHER FLOWS		
Huntington Creek RHF	21	15222
Huntington Creek LHF	45	32793

	Mean Annual Depletion (acre-ft)	Mean Annual Call (acre-ft)
HUNTER PLANT		
Cottonwood Creek	9558	11718
Joes Valley	3838	4826
CCCIC	5720	6891
Millsite	9292	9292
TOTAL	18851	21010

	Mean Annual Diversion (acre-ft)
HUNTINGTON PLANT	
HCIC Rights	6896
Private Rights	4104

SUMMARY DATA FOR SAN RAFAEL MODEL — *Scenario: Existing Conditions* — 8/16/2012 7:40 AM



SUMMARY DATA FOR MUDDY CREEK MODEL Scenario: Existing Conditions *9/6/2012 8:26 AM*

Diversions

	Mean Annual Diversion (acre-ft)	Mean Annual Shortage (acre-ft)	Mean Annual Shortage %
Total Diversion	17843		
Emery	12952	8288	39%
Moore	4891	3130	39%
Emery Reservoir Diversion	83		
Julius Flat Reservoir Diversion	590		

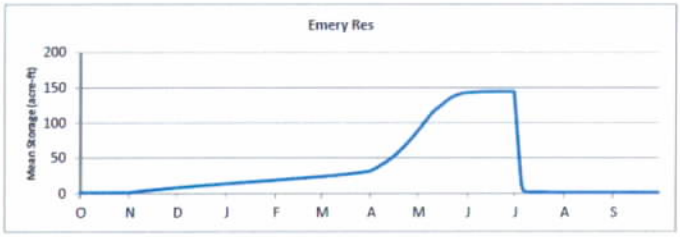
Reservoirs

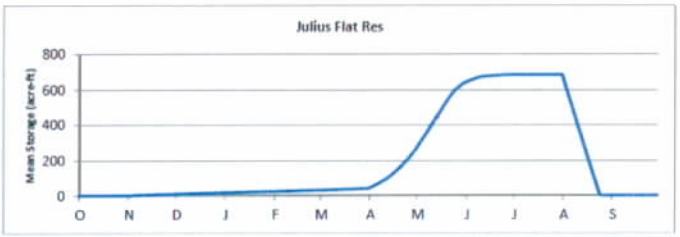
	Mean Annual Outflow (acre-ft)	Mean Annual Evaporation
Emery Reservoir Outflow	345	7
Julius Flat Reservoir Outflow	933	47
Spinners Reservoir Outflow	425	17
Henningson Reservoir Outflow	358	3
NEW Reservoir Outflow		

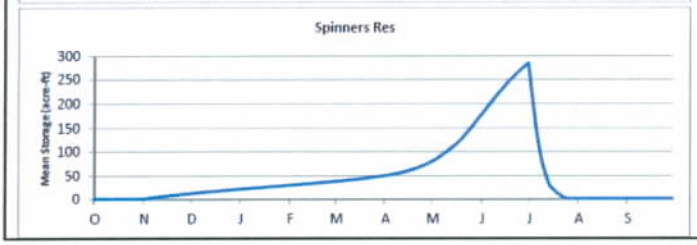
Other Summaries

	Mean Annual Flow (acre-ft)
San Rafael Return Flow	140
Muddy Creek Non-Diverted Water	9626
Muddy Creek Down-Stream Flow	13908

SUMMARY DATA FOR MUDDY CREEK MODEL Scenario: Existing Conditions *9/6/2012 8:26 AM*







Monthly Stream-gage Records and Correlation Summaries

09326500 FERRON CREEK (UPPER STATION) NEAR FERRON, UT														
Year	Exp	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
1912	0	883	1089	720	492	403	611	1297	14642	27842	7144	2505	1230	58858
1913	0	1234	1031	821	492	444	738	3201	15806	12385	4621	1682	2438	44893
1914	0	825	657	553	553	484	897	3037	28859	23379	8424	3193	1587	72448
1915	0	1248	833	738	676	611	845	3289	9408	18478	4356	1892	1194	43568
1916	0	587	536	615	573	518	1073	4223	13240	23020	6861	5780	1763	58789
1917	1	431	134	124	61	89	139	547	1596	3561	1082	295	195	8254
1918	0	978	811	738	676	555	1222	1650	10661	14688	4266	2878	2511	41634
1919	0	980	524	430	399	444	536	4863	19807	6978	2535	2104	1329	40929
1920	0	760	746	615	430	518	746	2029	20616	19349	4354	2194	1371	53728
1921	1	95	75	68	84	93	103	188	1389	3803	945	436	222	7501
1922	0	1803	1240	1140	599	1111	1575	2515	20824	22705	3749	2561	1781	61603
1923	0	1438	1484	797	615	555	851	1363	18488	17609	6976	4167	2563	56906
1948	0	922	833	738	615	575	611	1253	11724	9421	4262	1773	819	33546
1949	0	770	561	524	478	389	811	5625	16973	24494	6363	4086	1335	62409
1950	0	1057	714	512	411	545	745	2591	10151	10042	5193	2307	1004	35272
1951	0	737	895	696	553	528	788	1983	10982	14876	6060	2832	1779	42709
1952	1	92	56	54	50	59	87	620	2991	3626	1133	455	303	9526
1953	0	1555	897	817	750	694	892	1488	5574	16859	6466	2541	1831	40364
1954	0	976	689	654	641	677	762	3977	10070	4019	3550	1297	964	28276
1955	0	616	490	523	492	458	487	1107	7672	8325	4479	3130	887	28666
1956	0	611	388	468	408	415	887	2118	12440	9517	5215	1406	728	34601
1957	1	70	48	43	43	44	56	136	710	3517	1280	400	260	6607
1958	0	2099	1224	887	738	680	904	3661	27267	24190	6290	2959	1254	72153
1959	0	767	601	460	366	433	549	1888	5522	5486	3114	1219	680	21085
1960	0	467	394	270	217	282	906	2612	10255	10588	4657	1192	902	32742
1961	0	819	481	356	310	305	534	1230	7317	5403	3459	2110	1287	23611
1962	0	1041	883	662	575	635	986	7087	17645	22397	7741	3362	1357	64371
1963	0	1065	474	263	184	305	505	964	11308	11147	4052	3102	1676	35045
1964	0	686	558	370	366	374	505	960	10092	13144	4687	2755	1006	35503
1965	0	698	662	615	615	555	515	2076	9652	29417	15366	4463	2251	66885
1966	0	2041	1093	986	662	613	1549	3868	10407	4120	3170	1575	611	30695
1967	0	719	562	697	523	569	841	813	8350	14757	6202	2658	1597	38288
1968	0	889	598	540	501	535	634	1004	8717	19107	5752	2438	1555	42270
1969	0	1186	744	524	445	460	889	3154	25043	17359	6506	3217	1468	60995
1970	0	1004	854	655	734	682	687	1140	14767	17944	6315	2719	1212	48713
1971	0	1055	767	540	438	595	1113	3068	9057	15525	5728	3483	1123	42492
1972	0	950	769	738	738	690	1315	2307	8892	8208	2501	1299	1146	29553
1973	0	1079	709	674	553	456	698	2091	18046	18591	6857	2156	1099	53009
1974	0	924	730	615	615	567	746	1367	13724	13129	3911	1563	958	38849
1975	0	922	703	611	525	464	635	992	9550	31521	12397	3328	1581	63229
1976	0	1194	988	740	476	278	365	1523	10098	6827	1997	904	682	26072
1977	-1	7478	9223	4899	4304	3511	3084	17591	27570	23980	10556	7375	7599	127170
1978	0	534	479	439	324	256	637	1605	7884	22854	7158	2400	1204	45774
1979	0	879	762	635	450	490	766	2967	17635	22177	6323	2333	1099	56516
1980	1	86	83	71	72	79	82	363	1670	3222	1061	253	175	7217
1981	0	1283	875	748	589	536	674	3336	7718	7757	1823	1192	1950	28481
1982	0	1014	1130	573	498	709	733	2146	15979	23468	10385	3191	1924	61750
1983	1	214	170	83	72	76	121	213	1517	3856	2485	789	253	9849
1984	1	202	130	113	84	87	106	267	2638	4354	1366	625	203	10175
1985	0	3400	1914	1323	837	708	1319	7601	18341	14241	4528	1773	1279	57264
1986	0	1000	562	424	470	697	1622	3826	17127	27390	6180	2158	1317	62773
1987	0	1285	938	740	526	483	780	4679	13476	6762	2164	1281	899	34013
1988	0	778	887	811	635	427	938	2632	10752	8834	2481	1186	752	31113
1989	0	762	594	601	580	646	1049	3751	8140	4629	1785	1349	871	24757
1990	0	719	598	490	463	446	655	2053	7486	8029	2380	1315	1055	25689
1991	0	843	792	582	388	413	488	1062	6555	15626	5004	2100	1168	35021
1992	0	805	791	609	619	595	720	3318	11230	4578	1763	1061	760	26849
1993	0	643	524	402	384	331	1109	2473	20910	17994	6893	2285	1864	55812
1994	0	1261	849	766	539	460	727	1918	9872	6496	1609	763	554	25814

1995	0	658	381	477	558	357	490	1567	8378	26826	14467	3943	2035	60137
1996	0	1388	1067	846	771	920	1178	2481	16471	13388	3267	1200	942	43919
1997	0	833	746	597	538	430	1266	3205	22491	24581	5583	2257	2227	64754
1998	0	1712	1428	1182	1214	1686	1644	2303	12016	19732	7152	2658	2011	54738
1999	0	1581	1277	928	859	724	1148	2077	12571	17532	5111	2579	1928	48315
2000	0	1097	785	714	712	694	944	3757	14884	5613	1829	1176	966	33171
2001	0	1006	693	571	636	628	1320	2563	18526	8473	2963	2049	1430	40858
2002	0	920	699	597	505	470	673	2049	9013	4623	1716	849	818	22932
2003	0	815	505	340	333	297	662	1738	13712	11373	2916	1906	859	35456
2004	0	778	589	383	400	450	1348	3263	13999	10114	3233	1488	889	36934
2005	0	1057	870	659	730	649	827	2553	20327	21435	6780	2690	1458	60035
2006	0	1178	902	463	492	552	743	3560	27047	17155	4141	1968	1402	59603
2007	0	1950	1119	1250	879	734	1410	3632	12885	5351	1809	1113	869	33001
2008	0	974	669	497	398	446	843	1936	12710	18036	5062	1900	1087	44558
2009	0	885	689	652	561	518	581	1820	21717	12589	2858	1081	821	44772
2010	0	704	493	427	484	420	594	1428	6020	15882	2848	1611	887	31798

09318000 HUNTINGTON CREEK NR HUNTINGTON, UTAH (Acre-Feet) - *Correlated Years

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM	ANN
*1912	2288	2234	2574	4100	1676	2281	3774	24019	35667	10221	4949	2423	96205	93258
*1913	2547	2301	2434	4100	1737	2467	6102	26113	10698	7715	3993	4019	74226	70316
1914	2880	2570	2930	3220	2350	3250	8000	46970	28220	8890	6280	3320	118880	118880
1915	3490	2420	1860	2130	1770	2700	7440	13760	14070	7620	3900	2490	63650	63650
1916	2520	2330	2390	2370	2060	3360	7630	33780	28560	8690	7240	3240	104170	104170
1917	3460	2140	2180	1540	1670	2750	5510	25700	46330	13950	6240	4030	115500	115500
*1918	2362	2546	2546	1317	1919	3153	4203	16893	14429	7367	5375	4111	66221	65011
*1919	2362	2870	2977	5418	1737	2181	8135	33274	1977	5637	4477	2555	73599	63812
*1920	2199	2613	2727	4979	1858	2481	4669	34724	21955	7447	4580	2608	92840	84850
*1921	2340	2613	2629	0	2480	2882	4485	22676	52125	12517	7079	3729	115554	119797
1922	3860	3050	2460	2770	2500	3130	4610	31970	32920	10640	7530	3080	108520	108520
1923	1070	1750	2800	2980	2500	3070	4900	30850	19570	11100	5680	3120	89390	89390
1925	1990	1960	1570	1700	1580	2170	6190	12850	7250	5930	4150	2090	49430	49430
1927	2020	1740	1850	1970	1890	2130	4080	23350	15460	6870	5470	4680	71510	71510
1928	2160	2070	1660	1660	1550	2280	5480	33800	13580	7670	3270	2060	77240	77240
1929	2330	1910	1660	1660	1670	2460	2690	22420	21910	9130	5560	4700	78100	78100
1938	2580	1680	1940	1800	1630	1950	6860	20060	15370	7870	4500	2240	68480	68480
1940	1780	1410	1260	1170	1320	1720	4300	22980	9410	6180	2190	2140	55860	55860
1941	1910	1530	1640	1480	1470	1850	2460	32300	22060	9860	4770	4160	85490	85490
1942	3830	2610	2180	2030	1670	2100	8300	22860	22510	9370	4970	2330	84760	84760
1943	2260	2100	2060	1970	1760	2050	10610	12990	12560	7510	4550	1980	62400	62400
1944	2210	1650	1730	1410	1440	2020	2680	27670	28560	9800	6250	2420	87840	87840
1945	2280	2080	1840	1720	1600	2180	3160	18750	14240	8950	5800	2830	65430	65430
1946	2250	1960	1720	1600	1390	2130	10310	13800	9950	7490	3210	1700	57510	57510
1947	2650	1930	1760	1700	1710	2200	5440	21780	11920	9470	5700	2370	68630	68630
1948	2420	2170	2310	1970	1840	1940	3090	13780	7870	6150	3230	1690	48460	48460
*1949	2207	2825	2852	4246	1661	2567	9078	28190	30257	9445	6768	2555	102650	99088
*1950	2421	2658	2866	5272	1904	2467	5354	15980	6919	8282	4719	2120	60961	54517
*1951	2185	2457	2601	3221	1873	2539	4607	17466	14736	9147	5317	3148	69297	66752
*1952	2318	2825	2824	3953	1964	2653	9776	51356	49266	14386	7298	4797	153416	153053
*1953	2791	2446	2434	291	2116	2682	4007	7781	17934	9554	4983	3214	60234	62909
*1954	2362	2680	2671	1903	2101	2496	7057	15837	0	6651	3556	2067	49380	43054
*1955	2093	2903	2848	4070	1764	2105	3538	11544	4149	7575	5663	1971	50223	43688
*1956	2088	3015	2922	5272	1691	2682	4779	20080	6079	8302	3682	1763	62354	53450
*1957	2155	2914	2977	4979	1737	2210	3848	10520	47506	15848	6665	4230	105587	105115
*1958	3190	2089	2337	438	2101	2696	6665	46629	29772	9375	5467	2449	113209	115100
*1959	2204	2779	2935	5916	1726	2194	4495	7695	0	6218	3462	1698	41323	31238
*1960	1985	3015	3200	8055	1494	2710	5379	16159	7807	7755	3429	1988	62975	50379
*1961	2243	2913	3080	6736	1532	2173	3689	10909	0	6561	4488	2498	46822	35386
*1962	2406	2468	2657	2781	2040	2824	10866	29389	26881	10817	5928	2594	101653	102340
*1963	2429	2926	3214	8640	1539	2124	3358	18057	8711	7148	5628	3016	66792	54156
*1964	2148	2825	3061	5857	1630	2138	3358	15873	11925	7785	5237	2133	63970	54944
*1965	2155	2714	2727	2342	1919	2138	4730	15085	38219	18403	7194	3768	101393	106446

*1966	3146	2234	2198	1610	1995	3625	6922	16446	0	6274	3866	1605	49920	47012
*1967	2170	2825	2601	3660	1934	2610	3174	12758	14542	9286	5122	2911	63593	59493
*1968	2295	2781	2824	3953	1888	2310	3407	13420	21567	8839	4868	2858	71011	66046
*1969	2517	2624	2852	4686	1767	2682	6040	42637	18741	9594	5766	2739	102646	96789
*1970	2377	2502	2671	584	2101	2396	3578	24251	19678	9405	5191	2397	77130	76589
*1971	2421	2591	2824	4832	1979	2996	5942	14029	15769	8819	6066	2278	70547	66407
*1972	2340	2592	2549	467	2116	3289	5008	13728	3960	5609	3554	2312	47524	45145
*1973	2436	2658	2643	3221	1767	2410	4742	30123	20728	9942	4546	2251	87467	83684
*1974	2318	2636	2727	2342	1934	2481	3860	22372	11909	7009	3855	2067	65509	60396
*1975	2318	2669	2727	3514	1767	2310	3395	14906	41610	15450	5893	2885	99443	100435
*1976	2517	2346	2546	4246	1494	1924	4044	15891	1734	5110	3095	1698	46645	39425
*1977	2190	2421	2894	4979	1602	1850	4337	2745	0	4172	2907	1803	31899	17494
*1978	2029	2914	2963	6590	1464	2324	4142	11917	27608	10240	4822	2383	79397	71761
*1979	2288	2602	2699	4686	1812	2510	5820	29389	26526	9405	4742	2251	94730	89432
*1980	2273	2524	2588	731	2268	2581	6628	27707	42741	13670	4972	3109	111792	115133
*1981	2586	2474	2535	2650	1882	2373	6268	11627	3232	4934	3431	3373	47364	43384
*1982	2384	2189	2782	3953	2146	2453	4815	26418	28609	13452	5732	3333	98267	98021
*1983	3220	1554	2421	731	2222	3139	4791	24967	52981	27827	11144	4138	139134	158358
*1984	3131	2000	2003	0	2389	2925	5452	45036	61024	16703	9255	3478	153396	163711
*1985	4152	1319	1739	0	2146	3296	11491	30643	13702	7626	4097	2489	82699	90647
*1986	2377	2825	2991	4393	2131	3725	6873	28476	34940	9266	4546	2542	105085	99712
*1987	2591	2401	2546	3514	1797	2524	7914	21942	1621	5269	3533	1988	57641	52481
*1988	2214	2457	2448	2049	1721	2753	5403	17055	4964	5588	3429	1790	51872	47702
*1989	2201	2787	2739	2781	2049	2909	6776	12382	0	4897	3612	1949	45083	37268
*1990	2169	2783	2894	4495	1746	2346	4697	11211	3671	5488	3573	2192	47264	38799
*1991	2258	2569	2768	5564	1691	2110	3480	9553	15947	8093	4477	2344	60855	54123
*1992	2236	2569	2727	2196	1979	2439	6249	17914	0	4872	3279	1803	48262	40722
*1993	2111	2870	3019	5711	1570	2996	5207	35243	19759	9972	4684	3254	96395	88216
*1994	2570	2503	2510	3382	1767	2449	4531	15483	1195	4722	2937	1531	45579	39004
*1995	2125	3026	2908	3074	1615	2110	4105	12812	34036	17508	6595	3491	93406	95410
*1996	2665	2256	2393	0	2465	3096	5220	27295	12329	6373	3440	2040	69573	68756
*1997	2251	2613	2741	3367	1721	3225	6114	38072	30402	8670	4661	3742	107579	102980
*1998	2902	1855	1933	0	3633	3754	4999	19328	22569	10230	5122	3452	79777	86492
*1999	2806	2022	2281	0	2161	3053	4730	20313	19016	8202	5029	3346	72960	75965
*2000	2451	2569	2588	877	2116	2753	6787	24448	0	4941	3417	2080	55028	51085
*2001	2384	2680	2782	1903	2025	3296	5318	30983	4383	6065	4419	2687	68925	63714
*2002	2318	2670	2745	3880	1782	2371	4692	13945	0	4828	3036	1880	44147	34271
*2003	2244	2881	3102	6443	1524	2353	4313	22354	9067	6025	4258	1935	66499	54862
*2004	2214	2792	3047	5418	1752	3339	6175	22873	7032	6333	3774	1974	66723	57260
*2005	2421	2479	2657	584	2055	2596	5305	34205	25331	9863	5156	2726	95379	95229
*2006	2510	2446	2935	4100	1904	2467	6543	46236	18418	7238	4327	2647	101770	94490
*2007	3080	2201	1836	0	2177	3425	6628	20868	0	4922	3337	1948	50420	50789
*2008	2355	2703	2880	5418	1752	2610	4558	20563	19839	8153	4246	2238	77315	69807
*2009	2288	2680	2671	3074	1858	2238	4411	36694	11037	5965	3302	1882	78102	70135
AVE.	2440	2446	2527	3016	1876	2571	5455	22643	17719	8783	4845	2666	76987	74121

Linear Regression Correlation Coefficients

1 OCT A=0.163717364E+04, B=0.739657500E+00, R= 0.595079, R*R= 0.354120
2 NOV A=0.344989081E+04, B=-.111549648E+01, R= 0.521026, R*R= 0.271468
3 DEC A=0.357559262E+04, B=-.139160625E+01, R= 0.552392, R*R= 0.305137
4 JAN A=0.112770076E+05, B=-.146475303E+02, R= 0.690168, R*R= 0.476331
5 FEB A=0.106908806E+04, B=0.151713339E+01, R= 0.282394, R*R= 0.079747
6 MAR A=0.140938831E+04, B=0.142936125E+01, R= 0.681161, R*R= 0.463980
7 APR A=0.218207860E+04, B=0.122484396E+01, R= 0.727734, R*R= 0.529597
8 MAY A=-.219049333E+04, B=0.179024011E+01, R= 0.939923, R*R= 0.883454
9 JUN A=-.929661854E+04, B=0.161507342E+01, R= 0.979189, R*R= 0.958811
10 JUL A=0.312206474E+04, B=0.994181448E+00, R= 0.824203, R*R= 0.679310
11 AUG A=0.205870021E+04, B=0.115146116E+01, R= 0.791559, R*R= 0.626566
12 SEP A=0.800654025E+03, B=0.131892033E+01, R= 0.848901, R*R= 0.720633
13 ANN A=-.338916757E+04, B=0.164226537E+01, R= 0.967824, R*R= 0.936683

09330500 MUDDY CREEK NEAR EMERY, UT (Acre-Feet) - *Correlated Years

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	SUM	ANN

1911	1600	1070	610	120	170	2320	3470	10610	7790	6670	3970	1170	39570	39570
1912	850	220	120	180	290	560	3150	8520	11360	6690	3240	2410	37590	37590
1913	1560	600	310	430	440	1030	3140	10410	7850	4950	3140	1630	35490	35490
*1914	823	558	473	506	434	798	2309	15844	10846	5774	3247	1840	43451	45509
*1915	1290	727	661	650	549	743	2534	3792	8589	3332	2096	1336	26299	26388
*1916	556	439	532	528	469	955	3370	6165	10680	4836	5540	2054	36124	36458
*1917	4694	1233	1155	573	799	1250	4493	7850	16478	7217	3034	2293	51069	52190
*1918	990	707	661	650	505	1093	1060	4566	6844	3278	2972	2998	26325	25116
*1919	990	419	354	339	398	467	3945	10236	3293	2232	2282	1512	26467	24633
*1920	745	648	532	373	469	660	1401	10738	8990	3326	2361	1563	31806	33115
*1921	957	648	601	828	835	918	1267	6568	17592	6393	4283	2633	43523	47204
*1922	1902	1134	1056	562	996	1416	1842	10862	10532	2965	2689	2079	38034	38319
*1923	1502	1372	720	573	505	752	799	9418	8188	4908	4115	3061	35913	35220
*1948	923	727	661	573	523	531	700	5223	4417	3272	1989	870	20409	19740
*1949	756	459	443	428	353	715	4637	8476	11357	4535	4044	1512	37716	38855
1950	693	835	613	505	580	778	2164	4080	4552	2717	1404	956	19877	19877
1951	762	827	738	609	510	719	1972	5546	6407	3667	2210	1156	25123	25123
1952	970	640	610	550	490	700	5090	18840	17960	7090	4200	1890	59030	59030
1953	1414	1025	900	879	736	894	838	2668	6307	4260	2618	1289	23828	23828
1954	900	607	591	556	525	578	1308	3259	2436	1734	1014	947	14455	14455
1955	588	464	428	369	347	360	573	3045	3929	2194	1429	765	14491	14491
1956	641	569	585	524	502	718	1093	4383	4552	2731	1388	877	18563	18563
1957	770	400	380	410	420	480	780	4460	13340	8390	4100	1720	35650	35650
1958	1630	1290	960	860	890	830	6340	16410	12440	4660	2740	1680	50730	50730
1959	1020	572	494	411	512	661	1033	1878	2493	1688	942	696	12400	12400
1960	594	393	369	336	323	793	1830	4931	5060	2890	1220	1021	19760	19760
1961	892	505	517	476	417	687	1335	2575	2616	1722	1394	1079	14215	14215
1962	668	712	589	472	448	503	4729	8116	8648	5566	3348	1448	35247	35247
1963	1016	591	400	373	417	764	1016	4223	3780	2799	1920	1091	18390	18390
1964	746	549	551	430	432	458	986	4241	5687	3661	2590	1055	21386	21386
1965	840	450	430	430	330	560	1290	5480	10980	7720	3520	2390	34420	34420
1966	1803	864	684	660	614	1152	2031	3297	2370	1884	1724	733	17816	17816
1967	575	345	485	435	444	618	466	2926	5296	4229	2813	1605	20237	20237
1968	912	480	411	371	374	489	776	4788	9219	4401	2614	1408	26243	26243
1969	1120	640	550	550	520	700	2360	10120	9300	5030	2440	1740	35070	35070
1970	1884	885	512	475	495	623	1150	7817	8892	5197	3539	1696	33165	33165
1971	778	793	726	676	595	986	2342	4399	6163	3517	3223	1396	25594	25594
1972	941	781	657	589	528	889	1333	2858	3231	1886	1761	817	16271	16271
1973	841	617	573	502	444	584	1892	8448	9556	4699	3021	1779	32956	32956
1974	1125	723	615	553	526	780	1654	8983	7394	3374	2406	1440	29573	29573
1975	1080	780	570	550	450	580	1340	5330	11760	6260	2540	2130	33370	33370
1976	1464	682	660	492	376	367	852	3308	3059	2184	1142	754	15340	15340
1977	659	328	307	307	278	352	684	871	936	1049	464	570	6805	6805
1978	290	360	270	280	240	470	1230	4810	10180	5150	2300	1410	26990	26990
1979	1150	696	517	379	395	825	2188	8487	9888	5562	2386	1759	34232	34232
1980	1040	870	770	800	790	670	2900	11860	12120	6760	2740	2110	43430	43430
1981	1928	588	611	407	430	530	1610	2531	3062	1626	2452	2741	18516	18516
1982	1340	670	560	360	450	610	1770	8310	10630	5700	3040	2210	35650	35650
1983	2430	1270	790	530	590	930	1300	10210	19640	14700	6370	3550	62310	62310
1984	1770	1170	1040	720	760	930	2150	14760	16070	9860	6160	3470	58860	58860
1985	3750	2070	1390	900	760	1340	6650	10700	9560	4680	2420	2780	47000	47000
1986	1424	729	495	538	718	1759	3142	6912	9640	4860	2426	2210	34853	34853
1987	1400	1027	805	649	563	867	2975	4165	3445	2148	1428	906	20378	20378
1988	789	646	259	256	287	985	1537	4318	4473	2319	1970	996	18835	18835
1989	843	517	510	493	550	844	1347	1799	1726	1357	1452	730	12168	12168
1990	557	482	422	394	344	567	1012	1666	1958	1527	1210	760	10899	10899
1991	605	520	380	326	324	399	854	3453	6137	2868	1995	1745	19606	19606
1992	852	521	392	403	418	579	1688	4310	3342	1898	1585	1242	17230	17230

1993	748	586	529	527	435	929	1983	9931	8819	4235	2646	2104	33472	33472
1994	1347	748	630	409	375	563	911	2694	2826	1944	1448	744	14639	14639
1995	590	320	430	480	260	250	1120	5930	12020	9390	5340	2560	38690	38690
1996	1769	1114	853	772	768	823	1755	8761	6577	2910	2120	1142	29364	29364
1997	935	751	644	617	587	1028	1878	9031	9535	4905	2557	2456	34924	34924
1998	1530	1120	900	1350	1370	1190	1530	5780	10270	7760	3500	2880	39180	39180
1999	1446	1146	814	726	630	1059	1448	4897	8362	4028	2963	1864	29383	29383
2000	1299	660	588	650	602	729	2069	4850	3051	2116	1545	1170	19329	19329
2001	968	595	436	456	462	1414	1595	6847	5248	2868	2128	1008	24025	24025
2002	753	530	380	322	380	516	1188	2943	2329	2089	1117	813	13360	13360
2003	705	610	358	286	218	1010	1233	5064	6776	3035	2452	1289	23036	23036
2004	863	586	324	375	412	1084	2434	6712	6117	3035	2337	1164	25443	25443
2005	870	660	560	560	540	720	1970	11540	21710	7830	3440	2270	52670	52670
2006	1340	850	390	380	600	710	3280	12000	8960	3900	2830	1750	36990	36990
2007	1591	930	803	655	693	1291	1980	4792	3594	2408	1779	785	21301	21301
2008	455	301	175	107	178	588	1602	5135	7771	3864	2854	1216	24246	24246
2009	895	694	605	572	479	422	963	7043	6704	2612	2067	1023	24079	24079
AVE.	1143	715	579	511	505	793	1982	6651	7809	4234	2610	1599	29132	29207

Linear Regression Correlation Coefficients

1 OCT A=-.100052516E+03, B=0.111219567E+01, R= 0.941838, R*R= 0.887058

2 NOV A=-.971775982E+02, B=0.993003150E+00, R= 0.889409, R*R= 0.791048

3 DEC A=-.705923421E+02, B=0.988262082E+00, R= 0.839668, R*R= 0.705043

4 JAN A=-.105488036E+03, B=0.111173660E+01, R= 0.865778, R*R= 0.749571

5 FEB A=0.531064520E+01, B=0.892088824E+00, R= 0.924784, R*R= 0.855225

6 MAR A=-.309509538E+02, B=0.921399579E+00, R= 0.921503, R*R= 0.849167

7 APR A=-.422927016E+03, B=0.898688814E+00, R= 0.895637, R*R= 0.802166

8 MAY A=-.203924473E+04, B=0.619648819E+00, R= 0.950079, R*R= 0.902649

9 JUN A=0.785791419E+02, B=0.460521432E+00, R= 0.945577, R*R= 0.894117

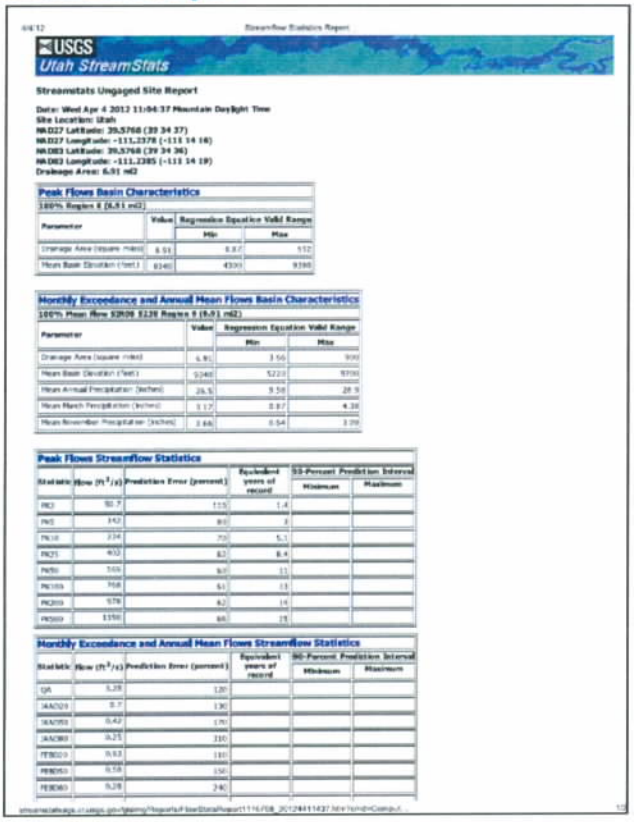
10 JUL A=0.710261363E+03, B=0.601359823E+00, R= 0.965476, R*R= 0.932143

11 AUG A=0.421991405E+03, B=0.885537106E+00, R= 0.924885, R*R= 0.855413

12 SEP A=-.162389044E+03, B=0.125923364E+01, R= 0.837234, R*R= 0.700960

13 ANN A=-.246069435E+04, B=0.662113502E+00, R= 0.975676, R*R= 0.951944

Streamstats Output



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:04:37 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5768 (39 34 37)
NAD27 Longitude: -111.2378 (-111 14 16)
NAD83 Latitude: 39.5768 (39 34 36)
NAD83 Longitude: -111.2385 (-111 14 19)
Drainage Area: 6.91 mi2

Peak Flows Basin Characteristics

100% Region 6 (6.91 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	6.91	0.87	512
Mean Basin Elevation (feet)	9240	4300	9300

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 1200 1120 Region 6 (6.91 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	6.91	1.56	900
Mean Basin Elevation (feet)	9240	5220	9700
Mean Annual Precipitation (inches)	26.5	9.58	28.5
Mean March Precipitation (inches)	3.17	0.87	4.38
Mean November Precipitation (inches)	2.66	0.54	3.29

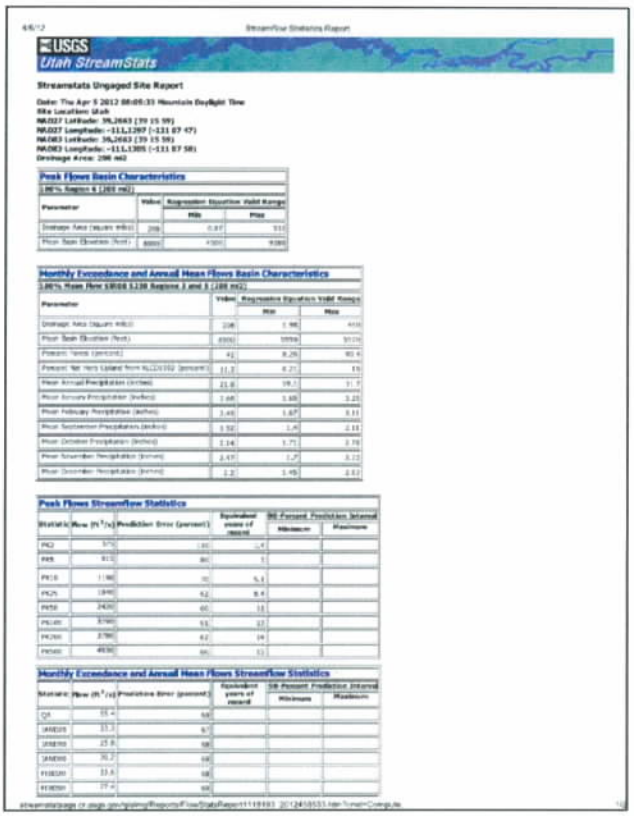
Peak Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	90.7	115	1.4		
PK5	142	80	3		
PK10	234	70	5.1		
PK25	402	62	8.4		
PK50	555	60	11		
PK100	708	61	13		
PK200	878	62	16		
PK500	1190	66	19		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	5.28	120			
JAN2QA	3.7	130			
JAN7Q10	0.42	170			
JAN30Q	0.25	210			
FEB2Q10	0.53	180			
FEB30Q5	0.58	150			
FEB30Q	0.78	240			

Figure 26 - Cleveland Reservoir Drainage



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Thu Apr 5 2012 08:05:33 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.2663 (39 15 59)
NAD27 Longitude: -111.1207 (-111 07 47)
NAD83 Latitude: 39.2663 (39 15 59)
NAD83 Longitude: -111.1305 (-111 07 58)
Drainage Area: 208 mi2

Peak Flows Basin Characteristics

100% Region 6 (208 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	208	0.87	512
Mean Basin Elevation (feet)	8800	4300	9300

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 1200 1120 Region 2 and 3 (208 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	208	1.98	450
Mean Basin Elevation (feet)	8800	5050	9550
Percent Forest (percent)	42	0.26	90.4
Percent Net Forest Gained from NLCD1992 (percent)	11.2	0.21	19
Mean Annual Precipitation (inches)	21.8	10.7	31.7
Mean January Precipitation (inches)	1.68	1.60	3.25
Mean February Precipitation (inches)	1.49	1.07	3.11
Mean September Precipitation (inches)	1.52	1.0	2.11
Mean October Precipitation (inches)	2.14	1.71	3.78
Mean November Precipitation (inches)	2.47	1.7	3.12
Mean December Precipitation (inches)	2.2	1.46	2.62

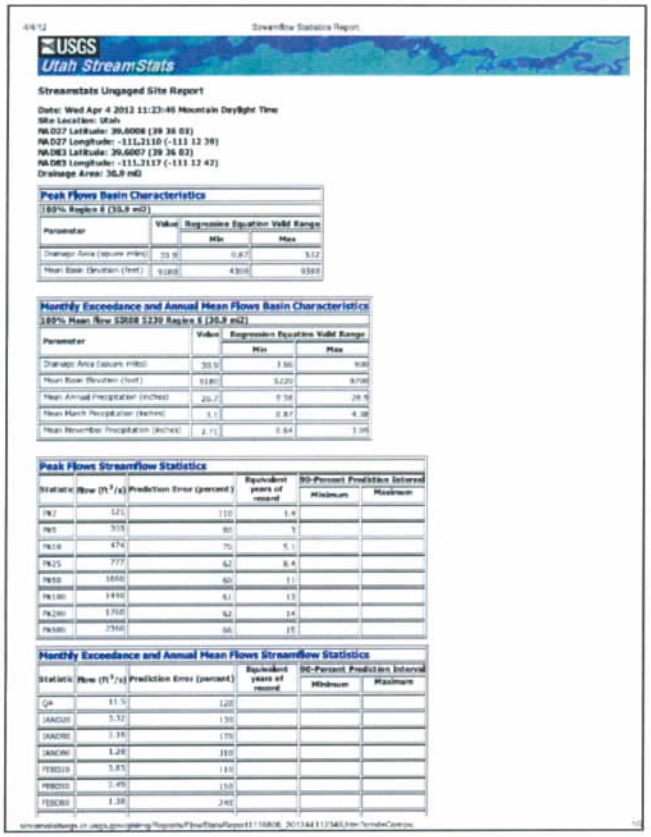
Peak Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	970	100	1.4		
PK5	1[illegible]	80	3		
PK10	1[illegible]	70	5.1		
PK25	1[illegible]	62	8.4		
PK50	2[illegible]	60	11		
PK100	2[illegible]	61	13		
PK200	2[illegible]	62	16		
PK500	4[illegible]	66	19		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	35.4	68			
JAN2QA	23.3	67			
JAN7Q10	15.8	68			
JAN30Q	16.2	68			
FEB2Q10	23.4	68			
FEB30Q5	27.4	68			

Figure 27 - Cottonwood Creek Drainage



4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:23:46 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.6008 (39 36 03)
NAD27 Longitude: -111.2110 (-111 12 39)
NAD83 Latitude: 39.6007 (39 36 03)
NAD83 Longitude: -111.2117 (-111 12 42)
Drainage Area: 30.0 mi2

Peak Flows Basin Characteristics

100% Region 6 (33.5 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	33.5	0.87	512
Mean Basin Elevation (feet)	9180	4300	9300

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 10808 1230 Region 6 (30.0 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	30.0	1.86	900
Mean Basin Elevation (feet)	9180	5220	8700
Mean Annual Precipitation (inches)	20.7	9.58	28.9
Mean March Precipitation (inches)	3.1	2.87	4.38
Mean November Precipitation (inches)	2.71	2.64	3.95

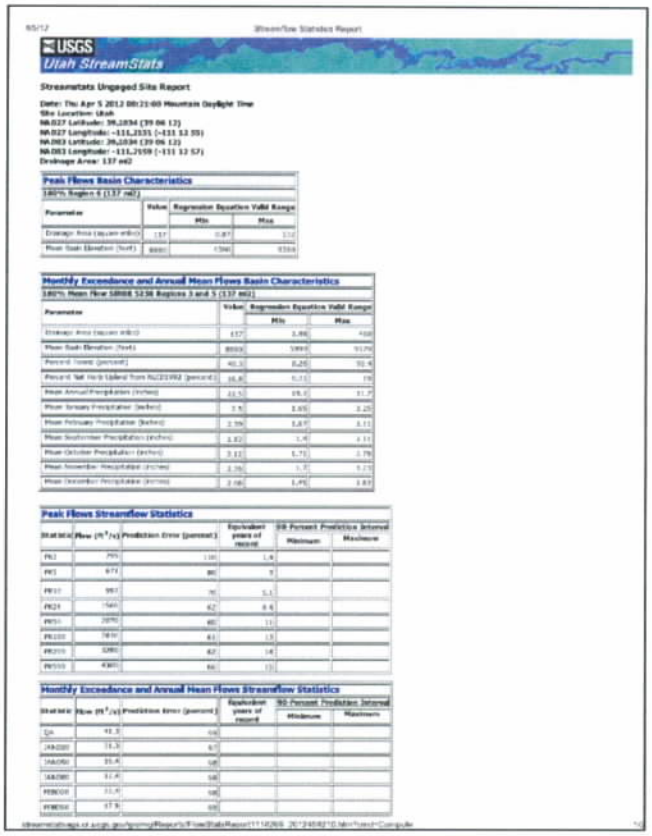
Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	321	110	1.4		
PK5	515	80	3		
PK10	674	70	5.1		
PK25	977	62	8.4		
PK50	1250	60	11		
PK100	1440	61	13		
PK200	1700	62	14		
PK500	2060	66	15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	11.5	120			
JAN200	5.32	130			
JAN200	7.39	170			
JAN200	1.28	310			
FEB200	5.85	140			
FEB200	7.49	150			
FEB200	1.38	240			

Figure 28 - Electric Lake Drainage



4/5/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Thu Apr 5 2012 08:21:40 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.1834 (39 06 12)
NAD27 Longitude: -111.2131 (-111 12 55)
NAD83 Latitude: 39.1834 (39 06 12)
NAD83 Longitude: -111.2159 (-111 12 57)
Drainage Area: 137 mi2

Peak Flows Basin Characteristics

100% Region 6 (137 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	137	0.87	512
Mean Basin Elevation (feet)	8800	4300	9300

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 10808 1230 Regions 3 and 5 (137 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	137	1.86	900
Mean Basin Elevation (feet)	8800	5300	9170
Percent Tank (percent)	40.3	0.20	30.5
Percent Tank Herb Upland from NLCD1992 (percent)	16.8	0.11	70
Mean Annual Precipitation (inches)	23.5	19.1	31.7
Mean January Precipitation (inches)	3.5	3.05	3.25
Mean February Precipitation (inches)	2.96	3.07	3.11
Mean September Precipitation (inches)	1.82	1.4	3.11
Mean October Precipitation (inches)	2.12	1.71	2.79
Mean November Precipitation (inches)	2.76	1.7	3.15
Mean December Precipitation (inches)	2.68	1.45	3.83

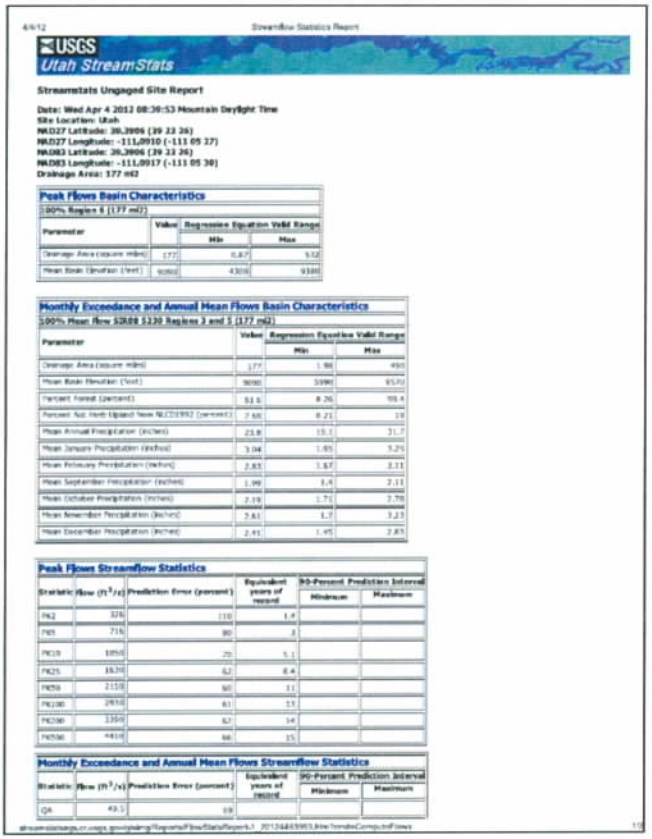
Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	795	110	1.4		
PK5	1274	80	3		
PK10	1667	70	5.1		
PK25	2417	62	8.4		
PK50	3090	60	11		
PK100	3630	61	13		
PK200	4280	62	14		
PK500	5090	66	15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	41.3	110			
JAN200	13.3	130			
JAN200	35.4	170			
JAN200	11.4	310			
FEB200	11.4	140			
FEB200	17.6	150			

Figure 29 - Ferron Creek Gage Drainage



4/4/12 Streamflow Statistics Report

USGS Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 08:30:53 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.3906 (39 23 26)
NAD27 Longitude: -111.0910 (-111 05 27)
NAD83 Latitude: 39.3906 (39 23 26)
NAD83 Longitude: -111.0917 (-111 05 30)
Drainage Area: 177 mi2

Peak Flows Basin Characteristics

100% Region 6 (177 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	177	0.87	532
Mean Basin Elevation (feet)	9202	4300	9300

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 32808 3230 Regions 3 and 5 (177 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	177	1.98	490
Mean Basin Elevation (feet)	9090	5990	9570
Percent Forest (percent)	51.5	8.26	99.4
Percent Sub Herb Upland Veg NLCD1992 (percent)	7.68	0.21	19
Mean Annual Precipitation (inches)	23.8	15.1	31.7
Mean January Precipitation (inches)	3.04	1.65	5.25
Mean February Precipitation (inches)	2.83	1.67	3.11
Mean September Precipitation (inches)	1.99	1.4	2.11
Mean October Precipitation (inches)	2.19	1.71	2.78
Mean November Precipitation (inches)	2.61	1.7	3.23
Mean December Precipitation (inches)	2.41	1.45	2.85

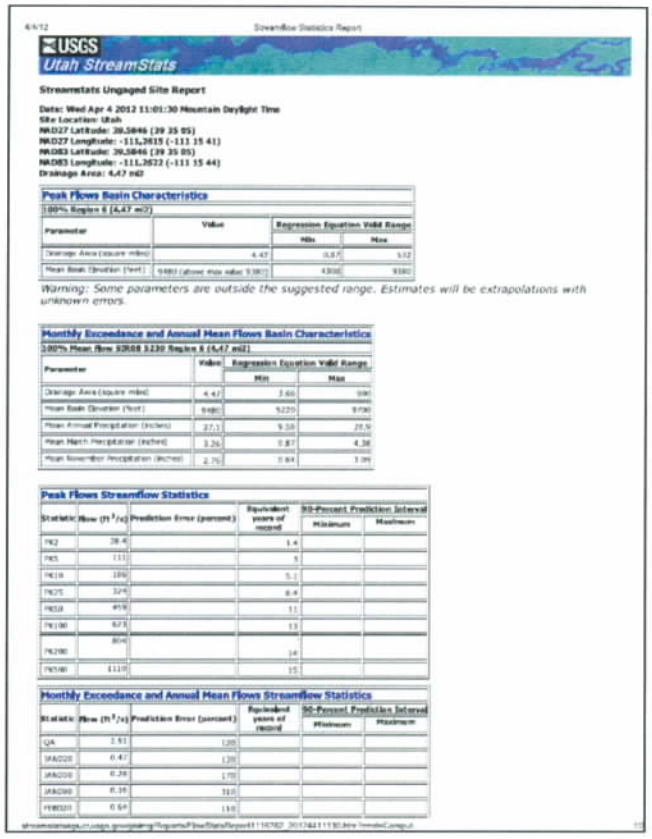
Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	326	110	1.4		
PK5	716	80	3		
PK10	1050	70	5.1		
PK25	1630	62	8.4		
PK50	2150	60	11		
PK100	2650	61	13		
PK200	3350	62	14		
PK500	4410	66	15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	43.1	68			

Figure 30 - Huntington Creek Gage Drainage



4/4/12 Streamflow Statistics Report

USGS Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:01:30 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5846 (39 35 05)
NAD27 Longitude: -111.2615 (-111 15 41)
NAD83 Latitude: 39.5846 (39 35 05)
NAD83 Longitude: -111.2622 (-111 15 44)
Drainage Area: 4.47 mi2

Peak Flows Basin Characteristics

100% Region 6 (4.47 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	4.47	0.87	532
Mean Basin Elevation (feet)	9480 (above max value 9300)	4300	9300

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 32808 3230 Region 6 (4.47 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	4.47	2.60	590
Mean Basin Elevation (feet)	9480	5220	9700
Mean Annual Precipitation (inches)	27.1	9.50	29.9
Mean March Precipitation (inches)	3.26	1.87	4.38
Mean November Precipitation (inches)	2.76	1.84	3.99

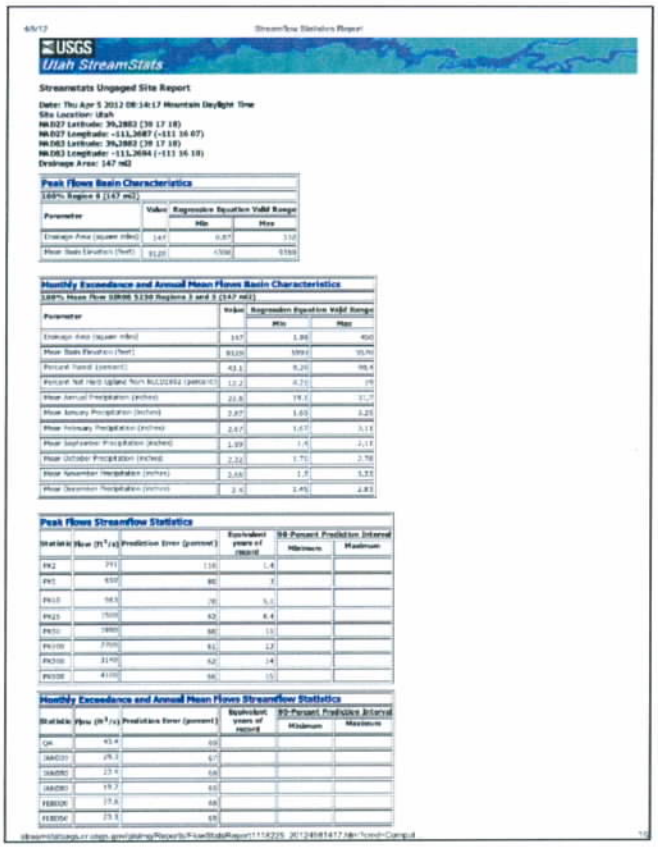
Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	28.4		1.4		
PK5	111		5		
PK10	199		5.1		
PK25	329		8.4		
PK50	459		11		
PK100	573		13		
PK200	694		14		
PK500	1110		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	7.93	120			
JANQ20	0.47	120			
JANQ50	0.39	170			
JANQ90	0.35	310			
FEBQ20	0.64	110			

Figure 31 - Huntington Reservoir Drainage



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Thu Apr 5 2012 08:14:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.2882 (39 17 18)
NAD27 Longitude: -111.2687 (-111 16 07)
NAD83 Latitude: 39.2882 (39 17 18)
NAD83 Longitude: -111.2694 (-111 16 18)
Drainage Area: 147 mi2

Peak Flows Basin Characteristics

100% Region 6 (147 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	147	0.87	132
Mean Basin Elevation (feet)	9120	5590	9380

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean Flow 10906 5230 Regions 3 and 5 (147 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	147	1.96	400
Mean Basin Elevation (feet)	9120	5990	9570
Percent Forest (percent)	43.1	9.26	96.4
Percent Net Herb Upland Non NLCD1992 (percent)	12.2	0.21	19
Mean Annual Precipitation (inches)	21.8	19.1	31.7
Mean January Precipitation (inches)	2.87	1.65	3.26
Mean February Precipitation (inches)	2.67	1.67	3.11
Mean September Precipitation (inches)	1.99	1.4	2.11
Mean October Precipitation (inches)	2.22	1.71	2.78
Mean November Precipitation (inches)	2.65	1.7	3.13
Mean December Precipitation (inches)	2.4	1.45	2.83

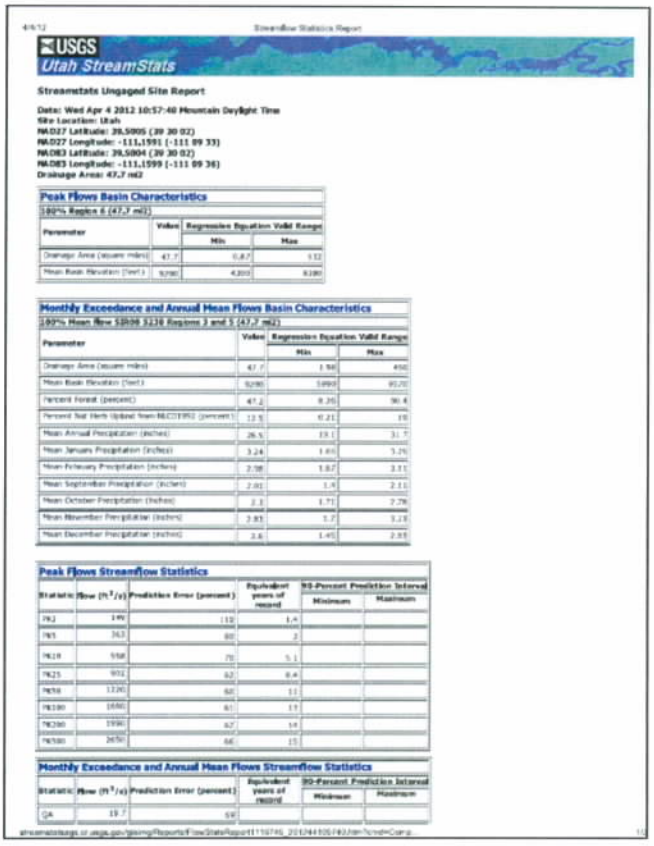
Peak Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	291	110	1.4		
PK5	650	80	3		
PK10	963	70	5.1		
PK25	1500	62	8.4		
PK50	1980	60	11		
PK100	2500	61	13		
PK200	3140	62	14		
PK500	4100	66	15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	43.4	69			
JAN50%	26.3	67			
JAN80%	23.4	68			
JAN90%	19.7	69			
FEB50%	27.6	68			
FEB90%	23.3	69			

Figure 32 - Joe's Valley Reservoir Drainage



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 10:57:40 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5005 (39 30 02)
NAD27 Longitude: -111.1591 (-111 09 33)
NAD83 Latitude: 39.5004 (39 30 02)
NAD83 Longitude: -111.1599 (-111 09 36)
Drainage Area: 47.7 mi2

Peak Flows Basin Characteristics

100% Region 6 (47.7 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	47.7	0.87	132
Mean Basin Elevation (feet)	9280	4200	9380

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean Flow 5898 3230 Regions 3 and 5 (47.7 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	47.7	1.96	400
Mean Basin Elevation (feet)	9280	5990	9570
Percent Forest (percent)	47.2	9.26	96.4
Percent Net Herb Upland Non NLCD1992 (percent)	13.5	0.21	19
Mean Annual Precipitation (inches)	26.5	19.1	31.7
Mean January Precipitation (inches)	3.24	1.65	3.26
Mean February Precipitation (inches)	2.98	1.67	3.11
Mean September Precipitation (inches)	2.01	1.4	2.11
Mean October Precipitation (inches)	2.3	1.71	2.78
Mean November Precipitation (inches)	2.83	1.7	3.13
Mean December Precipitation (inches)	2.6	1.45	2.83

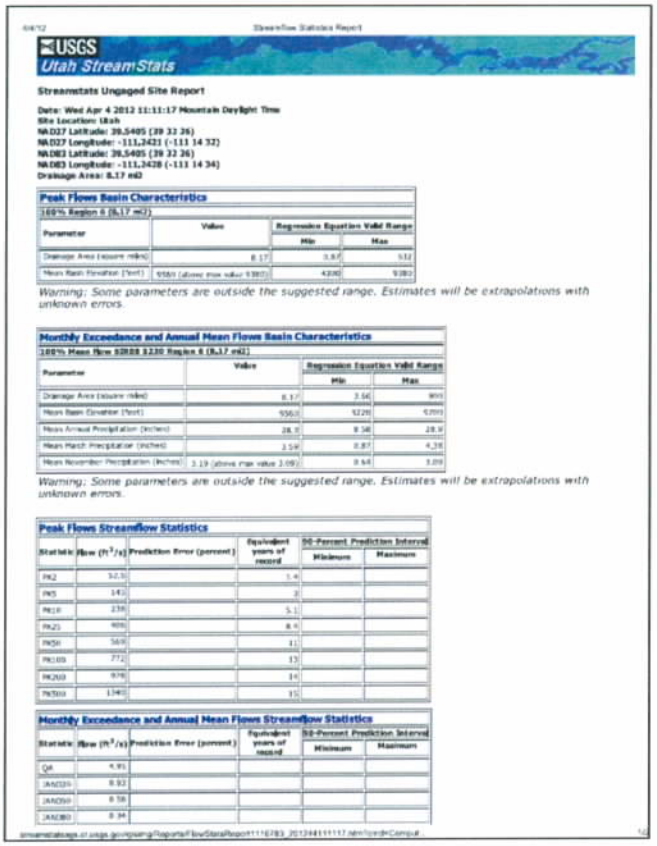
Peak Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	199	110	1.4		
PK5	543	80	3		
PK10	938	70	5.1		
PK25	972	62	8.4		
PK50	1320	60	11		
PK100	1690	61	13		
PK200	1990	62	14		
PK500	2650	66	15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft³/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	19.7	69			

Figure 33 - Left Hand Fork Drainage



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2438 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	512
Mean Basin Elevation (feet)	9560 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow SDRB 3230 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9560	5229	9790
Mean Annual Precipitation (inches)	28.9	9.38	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

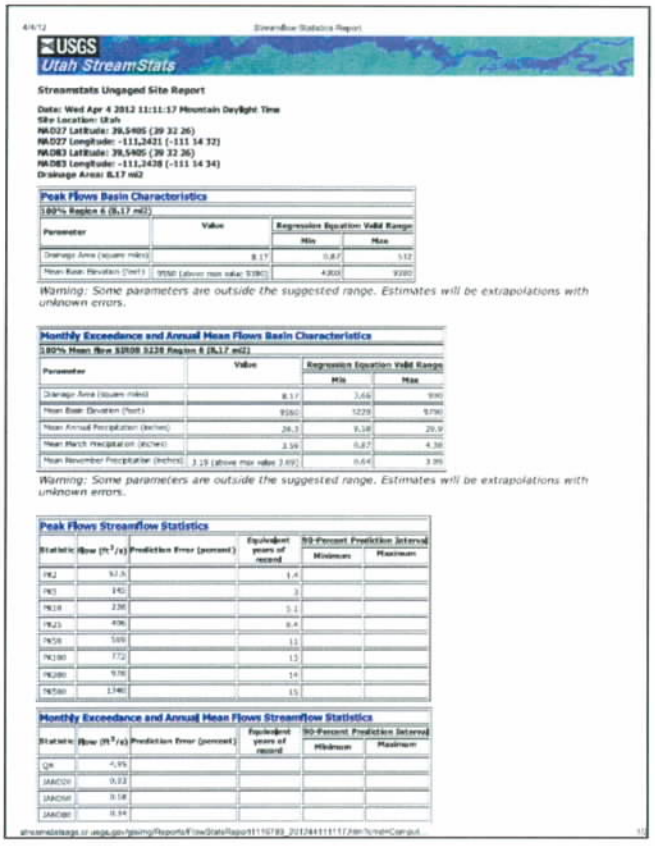
Peak Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.9		1.4		
PK5	140		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JANQ50	0.92				
JANQ90	0.58				
JANQ80	0.64				

Figure 34 – Miller Flat Reservoir Drainage



USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2438 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	512
Mean Basin Elevation (feet)	9560 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow SDRB 3230 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9560	5229	9790
Mean Annual Precipitation (inches)	28.3	9.38	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

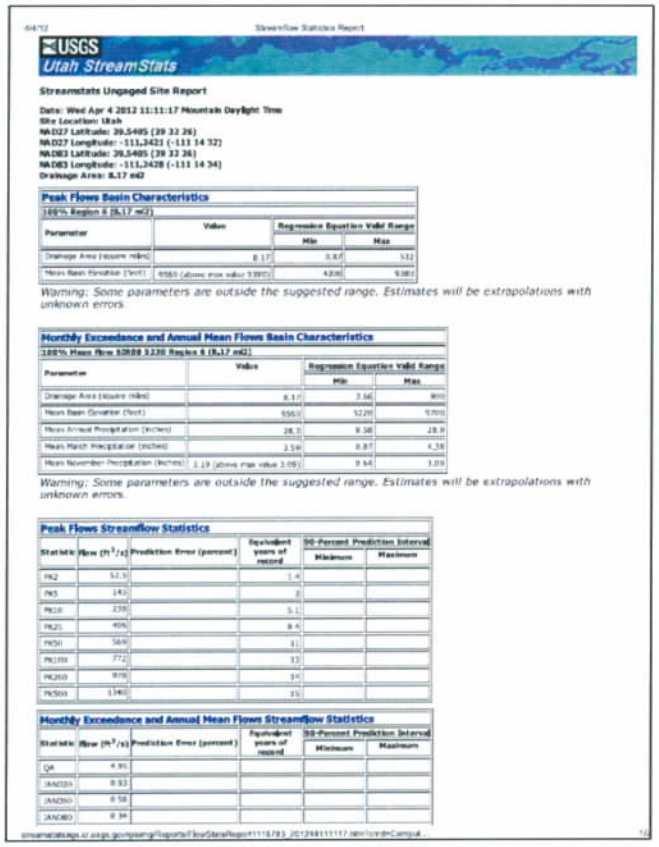
Peak Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.9		1.4		
PK5	140		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JANQ50	0.92				
JANQ90	0.58				
JANQ80	0.64				

Figure 35 –Millsite Reservoir Drainage



4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2428 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	532
Mean Basin Elevation (feet)	9560 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 52020 3220 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9560	5220	9700
Mean Annual Precipitation (inches)	28.3	9.58	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

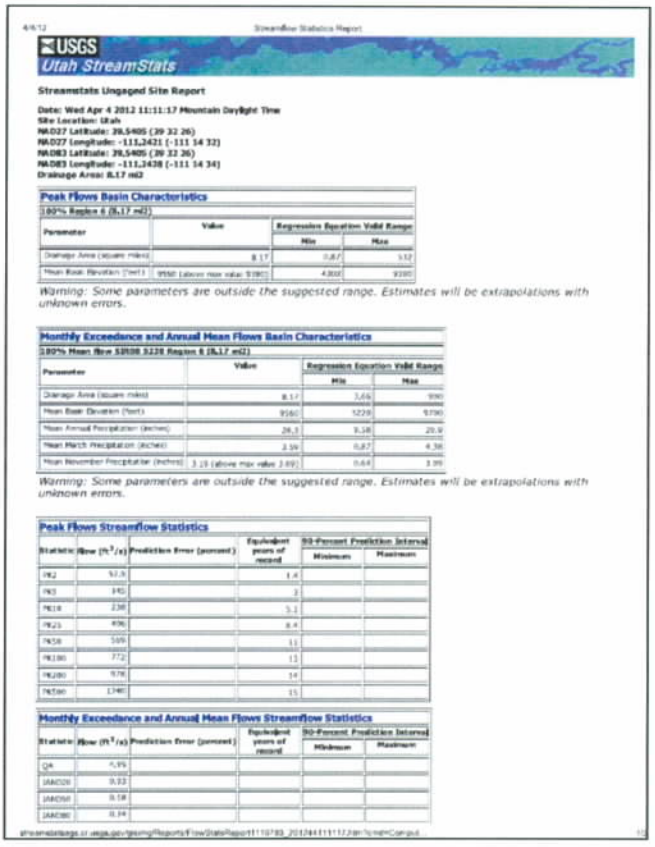
Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.9		1.4		
PK5	140		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JAN200	8.93				
JAN250	8.58				
JAN300	8.34				

streamstatsags.cr.usgs.gov/gisimg/Reports/FlowStatsReport1116783_20124411117.html?rcnt=Compute...

Figure 36 - Right Hand Fork Drainage



4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2428 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	532
Mean Basin Elevation (feet)	9560 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 52020 3220 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9560	5220	9700
Mean Annual Precipitation (inches)	28.3	9.58	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.9		1.4		
PK5	140		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JAN200	8.93				
JAN250	8.58				
JAN300	8.34				

streamstatsags.cr.usgs.gov/gisimg/Reports/FlowStatsReport1116783_20124411117.html?rcnt=Compute

Figure 37 - Rock Canyon Creek Drainage

4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2438 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	532
Mean Basin Elevation (feet)	9580 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 32808 5220 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9580	5220	9700
Mean Annual Precipitation (inches)	28.7	8.38	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.3		1.4		
PK5	145		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JAN050	0.92				
JAN090	0.58				
JAN080	0.34				

streamstatsags.cr.usgs.gov/gisimg/Reports/FlowStatsReport1116781_20120411111717.htm?crid=Compute... 1/2

Figure 38 - Rolfson Reservoir Drainage

4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 32)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2438 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.87	532
Mean Basin Elevation (feet)	9580 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 32808 5220 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	900
Mean Basin Elevation (feet)	9580	5220	9700
Mean Annual Precipitation (inches)	28.7	8.38	28.9
Mean March Precipitation (inches)	3.59	0.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.3		1.4		
PK5	145		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	978		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	4.95				
JAN050	0.92				
JAN090	0.58				
JAN080	0.34				

streamstatsags.cr.usgs.gov/gisimg/Reports/FlowStatsReport1116783_20120411111717.htm?crid=Compute... 1/2

Figure 39 - San Rafael Confluence Drainage

4/4/12 Streamflow Statistics Report

USGS
Utah StreamStats

Streamstats Ungaged Site Report

Date: Wed Apr 4 2012 11:11:17 Mountain Daylight Time
Site Location: Utah
NAD27 Latitude: 39.5405 (39 32 26)
NAD27 Longitude: -111.2421 (-111 14 52)
NAD83 Latitude: 39.5405 (39 32 26)
NAD83 Longitude: -111.2428 (-111 14 34)
Drainage Area: 8.17 mi2

Peak Flows Basin Characteristics

100% Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	0.83	132
Mean Basin Elevation (feet)	9580 (above max value 9380)	4300	9380

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Monthly Exceedance and Annual Mean Flows Basin Characteristics

100% Mean flow 60808 3230 Region 6 (8.17 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	8.17	3.66	800
Mean Basin Elevation (feet)	9563	5220	9700
Mean Annual Precipitation (inches)	28.5	9.38	28.9
Mean March Precipitation (inches)	3.56	2.87	4.38
Mean November Precipitation (inches)	3.19 (above max value 3.09)	0.64	3.09

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Peak Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	52.5		1.4		
PK5	140		2		
PK10	238		5.1		
PK25	406		8.4		
PK50	569		11		
PK100	772		13		
PK200	979		14		
PK500	1340		15		

Monthly Exceedance and Annual Mean Flows Streamflow Statistics

Statistic	flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
Q4	4.95				
JAN250	0.93				
JAN350	0.58				
JAN380	0.34				

streamstats.usgs.gov/ws/streamstats/Reports/FlowStatsReport/1116781_20120411111717.html?rid=Compute... 1/2

Figure 40 - Staker Canyon Drainage

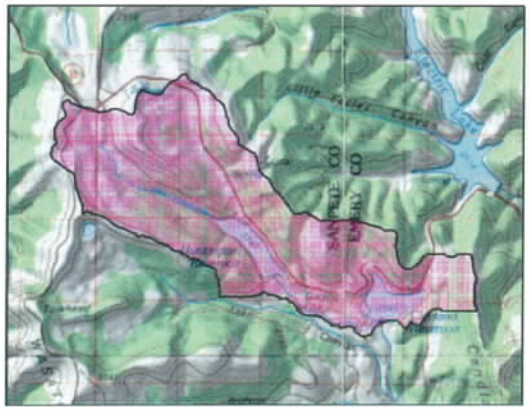


Figure 41 - Cleveland Reservoir Drainage Map

Figure 43 - Electric Lake Drainage Map

Figure 42 - Cottonwood Creek Reservoir Drainage Map

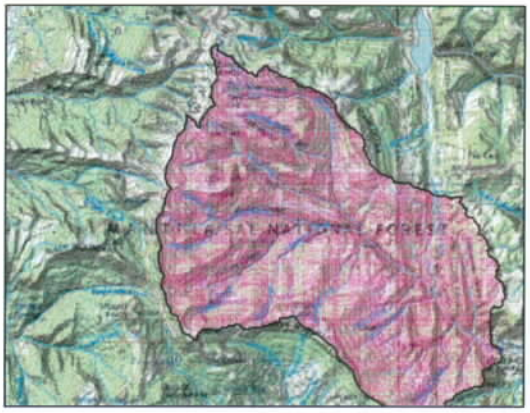


Figure 44 - Ferron Creek Gage Drainage Map

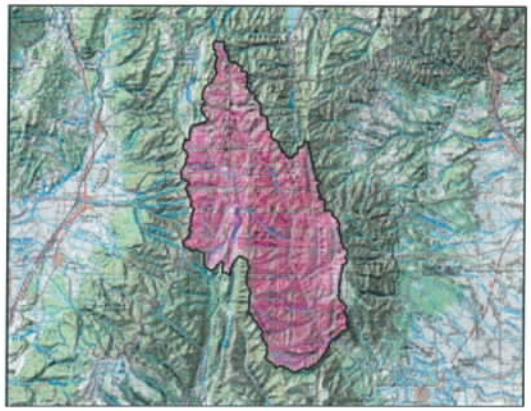


Figure 45 - Huntington Creek Drainage Map

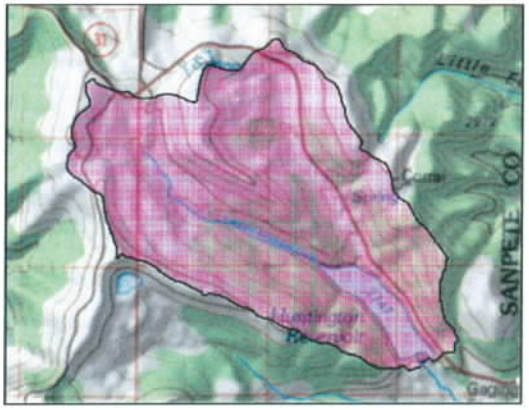


Figure 46 - Huntington Reservoir Drainage Map

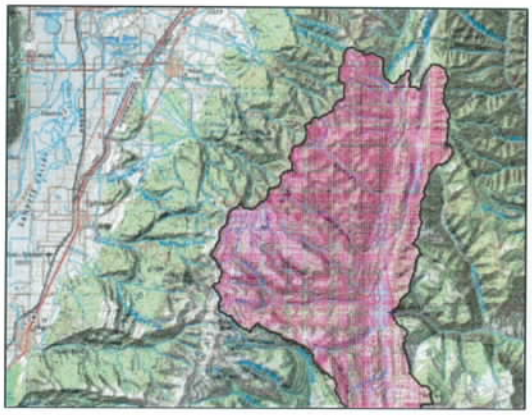


Figure 47 - Joe's Valley Reservoir Drainage Map

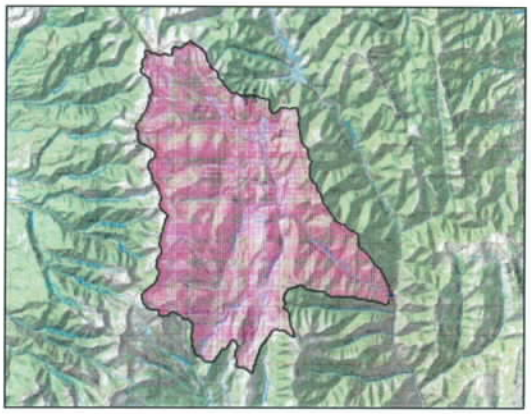


Figure 48 - Left Hand Fork Reservoir Drainage Map

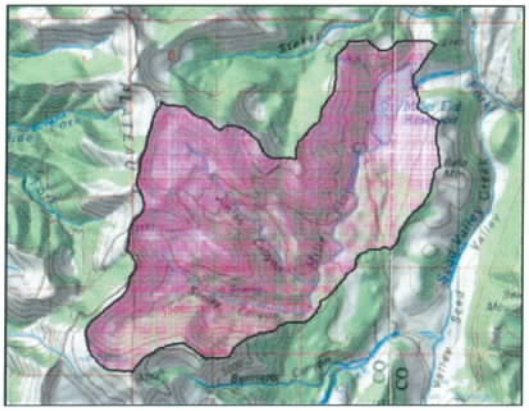


Figure 49 - Miller Flat Reservoir Drainage Map

Figure 51 - Right Hand Fork Reservoir Drainage Map

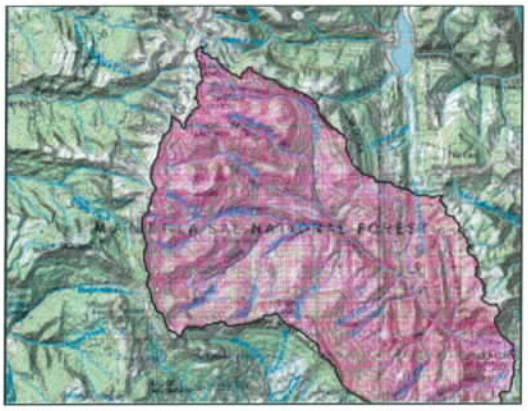


Figure 50 - Millsite Reservoir Drainage Map

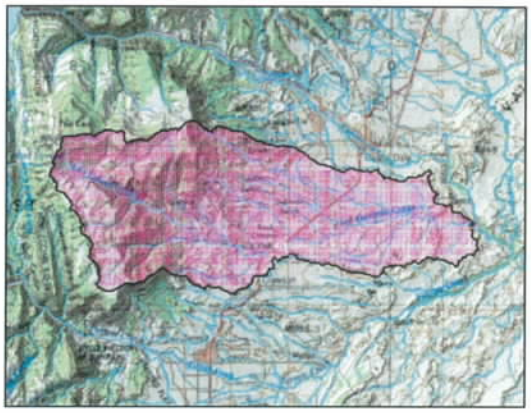


Figure 52 - Rock Canyon Creek Drainage Map

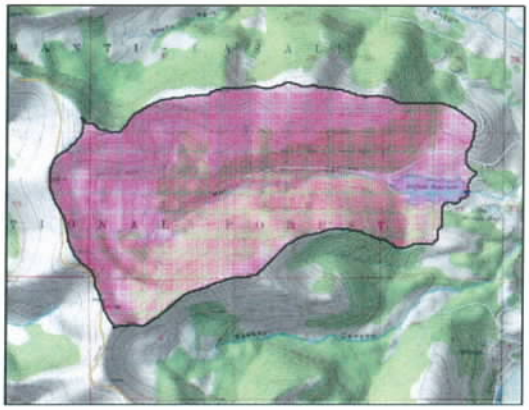


Figure 53 - Rolfson Reservoir Drainage Map

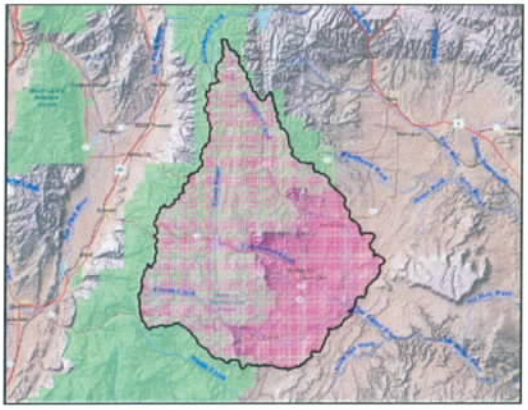


Figure 54 - San Rafael Confluence Drainage Map

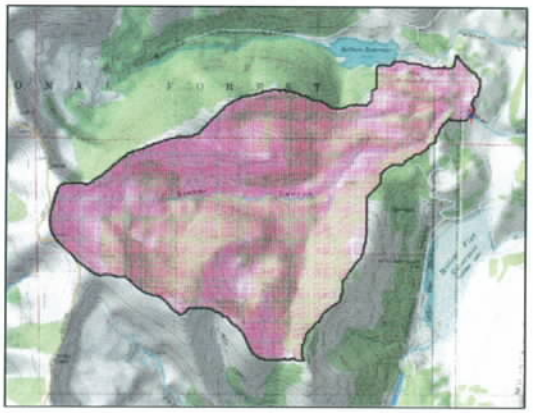


Figure 55 – Staker Canyon Reservoir Drainage Map

San Rafael Model Object Reports

Cleveland Reservoir

```
*********************************************************************
***  Object:  Cleveland Res            / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	8,254.00	0.00
1	8,264.00	25.00
2	8,274.00	290.00
3	8,284.00	930.00
4	8,294.00	1,855.00
5	8,304.00	3,070.00
6	8,314.00	4,535.00
7	8,321.00	5,690.00
8	8,326.00	6,590.00

```
*************************************************************
***  Object:  Cleveland Res  / Storage Reservoir Object  ***
***    Slot:  Max Release    / Table Slot                 ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	8,254.00	0.00
1	8,264.00	50.00
2	8,274.00	75.00
3	8,284.00	95.00
4	8,294.00	110.00
5	8,304.00	120.00
6	8,314.00	130.00
7	8,321.00	145.00
8	8,326.00	150.00

```
*********************************************************************
***  Object:  Cleveland Res            / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	8,321.00	0.00
1	8,326.00	2,400.00

```
*********************************************************************
***  Object:  Cleveland Res            / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot               ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.04
5	0.20
6	0.22
7	0.15
8	0.06
9	0.00
10	0.00
11	0.00

```
*********************************************************************
***  Object:  Cleveland Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                 ***
*********************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	8,254.00	0.00
1	8,264.00	5.00
2	8,274.00	48.00
3	8,284.00	80.00
4	8,294.00	105.00
5	8,304.00	138.00
6	8,314.00	155.00
7	8,321.00	175.00
8	8,326.00	185.00

Electric Lake

```
*********************************************************************
```

```
***  Object:  Electric Lake           / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	69.00	0.00
1	70.00	2.00
2	75.00	9.00
3	80.00	16.00
4	85.00	32.00
5	90.00	62.00
6	95.00	112.00
7	100.00	186.00
8	105.00	289.00
9	110.00	417.00
10	115.00	570.00
11	120.00	746.00
12	125.00	942.00
13	130.00	1,163.00
14	135.00	1,415.00
15	140.00	1,697.00
16	145.00	2,008.00
17	150.00	2,346.00
18	155.00	2,714.00
19	160.00	3,120.00
20	165.00	3,574.00
21	170.00	4,086.00
22	175.00	4,676.00
23	180.00	5,340.00
24	185.00	6,062.00
25	190.00	6,842.00
26	195.00	7,677.00
27	200.00	8,566.00
28	205.00	9,515.00
29	210.00	10,529.00
30	215.00	11,607.00
31	220.00	12,748.00
32	225.00	13,950.00
33	230.00	15,220.00
34	235.00	16,573.00
35	240.00	18,015.00
36	245.00	19,556.00
37	250.00	21,209.00
38	255.00	22,977.00
39	260.00	24,852.00
40	265.00	26,846.00
41	270.00	28,976.00
42	275.00	31,266.00
43	277.00	32,224.00

```
*************************************************************
***  Object:  Electric Lake  / Storage Reservoir Object  ***
***    Slot:  Max Release    / Table Slot                 ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	69.00	0.00
1	277.00	2,500.00

```
*********************************************************************
***  Object:  Electric Lake            / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	275.00	0.00
1	277.00	2,220.00

```
*********************************************************************
***  Object:  Electric Lake            / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.20
6	0.22
7	0.15
8	0.06
9	0.00
10	0.00
11	0.00

```
*****************************************************************
***  Object:  Electric Lake          / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                 ***
*****************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	69.00	0.00
1	70.00	2.00
2	75.00	1.40
3	80.00	1.40
4	85.00	3.20
5	90.00	6.00
6	95.00	10.00
7	100.00	14.80
8	105.00	20.60
9	110.00	25.60
10	115.00	30.60
11	120.00	35.20
12	125.00	39.20
13	130.00	44.20
14	135.00	50.40
15	140.00	56.40
16	145.00	62.20
17	150.00	67.60
18	155.00	73.60
19	160.00	81.20
20	165.00	90.80
21	170.00	102.40
22	175.00	118.00
23	180.00	132.80
24	185.00	144.40
25	190.00	156.00
26	195.00	167.00
27	200.00	177.80
28	205.00	189.80
29	210.00	202.80
30	215.00	215.60
31	220.00	228.20
32	225.00	240.40
33	230.00	254.00
34	235.00	270.60
35	240.00	288.40
36	245.00	308.20
37	250.00	330.60
38	255.00	353.60
39	260.00	375.00
40	265.00	398.80
41	270.00	426.00
42	275.00	458.00
43	277.00	479.00

Huntington North Reservoir

```
*********************************************************************
***  Object:  Huntington North Res     / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table   / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	5,780.00	0.00
1	5,785.00	1.00
2	5,790.00	12.00
3	5,795.00	70.00
4	5,800.00	208.00
5	5,805.00	450.00
6	5,810.00	807.00
7	5,815.00	1,300.00
8	5,820.00	1,940.00
9	5,825.00	2,720.00
10	5,830.00	3,650.00
11	5,835.00	4,710.00
12	5,840.00	5,910.00

```
*********************************************************************
***  Object:  Huntington North Res  / Storage Reservoir Object  ***
***    Slot:  Max Release           / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	5,780.00	0.00
1	5,835.00	100.00
2	5,840.00	100.00

```
*********************************************************************
***  Object:  Huntington North Res     / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	5,780.00	0.00
1	5,838.00	0.00
2	5,840.00	100.00

```
*********************************************************************
***  Object:  Huntington North Res      / Storage Reservoir Object  ***
```

```
***    Slot:  Evaporation Coefficients  / Table Slot                 ***
*************************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.02
1	0.04
2	0.12
3	0.24
4	0.41
5	0.49
6	0.49
7	0.43
8	0.30
9	0.15
10	0.07
11	0.02

```
*************************************************************************
***  Object:  Huntington North Res  / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                ***
*************************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	5,780.00	0.00
1	5,785.00	0.40
2	5,790.00	4.00
3	5,795.00	19.20
4	5,800.00	36.00
5	5,805.00	60.80
6	5,810.00	82.00
7	5,815.00	115.20
8	5,820.00	140.80
9	5,825.00	171.20
10	5,830.00	200.80
11	5,835.00	223.20
12	5,840.00	256.80

Huntington Reservoir

```
*************************************************************************
***  Object:  Huntington Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*************************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	8,978.00	0.00
1	8,980.00	2.00
2	8,990.00	217.00
3	9,000.00	940.00
4	9,010.00	1,997.00
5	9,020.00	3,310.00
6	9,030.00	4,804.00
7	9,035.00	5,617.00
8	9,040.00	6,400.00

```
*************************************************************
***  Object:  Huntington Res  / Storage Reservoir Object  ***
***    Slot:  Max Release     / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	8,978.00	0.00
1	9,035.00	126.00
2	9,040.00	126.00

```
*************************************************************************
***  Object:  Huntington Res          / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table / Table Slot                ***
*************************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	9,035.00	0.00
1	9,040.00	1,060.00

```
*************************************************************************
***  Object:  Huntington Res            / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
*************************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00

3	0.00
4	0.03
5	0.21
6	0.24
7	0.16
8	0.06
9	0.00
10	0.00
11	0.00

```
*****************************************************************
***  Object:  Huntington Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                 ***
*****************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	8,978.00	0.00
1	8,980.00	2.00
2	8,990.00	41.00
3	9,000.00	103.00
4	9,010.00	107.80
5	9,040.00	132.00

Joe's Valley Reservoir

```
*****************************************************************
***  Object:  Joes Valley Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                 ***
*****************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	6,820.00	0.00
1	6,825.00	1.00
2	6,830.00	8.00
3	6,835.00	23.00
4	6,840.00	53.00
5	6,845.00	108.00
6	6,850.00	199.00
7	6,855.00	341.00
8	6,860.00	524.00
9	6,865.00	775.00
10	6,870.00	1,120.00
11	6,875.00	1,540.00
12	6,880.00	2,070.00
13	6,885.00	2,690.00
14	6,890.00	3,420.00
15	6,895.00	4,300.00
16	6,900.00	5,310.00
17	6,905.00	6,500.00
18	6,910.00	7,850.00
19	6,915.00	9,400.00
20	6,920.00	11,150.00
21	6,925.00	13,130.00
22	6,930.00	15,330.00
23	6,935.00	17,760.00
24	6,940.00	20,450.00
25	6,945.00	23,380.00
26	6,950.00	26,570.00
27	6,955.00	30,010.00
28	6,960.00	33,720.00
29	6,965.00	37,710.00
30	6,970.00	42,010.00
31	6,975.00	46,660.00
32	6,980.00	51,700.00
33	6,985.00	57,090.00
34	6,990.00	62,810.00
35	6,995.00	68,850.00

```
*************************************************************
***  Object:  Joes Valley Res  / Storage Reservoir Object  ***
***    Slot:  Max Release      / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	6,820.00	0.00
1	6,990.00	385.00
2	6,995.00	385.00

```
*****************************************************************
***  Object:  Joes Valley Res          / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*****************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	6,989.00	0.00
1	6,995.00	5,000.00

```
*****************************************************************
***  Object:  Joes Valley Res          / Storage Reservoir Object  ***
```

```
***    Slot:  Evaporation Coefficients  / Table Slot                 ***
*************************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.02
3	0.14
4	0.19
5	0.36
6	0.37
7	0.29
8	0.22
9	0.05
10	0.00
11	0.00

```
*********************************************************************
***  Object:  Joes Valley Res        / Storage Reservoir Object   ***
***    Slot:  Elevation Area Table  / Table Slot                  ***
*********************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	6,820.00	0.00
1	6,825.00	0.40
2	6,830.00	2.40
3	6,835.00	3.60
4	6,840.00	8.40
5	6,845.00	13.60
6	6,850.00	22.80
7	6,855.00	34.00
8	6,860.00	39.20
9	6,865.00	61.20
10	6,870.00	76.80
11	6,875.00	91.20
12	6,880.00	120.80
13	6,885.00	127.20
14	6,890.00	164.80
15	6,895.00	187.20
16	6,900.00	216.80
17	6,905.00	259.20
18	6,910.00	280.80
19	6,915.00	339.20
20	6,920.00	360.80
21	6,925.00	431.20
22	6,930.00	448.80
23	6,935.00	523.20
24	6,940.00	552.80
25	6,945.00	619.20
26	6,950.00	656.80
27	6,955.00	719.20
28	6,960.00	764.80
29	6,965.00	831.20
30	6,970.00	888.80
31	6,975.00	971.20
32	6,980.00	1,044.80
33	6,985.00	1,111.20
34	6,990.00	1,176.80
35	6,995.00	1,239.20

Miller Flat Reservoir

```
*********************************************************************
***  Object:  Miller Flat Res        / Storage Reservoir Object   ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	8,411.00	0.00
1	8,415.00	124.00
2	8,420.00	328.00
3	8,425.00	607.00
4	8,430.00	960.00
5	8,435.00	1,382.00
6	8,440.00	1,869.00
7	8,445.00	2,421.00
8	8,450.00	3,038.00
9	8,455.00	3,712.00
10	8,460.00	4,445.00
11	8,465.00	5,229.00
12	8,465.20	5,250.00
13	8,466.00	5,272.63
14	8,467.00	5,340.73
15	8,468.00	5,495.24
16	8,469.00	5,650.76
17	8,470.00	5,814.77
18	8,471.00	5,975.95
19	8,472.00	6,144.52
20	8,473.00	6,309.51
21	8,474.00	6,481.73
22	8,475.00	6,650.27
23	8,476.00	6,820.50
24	8,477.00	6,998.18
25	8,478.00	7,171.79
26	8,479.00	7,352.79

27	8,480.00	7,529.81
28	8,481.00	7,714.58
29	8,482.00	7,895.18
30	8,483.00	8,083.66
31	8,484.00	8,267.65
32	8,485.00	8,459.72
33	8,486.00	8,647.25
34	8,487.00	8,842.69
35	8,488.00	9,033.26
36	8,489.00	9,232.01
37	8,490.00	9,425.91
38	8,495.20	9,700.00

```
*************************************************************
***  Object:  Miller Flat Res  / Storage Reservoir Object  ***
***    Slot:  Max Release      / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	8,411.00	0.00
1	8,465.20	280.00
2	8,495.20	280.00

```
*********************************************************************
***  Object:  Miller Flat Res          / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	8,465.20	0.00
1	8,470.20	2,000.00

```
*********************************************************************
***  Object:  Miller Flat Res           / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.08
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*****************************************************************
***  Object:  Miller Flat Res       / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                ***
*****************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	8,411.00	0.00
1	8,415.00	31.00
2	8,420.00	40.80
3	8,425.00	55.80
4	8,430.00	70.60
5	8,435.00	84.40
6	8,440.00	97.40
7	8,445.00	110.40
8	8,450.00	123.40
9	8,455.00	134.80
10	8,460.00	146.60
11	8,465.00	156.80
12	8,465.20	158.00
13	8,468.00	165.22
14	8,469.00	169.44
15	8,470.00	172.58
16	8,471.00	174.95
17	8,472.00	177.19
18	8,473.00	179.30
19	8,474.00	181.43
20	8,475.00	183.44
21	8,476.00	185.44
22	8,477.00	187.48
23	8,478.00	189.46
24	8,479.00	191.55
25	8,480.00	193.65
26	8,481.00	195.89
27	8,482.00	198.04
28	8,483.00	200.20
29	8,484.00	202.27
30	8,485.00	204.31
31	8,486.00	206.19
32	8,487.00	208.10
33	8,488.00	209.96
34	8,489.00	211.84

35	8,490.00	213.61
36	8,495.20	215.00

Millsite Reservoir

```
*********************************************************************
***  Object:  Millsite Res            / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	6,130.00	0.00
1	6,150.00	875.00
2	6,170.00	2,875.00
3	6,190.00	6,500.00
4	6,210.00	12,250.00
5	6,225.00	18,500.00
6	6,230.00	20,500.00
7	6,232.50	22,000.00

```
*************************************************************
***  Object:  Millsite Res  / Storage Reservoir Object  ***
***    Slot:  Max Release   / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	6,130.00	120.00
1	6,150.00	250.00
2	6,170.00	325.00
3	6,190.00	390.00
4	6,210.00	440.00
5	6,225.00	480.00
6	6,230.00	480.00
7	6,232.50	480.00

```
*********************************************************************
***  Object:  Millsite Res            / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	6,225.00	0.00
1	6,232.50	10,500.00

```
*********************************************************************
***  Object:  Millsite Res              / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.10
3	0.27
4	0.32
5	0.49
6	0.53
7	0.38
8	0.29
9	0.15
10	0.08
11	0.04

```
*********************************************************************
***  Object:  Millsite Res            / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table    / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	6,130.00	0.00
1	6,150.00	70.00
2	6,170.00	140.00
3	6,190.00	225.00
4	6,210.00	350.00
5	6,225.00	435.00
6	6,230.00	475.00
7	6,232.50	540.00

Rock Creek Reservoir (Potential Reservoir)

```
*********************************************************************
***  Object:  Rock Creek Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	5,410.00	1.71
1	5,415.00	14.28
2	5,420.00	42.51
3	5,425.00	110.73
4	5,430.00	296.86
5	5,435.00	593.16
6	5,440.00	1,001.24
7	5,445.00	1,611.55
8	5,450.00	2,519.58
9	5,455.00	3,683.77
10	5,460.00	5,102.92
11	5,465.00	6,776.19
12	5,470.00	8,785.50
13	5,475.00	11,103.77
14	5,480.00	13,741.32
15	5,485.00	15,000.00

```
*************************************************************
***  Object:  Rock Creek Res   / Storage Reservoir Object  ***
***    Slot:  Max Release      / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	5,410.00	0.00
1	5,411.00	400.00
2	5,485.00	400.00

```
*********************************************************************
***  Object:  Rock Creek Res            / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table   / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	5,480.00	0.00
1	5,485.00	2,000.00

```
*********************************************************************
***  Object:  Rock Creek Res              / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients    / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.02
1	0.04
2	0.12
3	0.24
4	0.41
5	0.49
6	0.49
7	0.43
8	0.30
9	0.15
10	0.07
11	0.02

```
*******************************************************************
***  Object:  Rock Creek Res         / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table   / Table Slot                ***
*******************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	5,410.00	1.03
1	5,415.00	3.88
2	5,420.00	8.08
3	5,425.00	25.05
4	5,430.00	49.29
5	5,435.00	69.23
6	5,440.00	97.96
7	5,445.00	154.30
8	5,450.00	208.19
9	5,455.00	258.07
10	5,460.00	307.90
11	5,465.00	366.29
12	5,470.00	433.74
13	5,475.00	494.92
14	5,480.00	566.54
15	5,485.00	600.00

Rolfson Reservoir

```
*********************************************************************
***  Object:  Rolfson Res              / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table   / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	8,836.00	0.00
1	8,837.00	20.00
2	8,838.00	42.00
3	8,839.00	66.00
4	8,840.00	92.00
5	8,841.00	119.00
6	8,842.00	147.00
7	8,843.00	177.00
8	8,844.00	209.00
9	8,845.00	243.00
10	8,846.00	278.00
11	8,847.00	315.00
12	8,848.00	355.00
13	8,849.00	397.00
14	8,850.00	442.00
15	8,851.00	489.00
16	8,851.30	504.00
17	8,852.00	545.00
18	8,853.00	605.00
19	8,854.00	667.00
20	8,855.00	729.00
21	8,856.00	794.00
22	8,857.00	858.00
23	8,858.00	925.00
24	8,859.00	990.00
25	8,860.00	1,059.00
26	8,861.00	1,127.00
27	8,862.00	1,198.00
28	8,863.00	1,267.00

```
*************************************************************
***  Object:  Rolfson Res  / Storage Reservoir Object  ***
***    Slot:  Max Release  / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	8,836.00	0.00
1	8,858.00	200.00
2	8,863.00	200.00

```
*********************************************************************
***  Object:  Rolfson Res                / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	8,851.30	0.00
1	8,854.30	1,000.00

```
**********************************************************************
***  Object:  Rolfson Res                 / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
**********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*******************************************************************
***  Object:  Rolfson Res                / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                ***
*******************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	8,836.00	19.00
1	8,837.00	21.00
2	8,838.00	24.00
3	8,839.00	25.00
4	8,840.00	26.00
5	8,841.00	28.00
6	8,842.00	29.00
7	8,843.00	31.00
8	8,844.00	33.00
9	8,845.00	34.00
10	8,846.00	36.00
11	8,847.00	39.00
12	8,848.00	41.00

13	8,849.00	43.00
14	8,850.00	46.00
15	8,851.00	48.00
16	8,851.30	49.00
17	8,852.00	59.98
18	8,853.00	61.00
19	8,854.00	62.13
20	8,855.00	63.24
21	8,856.00	64.35
22	8,857.00	65.36
23	8,858.00	66.37
24	8,859.00	67.31
25	8,860.00	68.26
26	8,861.00	69.16
27	8,862.00	70.07
28	8,863.00	70.92

CCCIC Data

```
****************************************
***  Simulation Object: CCCIC Data   ***
***  SimObj Type:       Data Object  ***
****************************************
```

```
************************************************
***  CCCIC Data (Data Object) Scalar Slots  ***
************************************************
```

Type	Slot Name	Value	Units
Scalar	Class1Flow	108.11	cfs
Scalar	Class2Flow	39.07	cfs
Scalar	Class3Flow	28.33	cfs
Scalar	HighWatIrrAcres	NaN	acre
Scalar	Class4Flow	87.25	cfs

```
*************************************************************
***  CCCIC Data (Data Object) Other Non-Series Slots  ***
*************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Periodic	AprMayJun Release Schedule	12	1	
Periodic	IrrRequired	12	1	
Table	CCCCIC Diversions	64	14	Year, Jan Avg, Feb Avg, Mar Avg, Apr Avg,...

```
************************************************
***  CCCIC Data (Data Object) Series Slots  ***
************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
Series	Class1Diversions	cfs	1	1	1 Day	Sep 30, 1949	Sep 30, 1949
Series	Class2Diversions	cfs	1	1	1 Day	Sep 30, 1949	Sep 30, 1949
Series	Class3Diversions	cfs	1	1	1 Day	Sep 30, 1949	Sep 30, 1949
Series	Class4Diversions	cfs	1	1	1 Day	Sep 30, 1949	Sep 30, 1949

```
************************************************
***  Object:  CCCIC Data   / Data Object    ***
***    Slot:  IrrRequired  / Periodic Slot  ***
************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.09
0:00 May 1	4.98
0:00 Jun 1	6.55
0:00 Jul 1	7.78
0:00 Aug 1	6.25
0:00 Sep 1	3.92
0:00 Oct 1	0.71
0:00 Nov 1	0.00
0:00 Dec 1	0.00

Electric Lake Data

```
***********************************************
***  Simulation Object: Electric Lake Data  ***
***  SimObj Type:       Data Object         ***
***********************************************
```

```
*********************************************************
***  Electric Lake Data (Data Object) Scalar Slots  ***
*********************************************************
```

Type	Slot Name	Value	Units
Scalar	Dead Pool Stor	746.00	acre-feet
Scalar	Winter Release	6.00	cfs

Scalar	Min Flow	0.00	cfs
Scalar	Ini Stor	20,000.00	acre-feet

FCRC Data

```
****************************************
***  Simulation Object: FCRC Data    ***
***  SimObj Type:       Data Object  ***
****************************************
```

```
*************************************************
***  Object:  FCRC Data     / Data Object    ***
***    Slot:  IrrRequired   / Periodic Slot  ***
*************************************************
```

	0.00 [NONE]
[in/month]	
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.05
0:00 May 1	4.87
0:00 Jun 1	6.18
0:00 Jul 1	7.84
0:00 Aug 1	6.02
0:00 Sep 1	3.51
0:00 Oct 1	0.68
0:00 Nov 1	0.00
0:00 Dec 1	0.00

HCIC Diversion Data

```
*******************************************
***  Simulation Object: HCIC Div Data  ***
***  SimObj Type:       Data Object    ***
*******************************************
```

```
****************************************************
***  HCIC Div Data (Data Object) Scalar Slots  ***
****************************************************
```

Type	Slot Name	Value	Units
Scalar	HCIC Direct Flow Right	352.25	cfs
Scalar	Percent CCH to HC	0.40	decimal
Scalar	Clevelands Percent	0.63	decimal
Scalar	Huntingtons Percent	0.12	decimal
Scalar	North Ditch Percent	0.25	decimal
Scalar	Huntington Irr Acres	2,730.00	acre
Scalar	Cleveland Irr Acres	12,770.00	acre
Scalar	North Ditch Irr Acres	4,940.00	acre
Scalar	HCIC Efficiency	0.70	decimal
Scalar	HCIC RF Percent	0.70	decimal

```
*************************************************************
***  HCIC Div Data (Data Object) Other Non-Series Slots  ***
*************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Periodic	IrrRequiredHuntington	12	1	
Periodic	IrrRequiredCleveland	12	1	
Periodic	IrrRequiredNDitch	12	1	

```
*********************************************************
***  Object:  HCIC Div Data          / Data Object    ***
***    Slot:  IrrRequiredHuntington  / Periodic Slot  ***
*********************************************************
```

	0.00 [NONE]
[in/month]	
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.09
0:00 May 1	4.98
0:00 Jun 1	6.55
0:00 Jul 1	7.78
0:00 Aug 1	6.25
0:00 Sep 1	3.92
0:00 Oct 1	0.71
0:00 Nov 1	0.00
0:00 Dec 1	0.00

```
*********************************************************
***  Object:  HCIC Div Data          / Data Object    ***
***    Slot:  IrrRequiredCleveland   / Periodic Slot  ***
*********************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.09
0:00 May 1	4.98
0:00 Jun 1	6.55
0:00 Jul 1	7.78
0:00 Aug 1	6.25
0:00 Sep 1	3.92
0:00 Oct 1	0.71
0:00 Nov 1	0.00
0:00 Dec 1	0.00

```
*****************************************************
***  Object:  HCIC Div Data       / Data Object    ***
***    Slot:  IrrRequiredNDitch  / Periodic Slot  ***
*****************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.09
0:00 May 1	4.98
0:00 Jun 1	6.55
0:00 Jul 1	7.78
0:00 Aug 1	6.25
0:00 Sep 1	3.92
0:00 Oct 1	0.71
0:00 Nov 1	0.00
0:00 Dec 1	0.00

HCIC Res Data

```
*******************************************
***  Simulation Object: HCIC Res Data  ***
***  SimObj Type:       Data Object    ***
*******************************************
```

```
****************************************************
***  HCIC Res Data (Data Object) Scalar Slots  ***
****************************************************
```

Type	Slot Name	Value	Units
Scalar	Hunt Dead Pool Stor	700.00	acre-feet
Scalar	Miller Dead Pool Stor	1,160.00	acre-feet
Scalar	Cleve Dead Pool Stor	700.00	acre-feet
Scalar	Rolf Dead Pool Stor	27.00	acre-feet
Scalar	Hunt Min Flow	0.00	cfs
Scalar	Cleve Min Flow	0.00	cfs
Scalar	Rolf Min Flow	0.00	cfs
Scalar	Miller Min Flow	0.00	cfs
Scalar	Hunt Pool1	NaN	acre-feet
Scalar	Hunt Pool2	NaN	acre-feet
Scalar	Hunt Pool3	NaN	acre-feet
Scalar	Cleve Pool1	NaN	acre-feet
Scalar	Cleve Pool2	NaN	acre-feet
Scalar	Rolf Const Release	12.00	cfs
Scalar	Miller Const Release	40.00	cfs
Scalar	Hunt Rel Percent	0.65	decimal

Hunter Plant Data

```
*********************************************
***  Simulation Object: Hunter Plant Data  ***
***  SimObj Type:       Data Object        ***
*********************************************
```

```
*****************************************************
***  Hunter Plant Data (Data Object) Scalar Slots  ***
*****************************************************
```

Type	Slot Name	Value	Units
Scalar	Annual Demand	19,000.00	acre-ft
Scalar	Percent of FCRC	0.37	decimal
Scalar	Percent of CCCIC	0.27	decimal

```
*****************************************************************
***  Hunter Plant Data (Data Object) Other Non-Series Slots  ***
*****************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Periodic	Demand Curve	12	1	
Periodic	HunterPlantCWCEff	12	1	
Periodic	PercentCWCCalled	12	1	

```
+----------+-------------------+------+------+---------------+

*****************************************************
***  Hunter Plant Data (Data Object) Series Slots  ***
*****************************************************

+--------+---------------------+-------+------+------+-------+-------------+-------------+
| Type   | Slot Name           | Units | Rows | Cols | Step  | Start       | End         |
|========|=====================|=======|======|======|=======|=============|=============|
| Series | CCCIC Water         | NONE  |    1 |    1 | 1 Day | Oct 1, 1949 | Oct 1, 1949 |
| Series | Joes Valley Water   | NONE  |    1 |    1 | 1 Day | Oct 1, 1949 | Oct 1, 1949 |
| Series | Millsite Water      | NONE  |    1 |    1 | 1 Day | Oct 1, 1949 | Oct 1, 1949 |
| Series | FCRC Water          | NONE  |    1 |    1 | 1 Day | Oct 1, 1949 | Oct 1, 1949 |
| Series | Direct Flow Shortage | cfs   |    1 |    1 | 1 Day | Oct 1, 1949 | Oct 1, 1949 |
+--------+---------------------+-------+------+------+-------+-------------+-------------+

*****************************************************
***  Object:  Hunter Plant Data  / Data Object    ***
***    Slot:  Demand Curve       / Periodic Slot  ***
*****************************************************

+-------------+-----------+
|             | [decimal] |
|=============|===========|
|  0:00 Jan 1 |      0.07 |
|  0:00 Feb 1 |      0.07 |
|  0:00 Mar 1 |      0.07 |
|  0:00 Apr 1 |      0.07 |
|  0:00 May 1 |      0.09 |
|  0:00 Jun 1 |      0.09 |
|  0:00 Jul 1 |      0.10 |
|  0:00 Aug 1 |      0.10 |
|  0:00 Sep 1 |      0.10 |
|  0:00 Oct 1 |      0.09 |
|  0:00 Nov 1 |      0.09 |
|  0:00 Dec 1 |      0.08 |
+-------------+-----------+

*****************************************************
***  Object:  Hunter Plant Data  / Data Object    ***
***    Slot:  HunterPlantCWCEff  / Periodic Slot  ***
*****************************************************

+-------------+-----------+
|             |      0.00 |
|             |    [NONE] |
|-------------|-----------|
|             | [decimal] |
|=============|===========|
|  0:00 Jan 1 |      0.55 |
|  0:00 Feb 1 |      0.60 |
|  0:00 Mar 1 |      0.70 |
|  0:00 Apr 1 |      0.75 |
|  0:00 May 1 |      0.80 |
|  0:00 Jun 1 |      0.80 |
|  0:00 Jul 1 |      0.85 |
|  0:00 Aug 1 |      0.85 |
|  0:00 Sep 1 |      0.75 |
|  0:00 Oct 1 |      0.75 |
|  0:00 Nov 1 |      0.65 |
|  0:00 Dec 1 |      0.50 |
+-------------+-----------+

*****************************************************
***  Object:  Hunter Plant Data  / Data Object    ***
***    Slot:  PercentCWCCalled   / Periodic Slot  ***
*****************************************************

+-------------+-----------+
|             |      0.00 |
|             |    [NONE] |
|-------------|-----------|
|             | [decimal] |
|=============|===========|
|  0:00 Jan 1 |      0.00 |
|  0:00 Feb 1 |      0.10 |
|  0:00 Mar 1 |      0.25 |
|  0:00 Apr 1 |      0.55 |
|  0:00 May 1 |      0.60 |
|  0:00 Jun 1 |      0.65 |
|  0:00 Jul 1 |      0.65 |
|  0:00 Aug 1 |      0.65 |
|  0:00 Sep 1 |      0.65 |
|  0:00 Oct 1 |      0.65 |
|  0:00 Nov 1 |      0.60 |
|  0:00 Dec 1 |      0.40 |
+-------------+-----------+
```

Huntington North Data

```
*****************************************************
***  Simulation Object: Huntington North Data  ***
***  SimObj Type:       Data Object            ***
*****************************************************

*********************************************************
***  Huntington North Data (Data Object) Scalar Slots  ***
*********************************************************

+--------+-----------+----------+---------+
| Type   | Slot Name |    Value | Units   |
|========|===========|==========|=========|
| Scalar | Dead Pool | 1,540.00 | acre-ft |
| Scalar | Min Flow  |     0.00 | cfs     |
```

```
+--------+-----------+----------+---------+
```

Huntington Plan Data

```
*************************************************
***  Simulation Object: Huntington Plant Data  ***
***  SimObj Type:       Data Object            ***
*************************************************

*******************************************************
***  Object:  Huntington Plant Data  / Data Object    ***
***    Slot:  Demand Curve           / Periodic Slot  ***
*******************************************************

+-------------+-----------+
|             | [decimal] |
|=============|===========|
|  0:00 Jan 1 |      0.07 |
|  0:00 Feb 1 |      0.08 |
|  0:00 Mar 1 |      0.08 |
|  0:00 Apr 1 |      0.08 |
|  0:00 May 1 |      0.09 |
|  0:00 Jun 1 |      0.09 |
|  0:00 Jul 1 |      0.10 |
|  0:00 Aug 1 |      0.10 |
|  0:00 Sep 1 |      0.09 |
|  0:00 Oct 1 |      0.07 |
|  0:00 Nov 1 |      0.07 |
|  0:00 Dec 1 |      0.07 |
+-------------+-----------+
```

Joe's Valley Data

```
*********************************************
***  Simulation Object: Joes Valley Data  ***
***  SimObj Type:       Data Object       ***
*********************************************

*****************************************************
***  Joes Valley Data (Data Object) Scalar Slots  ***
*****************************************************

+--------+----------------+----------+-----------+
| Type   | Slot Name      |    Value | Units     |
|========|================|==========|===========|
| Scalar | Dead Pool Stor | 7,850.00 | acre-feet |
| Scalar | Min Flow       |    10.00 | cfs       |
+--------+----------------+----------+-----------+

*****************************************************
***  Joes Valley Data (Data Object) Series Slots  ***
*****************************************************

+--------+-------------+-----------+-------+------+-------+-------------+-------------+
| Type   | Slot Name   | Units     |  Rows | Cols | Step  | Start       | End         |
|========|=============|===========|=======|======|=======|=============|=============|
| Series | CCCIC       | acre-feet | 21915 |    1 | 1 Day | Oct 1, 1949 | Sep 30, 2009 |
| Series | PacifiCorp  | acre-feet | 21915 |    1 | 1 Day | Oct 1, 1949 | Sep 30, 2009 |
| Series | CCH Canal   | acre-feet | 21915 |    1 | 1 Day | Oct 1, 1949 | Sep 30, 2009 |
| Series | Orangeville | acre-feet | 21915 |    1 | 1 Day | Oct 1, 1949 | Sep 30, 2009 |
| Series | Castledale  | acre-feet | 21915 |    1 | 1 Day | Oct 1, 1949 | Sep 30, 2009 |
+--------+-------------+-----------+-------+------+-------+-------------+-------------+
```

Lower Canal Data

```
*********************************************
***  Simulation Object: Lower Canal Data  ***
***  SimObj Type:       Data Object       ***
*********************************************

*****************************************************
***  Lower Canal Data (Data Object) Scalar Slots  ***
*****************************************************

+--------+-------------------+--------+-------+
| Type   | Slot Name         |  Value | Units |
|========|===================|========|=======|
| Scalar | Jeffs Irr Acres   | 517.00 | acre  |
| Scalar | Brasher Irr Acres | 130.00 | acre  |
+--------+-------------------+--------+-------+
```

Millsite Data

```
*******************************************
***  Simulation Object: Millsite Data  ***
***  SimObj Type:       Data Object    ***
*******************************************

*************************************************
***  Millsite Data (Data Object) Scalar Slots  ***
*************************************************

+--------+-------------------------+----------+-----------+
| Type   | Slot Name               |    Value | Units     |
|========|=========================|==========|===========|
| Scalar | Dead Pool Stor          | 2,000.00 | acre-feet |
| Scalar | Min Release             |     0.00 | cfs       |
| Scalar | Hydrologic Inflow Factor |     0.07 | decimal   |
| Scalar | PacifiCorp Pool         | 7,000.00 | acre-feet |
+--------+-------------------------+----------+-----------+

*************************************************
***  Millsite Data (Data Object) Series Slots  ***
```

```
**************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
Series	PacifiCorp	acre-feet	21915	1	1 Day	Oct 1, 1949	Sep 30, 2009
Series	FCRC PacifiCorp	acre-feet	21915	1	1 Day	Oct 1, 1949	Sep 30, 2009
Series	FCRC	acre-feet	21915	1	1 Day	Oct 1, 1949	Sep 30, 2009

Model Data

```
****************************************
***  Simulation Object: Model Data   ***
***  SimObj Type:       Data Object  ***
****************************************

**************************************************
***  Model Data (Data Object) Scalar Slots  ***
**************************************************
```

Type	Slot Name	Value	Units
Scalar	SanRafael RG Factor	0.06	decimal

```
**************************************************
***  Model Data (Data Object) Series Slots  ***
**************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
Series	Non Diverted Huntington	cfs	1	1	1 Day	Oct 2, 1949	Oct 2, 1949
Series	Non Diverted Cottonwood	cfs	1	1	1 Day	Oct 2, 1949	Oct 2, 1949
Series	Non Diverted Ferron	cfs	1	1	1 Day	Oct 2, 1949	Oct 2, 1949

Paradise Ditch Data

```
**************************************************
***  Simulation Object: Paradise Ditch Data  ***
***  SimObj Type:       Data Object          ***
**************************************************

*********************************************************
***  Paradise Ditch Data (Data Object) Scalar Slots  ***
*********************************************************
```

Type	Slot Name	Value	Units
Scalar	Flow Right	6.00	cfs

```
*******************************************************************
***  Paradise Ditch Data (Data Object) Other Non-Series Slots  ***
*******************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Periodic	IrrRequired	12	1	

```
*******************************************************
***  Object:  Paradise Ditch Data  / Data Object    ***
***    Slot:  IrrRequired          / Periodic Slot  ***
*******************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.05
0:00 May 1	4.87
0:00 Jun 1	6.18
0:00 Jul 1	7.84
0:00 Aug 1	6.02
0:00 Sep 1	3.51
0:00 Oct 1	0.68
0:00 Nov 1	0.00
0:00 Dec 1	0.00

Muddy Creek Object Reports

Emery Reservoir

```
*******************************************************
***  Simulation Object: Emery Res                   ***
***  SimObj Type:       Storage Reservoir Object    ***
*******************************************************

**************************************************
```

*** Emery Res -- Non-Default Method Selections ***

SimObj Type	Method Category	Selected Method
StorageReservoir	spillCalculationCategory	unregulatedSpillCalc
StorageReservoir	hydrologicInflowCalculationCategory	inputHydrologicInflow
StorageReservoir	Evaporation and Precipitation	Monthly Evaporation

*** Emery Res (Storage Reservoir Object) Scalar Slots ***

Type	Slot Name	Value	Units
Scalar	Diversion Capacity	NaN	cfs
Table	Max Iterations	50.00	NONE
Table	Convergence Percentage	0.00	NONE

*** Emery Res (Storage Reservoir Object) Other Non-Series Slots ***

Type	Slot Name	Rows	Cols	Column Labels
Table	Elevation Volume Table	3	2	Pool Elevation, Storage
Table	Max Release	2	2	Pool Elevation, Discharge
Table	Unregulated Spill Table	2	2	Pool Elevation, Unregulated Spill
Table	Evaporation Coefficients	12	1	Ave Monthly Evaporation
Table	Elevation Area Table	2	2	Pool Elevation, Surface Area

*** Emery Res (Storage Reservoir Object) Series Slots ***

Type	Slot Name	Units	Rows	Cols	Step	Start	End
SimObjMulti	Inflow	cfs	22281	2	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Outflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Storage	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Previous Storage	acre-feet	22282	1	1 Day	Sep 30, 1950	Oct 1, 2011
AggSeries	Pool Elevation	ft	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Flow FROM Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Flow TO Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Canal Flow	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
Series	Total Inflows	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Inflow Sum	cms	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Diversion	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
SimObjMulti	Return Flow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Release	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill Capacity Fraction	decimal	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Adjust	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Net	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Evaporation	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Precipitation Rate	ft/month	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Precipitation Volume	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Surface Area	acre	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

*** Object: Emery Res / Storage Reservoir Object ***
*** Slot: Elevation Volume Table / Table Slot ***

	Pool Elevation [ft]	Storage [acre-feet]
0	8,990.00	0.00
1	9,000.00	145.00
2	9,002.50	210.00

*** Object: Emery Res / Storage Reservoir Object ***
*** Slot: Max Release / Table Slot ***

	Pool Elevation [ft]	Discharge [cfs]
0	8,990.00	0.00
1	9,002.50	100.00

*** Object: Emery Res / Storage Reservoir Object ***
*** Slot: Unregulated Spill Table / Table Slot ***

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	9,000.00	0.00
1	9,002.50	1,040.00

```
*********************************************************************
***  Object:  Emery Res                  / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*********************************************************************
***  Object:  Emery Res              / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	8,990.00	0.00
1	9,002.50	16.00

Henningsons Reservoir

```
*****************************************************
***  Simulation Object: Henningsons Res           ***
***  SimObj Type:       Storage Reservoir Object  ***
*****************************************************
```

```
*************************************************************
***  Henningsons Res -- Non-Default Method Selections  ***
*************************************************************
```

SimObj Type	Method Category	Selected Method
StorageReservoir	spillCalculationCategory	unregulatedSpillCalc
StorageReservoir	Evaporation and Precipitation	Monthly Evaporation

```
*****************************************************************
***  Henningsons Res (Storage Reservoir Object) Scalar Slots  ***
*****************************************************************
```

Type	Slot Name	Value	Units
Scalar	Diversion Capacity	NaN	cfs
Table	Max Iterations	50.00	NONE
Table	Convergence Percentage	0.00	NONE

```
*********************************************************************************
***  Henningsons Res (Storage Reservoir Object) Other Non-Series Slots  ***
*********************************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Table	Elevation Volume Table	6	2	Pool Elevation, Storage
Table	Max Release	2	2	Pool Elevation, Discharge
Table	Unregulated Spill Table	3	2	Pool Elevation, Unregulated Spill
Table	Evaporation Coefficients	12	1	Ave Monthly Evaporation
Table	Elevation Area Table	6	2	Pool Elevation, Surface Area

```
*****************************************************************
***  Henningsons Res (Storage Reservoir Object) Series Slots  ***
*****************************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
SimObjMulti	Inflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Outflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Storage	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Previous Storage	acre-feet	22282	1	1 Day	Sep 30, 1950	Oct 1, 2011
AggSeries	Pool Elevation	ft	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Flow FROM Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Flow TO Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Canal Flow	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
Series	Total Inflows	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Inflow Sum	cms	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Diversion	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
SimObjMulti	Return Flow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Release	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill Capacity Fraction	decimal	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Evaporation	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Precipitation Rate	ft/month	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

AggSeries	Precipitation Volume	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Surface Area	acre	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

```
*****************************************************************
***  Object:  Henningsons Res         / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*****************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	9,987.00	0.00
1	9,990.00	15.00
2	10,000.00	105.00
3	10,010.00	300.00
4	10,014.60	469.00
5	10,018.60	590.00

```
*************************************************************
***  Object:  Henningsons Res  / Storage Reservoir Object  ***
***    Slot:  Max Release      / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	9,987.00	0.00
1	10,018.60	100.00

```
*******************************************************************
***  Object:  Henningsons Res          / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*******************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	0.00	0.00
1	10,017.10	0.00
2	10,019.00	1,300.00

```
*********************************************************************
***  Object:  Henningsons Res            / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot                ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*****************************************************************
***  Object:  Henningsons Res        / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                 ***
*****************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	9,987.00	0.00
1	9,990.00	8.00
2	10,000.00	15.00
3	10,010.00	23.00
4	10,014.60	27.00
5	10,018.60	33.00

Julius Flat Reservoir

```
*****************************************************
***  Simulation Object: Julius Flat Res           ***
***  SimObj Type:       Storage Reservoir Object  ***
*****************************************************
```

```
*********************************************************
***  Julius Flat Res -- Non-Default Method Selections  ***
*********************************************************
```

SimObj Type	Method Category	Selected Method
StorageReservoir	spillCalculationCategory	unregulatedSpillCalc
StorageReservoir	hydrologicInflowCalculationCategory	inputHydrologicInflow
StorageReservoir	Evaporation and Precipitation	Monthly Evaporation

```
*****************************************************************
***  Julius Flat Res (Storage Reservoir Object) Scalar Slots  ***
*****************************************************************
```

Type	Slot Name	Value	Units
Scalar	Diversion Capacity	NaN	cfs
Table	Max Iterations	50.00	NONE
Table	Convergence Percentage	0.00	NONE

```
*************************************************************************
***  Julius Flat Res (Storage Reservoir Object) Other Non-Series Slots  ***
*************************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Table	Elevation Volume Table	6	2	Pool Elevation, Storage
Table	Max Release	2	2	Pool Elevation, Discharge
Table	Unregulated Spill Table	2	2	Pool Elevation, Unregulated Spill
Table	Evaporation Coefficients	12	1	Ave Monthly Evaporation
Table	Elevation Area Table	7	2	Pool Elevation, Surface Area

```
*****************************************************************
***  Julius Flat Res (Storage Reservoir Object) Series Slots  ***
*****************************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
SimObjMulti	Inflow	cfs	22281	2	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Outflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Storage	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Previous Storage	acre-feet	22282	1	1 Day	Sep 30, 1950	Oct 1, 2011
AggSeries	Pool Elevation	ft	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Flow FROM Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Flow TO Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Canal Flow	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
Series	Total Inflows	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Inflow Sum	cms	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Diversion	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
SimObjMulti	Return Flow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Release	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill Capacity Fraction	decimal	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Adjust	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Net	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Evaporation	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Precipitation Rate	ft/month	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Precipitation Volume	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Surface Area	acre	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

```
*******************************************************************
***  Object:  Julius Flat Res          / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table   / Table Slot                ***
*******************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	940.00	0.00
1	950.00	7.00
2	960.00	59.00
3	970.00	220.00
4	980.00	508.00
5	986.75	725.00

```
*************************************************************
***  Object:  Julius Flat Res  / Storage Reservoir Object  ***
***    Slot:  Max Release      / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	940.00	0.00
1	986.75	100.00

```
*********************************************************************
***  Object:  Julius Flat Res          / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	985.75	0.00
1	986.50	1,300.00

```
*********************************************************************
***  Object:  Julius Flat Res          / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients  / Table Slot               ***
*********************************************************************
```

```
+----+-------------------------+
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*****************************************************************
***  Object:  Julius Flat Res       / Storage Reservoir Object  ***
***    Slot:  Elevation Area Table  / Table Slot                ***
*****************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	940.00	0.00
1	950.00	2.10
2	960.00	8.60
3	970.00	23.30
4	980.00	34.40
5	985.75	41.30
6	986.75	50.00

Spinners Reservoir

```
*****************************************************
***  Simulation Object: Spinners Res              ***
***  SimObj Type:       Storage Reservoir Object  ***
*****************************************************
```

```
*****************************************************
***  Spinners Res -- Non-Default Method Selections  ***
*****************************************************
```

SimObj Type	Method Category	Selected Method
StorageReservoir	spillCalculationCategory	unregulatedSpillCalc
StorageReservoir	hydrologicInflowCalculationCategory	inputHydrologicInflow
StorageReservoir	Evaporation and Precipitation	Monthly Evaporation

```
*****************************************************************
***  Spinners Res (Storage Reservoir Object) Scalar Slots  ***
*****************************************************************
```

Type	Slot Name	Value	Units
Scalar	Diversion Capacity	NaN	cfs
Table	Max Iterations	50.00	NONE
Table	Convergence Percentage	0.00	NONE

```
*************************************************************************
***  Spinners Res (Storage Reservoir Object) Other Non-Series Slots  ***
*************************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Table	Elevation Volume Table	12	2	Pool Elevation, Storage
Table	Max Release	2	2	Pool Elevation, Discharge
Table	Unregulated Spill Table	2	2	Pool Elevation, Unregulated Spill
Table	Evaporation Coefficients	12	1	Ave Monthly Evaporation
Table	Elevation Area Table	12	2	Pool Elevation, Surface Area

```
*****************************************************************
***  Spinners Res (Storage Reservoir Object) Series Slots  ***
*****************************************************************
```

Type	Slot Name	Units	Rows	Cols	Step	Start	End
SimObjMulti	Inflow	cfs	22281	2	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Outflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Storage	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Previous Storage	acre-feet	22282	1	1 Day	Sep 30, 1950	Oct 1, 2011
AggSeries	Pool Elevation	ft	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Flow FROM Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Flow TO Pumped Storage	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
AggSeries	Canal Flow	cfs	1	1	1 Day	Sep 30, 1950	Sep 30, 1950
Series	Total Inflows	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Inflow Sum	cms	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Diversion	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
SimObjMulti	Return Flow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Release	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Unregulated Spill Capacity Fraction	decimal	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Adjust	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Hydrologic Inflow Net	cfs	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

AggSeries	Evaporation	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
Series	Precipitation Rate	ft/month	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Precipitation Volume	acre-feet	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011
AggSeries	Surface Area	acre	22281	1	1 Day	Sep 30, 1950	Sep 30, 2011

```
*********************************************************************
***  Object:  Spinners Res            / Storage Reservoir Object  ***
***    Slot:  Elevation Volume Table  / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Storage [acre-feet]
0	9,585.00	0.00
1	9,590.00	5.00
2	9,595.00	10.00
3	9,600.00	75.00
4	9,605.00	130.00
5	9,610.00	275.00
6	9,615.00	400.00
7	9,620.00	600.00
8	9,625.00	790.00
9	9,626.30	865.00
10	9,645.00	1,041.42
11	9,650.00	1,300.09

```
*************************************************************
***  Object:  Spinners Res  / Storage Reservoir Object  ***
***    Slot:  Max Release   / Table Slot                ***
*************************************************************
```

	Pool Elevation [ft]	Discharge [cfs]
0	9,585.00	0.00
1	9,650.00	300.00

```
*********************************************************************
***  Object:  Spinners Res            / Storage Reservoir Object  ***
***    Slot:  Unregulated Spill Table / Table Slot                ***
*********************************************************************
```

	Pool Elevation [ft]	Unregulated Spill [cfs]
0	9,645.00	0.00
1	9,650.00	2,300.00

```
*********************************************************************
***  Object:  Spinners Res            / Storage Reservoir Object  ***
***    Slot:  Evaporation Coefficients / Table Slot               ***
*********************************************************************
```

	Ave Monthly Evaporation [ft/month]
0	0.00
1	0.00
2	0.00
3	0.00
4	0.06
5	0.22
6	0.23
7	0.17
8	0.07
9	0.00
10	0.00
11	0.00

```
*********************************************************************
***  Object:  Spinners Res          / Storage Reservoir Object    ***
***    Slot:  Elevation Area Table  / Table Slot                  ***
*********************************************************************
```

	Pool Elevation [ft]	Surface Area [acre]
0	9,585.00	0.00
1	9,590.00	1.00
2	9,595.00	3.00
3	9,600.00	13.00
4	9,605.00	21.00
5	9,610.00	29.00
6	9,615.00	35.00
7	9,620.00	41.00
8	9,625.00	49.00
9	9,626.30	51.00
10	9,645.00	55.00
11	9,650.00	60.00

MCIC Data

```
****************************************
***  Simulation Object: MCIC Data    ***
***  SimObj Type:       Data Object  ***
```

```
****************************************

************************************************
***  MCIC Data (Data Object) Scalar Slots  ***
************************************************
```

Type	Slot Name	Value	Units
Scalar	EmeryReturnFlowFraction	0.45	decimal
Scalar	MooreReturnFlowFraction	0.10	decimal
Scalar	EmeryIrrLand	4,580.00	acre
Scalar	MooreIrrLand	2,830.00	acre

```
*************************************************************
***  MCIC Data (Data Object) Other Non-Series Slots  ***
*************************************************************
```

Type	Slot Name	Rows	Cols	Column Labels
Periodic	EmeryIrrRequired	12	1	
Periodic	MooreIrrRequired	12	1	

```
*****************************************************
***  Object:  MCIC Data          / Data Object    ***
***    Slot:  EmeryIrrRequired  / Periodic Slot  ***
*****************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.05
0:00 May 1	4.87
0:00 Jun 1	6.18
0:00 Jul 1	7.84
0:00 Aug 1	6.02
0:00 Sep 1	3.51
0:00 Oct 1	0.68
0:00 Nov 1	0.00
0:00 Dec 1	0.00

```
*****************************************************
***  Object:  MCIC Data          / Data Object    ***
***    Slot:  MooreIrrRequired  / Periodic Slot  ***
*****************************************************
```

	0.00 [NONE]
	[in/month]
0:00 Jan 1	0.00
0:00 Feb 1	0.00
0:00 Mar 1	0.00
0:00 Apr 1	0.05
0:00 May 1	4.87
0:00 Jun 1	6.18
0:00 Jul 1	7.84
0:00 Aug 1	6.02
0:00 Sep 1	3.51
0:00 Oct 1	0.68
0:00 Nov 1	0.00
0:00 Dec 1	0.00

Reservoir Data

```
*****************************************
***  Simulation Object: ReservoirData  ***
***  SimObj Type:       Data Object    ***
*****************************************

*****************************************************
***  ReservoirData (Data Object) Scalar Slots  ***
*****************************************************
```

Type	Slot Name	Value	Units
Scalar	Emery Res Dead Pool	1.00	acre-feet
Scalar	Spinners Res Dead Pool	1.00	acre-feet
Scalar	Julius Flat Dead Pool	1.00	acre-feet
Scalar	Henningsons Res Dead Pool	1.00	acre-feet

Water Rights Priority Schedules

HUNTINGTON CREEK DISTRIBUTION SCHEDULE
April 1, 2007

Priority	Water User	Water Right Number	Type of Right	Acres	Interest	CFS	Cumulative CFS	Acre Feet	Cumulative Acre Feet	Cumulative Storage (af)	Source	Reservoir	Capacity (ac-ft)	Storage Rights By Reservoir	Use	Period Of Use
1st Class 1874	Huntington Cleveland Irrigation Company	93-219, 220, 221, 222, 224, 226, 228, 239, 240, 243, 253, 254, 272, 303, 304, 308, 310	A.H. Christensen Decree 1915	22,255.94	100%	150.00	150.00	145,647*	145,647*		Huntington Creek, Tributary Streams & Numerous Springs				Irrigation	Mar. 2 - Nov. 14
															Stock	Jan. 1 - Dec. 31
															Domestic	Jan. 1 - Dec. 31
															Municipal	Jan. 1 - Dec. 31
															Power Generation	Jan. 1 - Dec. 31
															Industrial	Jan. 1 - Dec. 31
2nd Class 1879	Huntington Cleveland Irrigation Company	93-2180, 2193, 2196, 2199, 2202, 2205, 2208, 2211, 2214, 2217, 2220, 2223, 2226, 2229, 2232, 2235, 2238	A.H. Christensen Decree 1915		100%	46.00	196.00				Huntington Creek, Tributary Streams & Numerous Springs				Same as First Class	
3rd Class 1884	Huntington Cleveland Irrigation Company	93-2191, 2194, 2197, 2200, 2203, 2206, 2209, 2212, 2215, 2218, 2221, 2224, 2227, 2230, 2233, 2236, 2239	A.H. Christensen Decree 1915		100%	77.25	272.25				Huntington Creek, Tributary Streams & Numerous Springs				Same as First Class	
4th Class 1888	Huntington Cleveland Irrigation Company	93-2192, 2195, 2198, 2201, 2204, 2207, 2210, 2213, 2216, 2219, 2222, 2225, 2228, 2231, 2234, 2237, 2240	A.H. Christensen Decree 1915		100%	80.50	352.75				Huntington Creek, Tributary Streams & Numerous Springs				Same as First Class	
1896	Huntington Cleveland Irrigation Company	93-1137	A.H. Christensen Decree 1915		100%			3,274.10	152,931.10	3,274.10	Lake Canyon Creek	Cleveland	8,280.00	3,274.10	Same as First Class with the addition of: Fish Culture	Jan. 1 - Dec. 31
															Storage	Jan. 1 - Dec. 31
		93-1138			100%			50.00	152,971.10	3,324.10	Lake Canyon Creek	Cleveland		3,324.10	Same as 93-1137	
1892	Huntington Cleveland Irrigation Company	93-1136	A.H. Christensen Decree 1915		100%			2,085.00	155,056.10	5,409.10	Lake Canyon Creek	Huntington	5,617.00	2,325.00	Same as 93-1137	
		93-1139			100%			50.00	155,014.10	5,407.10	Lake Canyon Creek	Cleveland		5,382.10		
May 22, 1914	Morris M. Gaymon	93-269	Application	122.82	20%	1.50	253.75	190.00	155,250.90		Huntington Creek				Irrigation	Apr. 1 - Oct. 15
	Lloyd Lotteral c/o Melvin Gilbert	93-296	Application		20%											
	Morrill J. Kirby	93-299	Application		20%											
	Nielson Ltd.	93-300	Application		40%											
July 25, 1916	Huntington Cleveland Irrigation Company	93-928	Application		100%			800.00	155,850.90	6,007.10	Lake Fork Creek	Huntington		6,023.00	Same as 93-1137	

HUNTINGTON CREEK DISTRIBUTION SCHEDULE

April 1, 2007

Priority	Water User	Water Right Number	Type of Right	Acres	Interest	CFS	Cumulative CFS	Acre Feet	Cumulative Acre Feet	Cumulative Storage (af)	Source	Reservoir	Capacity (ac. ft)	Storage Rights Reservoir	Use	Period Of Use
Dec. 21, 1916	Grant Johnson	93-254	Application	517.00	100%	10.00	163.75	2,068.00	157,910.90		Huntington Creek				Irrigation	Apr. 1 - Oct. 31
Jan. 12, 1921	Huntington-Cleveland Irrigation Company	93-280	Application		100%			455.00	160,555.90	9,475.10	Huntington Creek	Huntington	455.00	455.00	Storage 93-1137	
Aug. 5, 1922	Huntington-Cleveland Irrigation Company	93-091	Application		100%			9,480.00	169,390.12	10,364.72	Millers Flat Creek	Millers Flat	9,447.00	9,480.00	Storage 93-1137	
	Bureau of Reclamation	93-093	Application (pending)		100%			3,100.00	172,770.12	21,914.72	Huntington Creek	Huntington Creek	5,000.00	3,100.00	Irrigation	Apr. 1 - Oct. 31
															Stock	Jan. 1 - Dec. 31
															Storage	Jan. 1 - Dec. 31
															Domestic	Jan. 1 - Dec. 31
															Municipal	Jan. 1 - Dec. 31
															Industrial	Jan. 1 - Dec. 31
															Fish Culture	Jan. 1 - Dec. 31
															Recreation	Jan. 1 - Dec. 31
Aug. 21, 1926	Morris M. Guymon	93-270	Application	Inc. 1914	40%	2.56	166.31	Inc. 1914	Inc. 1914		Huntington Creek				Irrigation	Mar. 1 - Nov. 1
	Dale L. & Vilas H. Terry	93-289	Application		40%											
Apr. 11, 1935	Nielson Ltd.	93-283	Application	102.72	100%	4.10	170.41	450.00	170,187.40		Huntington Creek				Irrigation	Apr. 1 - Nov. 1
Dec. 5, 1955	PacifiCorp	93-268	Application	132.95	100%	2.28	172.69	531.00	170,719.20		Huntington Creek				Irrigation	Apr. 1 - Oct. 31
															Stock	Jan. 1 - Dec. 31
July 2, 1962	Huntington-Cleveland Irrigation Company	93-588	Application (pending)		100%			3,000.00	173,919.20	24,914.72	Huntington Creek	Huntington		3,000.00	Storage 93-1137	
		93-1140						4,000.00	177,919.20	28,914.72	Huntington Creek				Irrigation	Jan. 1 - Dec. 31
		93-1139	Application					2,000.00	179,919.20	30,914.72	Lake Canyon Creek	Cleveland		2,000.00	Storage 93-1137	
Dec. 10, 1968	PacifiCorp	93-1115	Application		100%	20.00	193.69				Dace Creek & Huntington Creek				Irrigation	Mar. 2 - Nov. 14
															Power Generation	Jan. 1 - Dec. 31
															Industrial	Jan. 1 - Dec. 31
		93-1116	Application		100%			32,250.00	214,969.20	63,139.72	Huntington Creek	Electric Lake	12,200.00	12,200.00	Power Generation	Jan. 1 - Dec. 31
															Industrial	Jan. 1 - Dec. 31
															Storage	Jan. 1 - Dec. 31

ACRE FEET - SOLID - DEFINED IN PROPOSED DETERMINATION OR WATER USERS CLAIM

ACRE FEET - REGULAR - CALCULATED VALUE

*Using 4.5 af/ac Average Duty Value

**Not Defined

***Using 3 af/ac Duty Value

2

87

COTTONWOOD CREEK DISTRIBUTION SCHEDULE

Without Transbasin Diversion

December 14, 2005

PRIORITY	WATER USER	WATER RIGHT NUMBERS	FLOW		SUB-TOTAL		SOURCE	PERIOD OF USE
			CFS	AF	CFS	AF		
1st Class Decree 1877	CCCIC	93-22, 2137, 2140, 2143, 2146, 2149, 2152, 2155, 2158, 2164, 2167, 2170, 2175, 2178, 2183	108.113	86.1%	108.113		Cottonwood Creek	Mar 1 - Nov 30
	Mill Ditch (Wilcox-SeelyDitch)	93-2187-2189, 3061-3078	8.816	7.16%	116.929		Cottonwood Creek	Mar 1 - Nov 30
	Wilberg Ditch (Magnusen)	93-2173	0.500	0.0044%	117.429		Cottonwood Creek	Mar 1 - Nov 30
	Wilsonville Ditch (Jorgensen)	93-2181	5.286	4.31%	122.715		Cottonwood Creek	Mar 1 - Nov 30, Jan 1 - Dec 31
2nd Class Decree 1879	CCCIC	93-2138, 2141, 2144, 2147, 2150, 2153, 2156, 2159, 2162, 2165, 2168, 2171, 2176, 2179, 2184	39.066		161.781		Cottonwood Creek	Mar 1 - Nov 30
	Huntington, Johansen, Jensen (C. E. Kofford)	93-234, 552, 571	3.300		165.081		Indian Creek	Mar 1 - Nov 30
	Johansen (Reynolds)	93-570	0.333		165.414		Indian Creek	Mar 1 - Nov 30
	Wilberg Ditch	93-2174	1.167		166.581		Cottonwood Creek	Mar 1 - Nov 30
1880	Vaughn Fail	93-573	2.000		168.581		Fuller Creek	Mar 1 - Nov 30
3rd Class Decree 1884	CCCIC	93-2139, 2142, 2145, 2148, 2151, 2154, 2157, 2160, 2163, 2166, 2169, 2172, 2177, 2180, 2185	8.330		176.911		Cottonwood Creek	Mar 1 - Nov 30
	Jennie C. Peacock	93-1088	0.500		177.911		Little Cottonwood Creek	Apr 1 - Oct 31
1890	Kirk Johansen	93-1076	3.650		181.061		Indian Creek	Apr 1 - Oct 31
	Kirk Johansen	93-1077	0.350		181.411		Little Joes Valley Creek	Apr 1 - Oct 31
June 10, 1909	Donald R. Curtis etal	93-910	0.300		181.711		Grimes Wash	Apr 1 - Oct 31
January 11, 1912	CCCIC	93-921	20.000		201.711		Cottonwood Creek	Jan 1 - Dec 31
June 2, 1919	Wilberg, Olsen, Strate	93-582, 620, 622, 945	9.990		211.701		Black Canyon Creek	May 12 - Jun 30
August 3, 1922	Bur. Of Reclamation	93-952		100,000.00		100,000.00	Cottonwood Creek	Jan 1 - Dec 31

PRIORITY	WATER USER	WATER RIGHT NUMBERS	FLOW		SUB-TOTAL		SOURCE	PERIOD OF USE
			CFS	AF	CFS	AF		
3rd Class Decree Cont. September 11, 1929	Oral E. Johansen	93-558		266.00		100,266.00	Indian Creek	Mar 1 - Nov 30
September 11, 1929	Bradley Vaughn & Kaylyn Fail; Craig & Deanna Humes Trust; William Allen and Vila Le Jewkes; Keneth Ray & Kathleen Woodruff	93-965		60.88		100,326.88	Swasey Creek	Apr 15 - Oct 1
September 9, 1932	Bur. Of Reclamation	93-980	4.460		216.161		Seely Creek	Apr 1 - Jul 1
February 26, 1940	Bur. Of Reclamation	93-1003		117,546.00		217,872.88	Cottonwood Creek	Mar 1 - Oct 31
April 23, 1945	CCCIC	93-1018	50.000		266.161		Cottonwood Creek	Jan 20 - Jul 20
April 23, 1947	CCCIC	93-1020	37.250		303.411		Cottonwood Creek	Jan 20 - Jul 20
June 28, 1947	USA Forest Service	93-1021	2.940		306.351		Reeder Creek	Mar 1 - Jul 1
June 28, 1947	USA Forest Service	93-1022	3.000		309.351		Lowry Creek	Mar 1 - Jul 1
June 25, 1973	Wildlife Resources	93-463	1.100		310.451		Cottonwood Creek Lund Ditch	Apr 1 - Oct 31 Jan 1 - Dec 31

Hunter Plant Demand (Courtesy of PacifiCorp Hunter Plant)

HUNTER PLANT WATER BUDGET - MONTHLY ACTUAL USAGE												
WATER YEAR APR 2007 TO MAR 2008												
	COTTONWOOD CREEK				MILLSITE				SNOWLAKE	TOTAL WATER REMAINING AT MONTHS END	ACTUAL DEMAND IN ACRE FEET	PROJECTED DEMAND IN ACRE FEET
MONTH	PRIMARY		PROJECT		PRIMARY		LEASED		STORAGE			
	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED				
YEAR END BALANCES			5497						1321			
APR	3000	750	8576	1232	2968	1060	7000	0	2032		1099	1600
MAY		851		0		487		0	2032		1338	1600
JUN	-447	952		0	-1052	703		0	1931		1756	1600
JUL	2065	1164		0	2968	791		0	1956		1930	1600
AUG		901		267		819		0	2001		1942	1600
SEP		0		1198		713		0	2100		1812	1600
OCT		0		1291		311		405	2100		2007	1600
NOV		0		1250		0		619	2100		1869	1600
DEC		0		167		0		1052	2000		1319	1600
JAN		0		109		0		1156	1931		1334	1600
FEB		0		107		0		884	1649		1273	1600
MAR		0		42		0		1074	1438		1327	1600
TOTALS	4618	4618	14073	5663	4884	4884	7000	5190	1438	11658	19006	19200
	Cottonwood Project Water Remaining			8410	Millsite Leased Water Remaining			1810	958	11178		

NOTE: THE SHADED AREAS INDICATE THE MONTHS A GIVEN WATER SUPPLY CAN BE USED

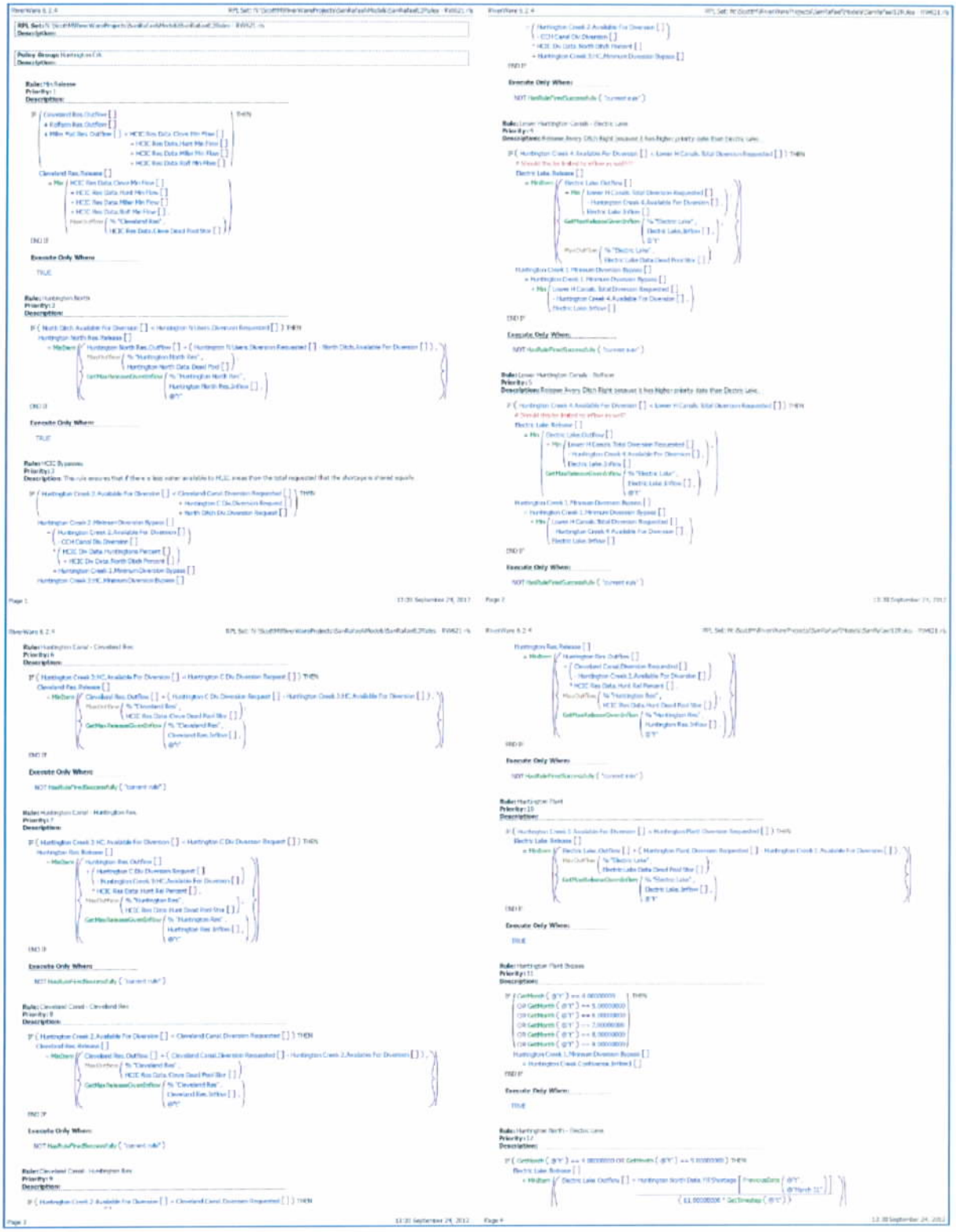
WATER YEAR APR 2008 TO MAR 2009												
	COTTONWOOD CREEK				MILLSITE				SNOWLAKE	TOTAL WATER REMAINING AT MONTHS END	ACTUAL DEMAND IN ACRE FEET	PROJECTED DEMAND IN ACRE FEET
MONTH	PRIMARY		PROJECT		PRIMARY		LEASED		STORAGE			
	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED				
YEAR END BALANCES			0						1438			
APR	1381	1381	8576	1232	2968	180	7000	0	1159		1840	1600
MAY	1476	1476		0		1058		0	1833		1860	1600
JUN	1269	1269		0	-1227	503		0	2083		1522	1600
JUL	1230	1230		0	3148	727		0	2110		1471	1600
AUG	932	932		268		610		0	2110		1810	1600
SEP	603	603		528		698		0	2110		1829	1600
OCT	0	0		1168	-446	667		0	2110		1835	1600
NOV	0	0		1131	0	0		747	2110		1878	1600
DEC	0	0		906	0	0		440	2032		1424	1600
JAN	0	0		118	0	0		1077	1786		1441	1600
FEB	0	0		106	0	0		925	1627		1190	1600
MAR				56				1096	1321		1458	1600
TOTALS	6891	6891	8576	5513	4443	4443	7000	4285	1627	7405	19558	19200
	Cottonwood Project Water Remaining			3063	Millsite Leased Water Remaining			2715	1147	6925		

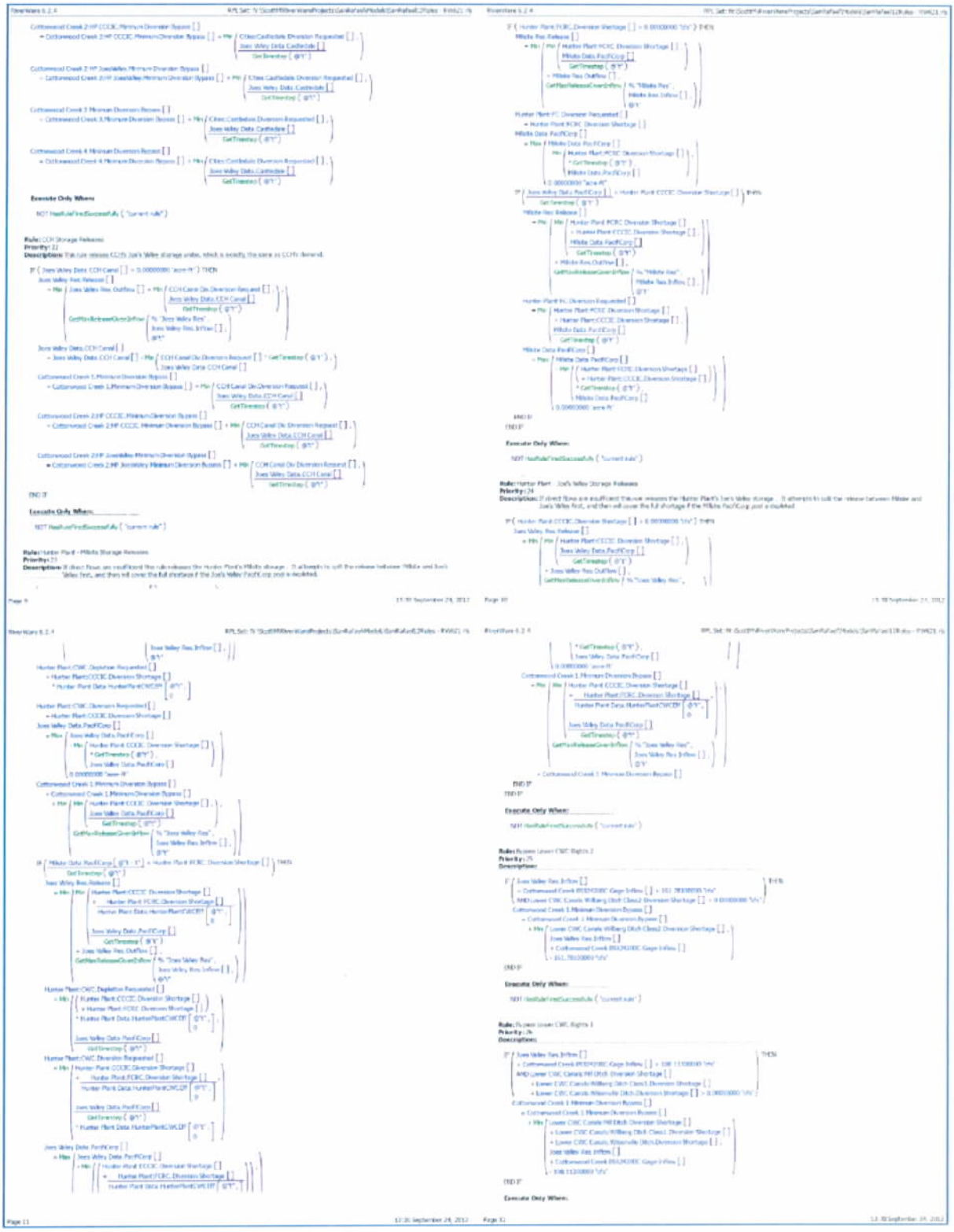
WATER YEAR APR 2009 TO MAR 2010												
	COTTONWOOD CREEK				MILLSITE				SNOWLAKE	TOTAL WATER REMAINING AT MONTHS END	ACTUAL DEMAND IN ACRE FEET	PROJECTED DEMAND IN ACRE FEET
MONTH	PRIMARY		PROJECT		PRIMARY		LEASED		STORAGE			
	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED				
YEAR END BALANCES			3007						1321			
APR	3249	938	8576	1232	2968	731	7000	0	1480		1510	1600
MAY		1230		0		842		0	1975		1577	1600
JUN		1190	-3007	0	-808	587		0	2032		1834	1600
JUL	1104	1104		126	2968	396		0	2032		1626	1600
AUG	797	797		348		716		0	2136		1965	1600
SEP	347	347		724		700		0	2136		1771	1600
OCT	0	0		1107	-487	669		0	2136		1776	1600
NOV				1071				735	2057		1885	1600
DEC				250				941	1981		1267	1600
JAN	0	106	-184	34				868	1605		1568	1600
FEB		95		0				909	1562		1047	1600
MAR		89						434	1109		976	1600
TOTALS	5497	5896	8392	4892	4641	4641	7000	3887	1109	7323	18802	19200
	Cottonwood Project Water Remaining			3500	Millsite Leased Water Remaining			3113	629	6843		

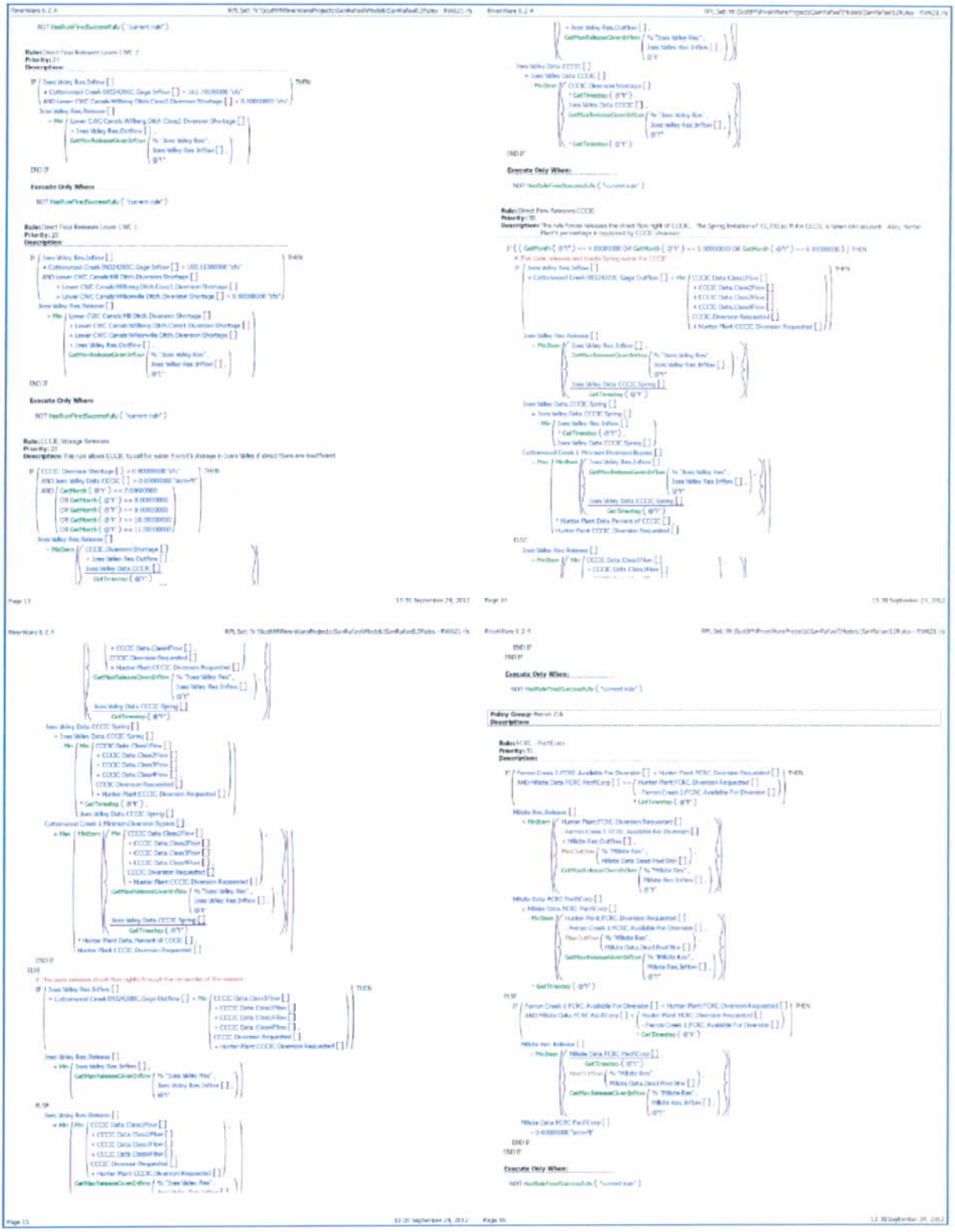
WATER YEAR APR 2010 TO MAR 2011												
	COTTONWOOD CREEK				MILLSITE				SNOWLAKE	TOTAL WATER REMAINING AT MONTHS END	ACTUAL DEMAND IN ACRE FEET	PROJECTED DEMAND IN ACRE FEET
MONTH	PRIMARY		PROJECT		PRIMARY		LEASED		STORAGE			
	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED				
YEAR END BALANCES			3500						1109			
APR	3478	492	8576	1232	2968	807	7000	0	898		1510	1600
MAY		1660		0		1076		0	1605		2029	1600
JUN	281	1607	3500	0	-679	406		0	2136		1482	1600
JUL	1192	1192		115	2968	643		0	2032		2054	1600
AUG	615	615		583	1484	468		0	2032		1666	1600
SEP	258	258		932		438		0	2032		1628	1600
OCT	0	0		1230	-2646	258		0	1931		1589	1600
NOV				1031				683	1931		1714	1600
DEC				1083				753	2032		1937	1600
JAN				103				1002	1833		1304	1600
FEB				84				895	1649		1163	1600
MAR				456				178	1418		865	1600
TOTALS	5824	5824	8576	6849	4096	4096	7000	3511	1418	6634	18941	19200
Water remaining at months end	Cottonwood Primary	**0**	Cottonwood Project	1727	Millsite Primary	0	Millsite Leased	3489	938	**6154**		

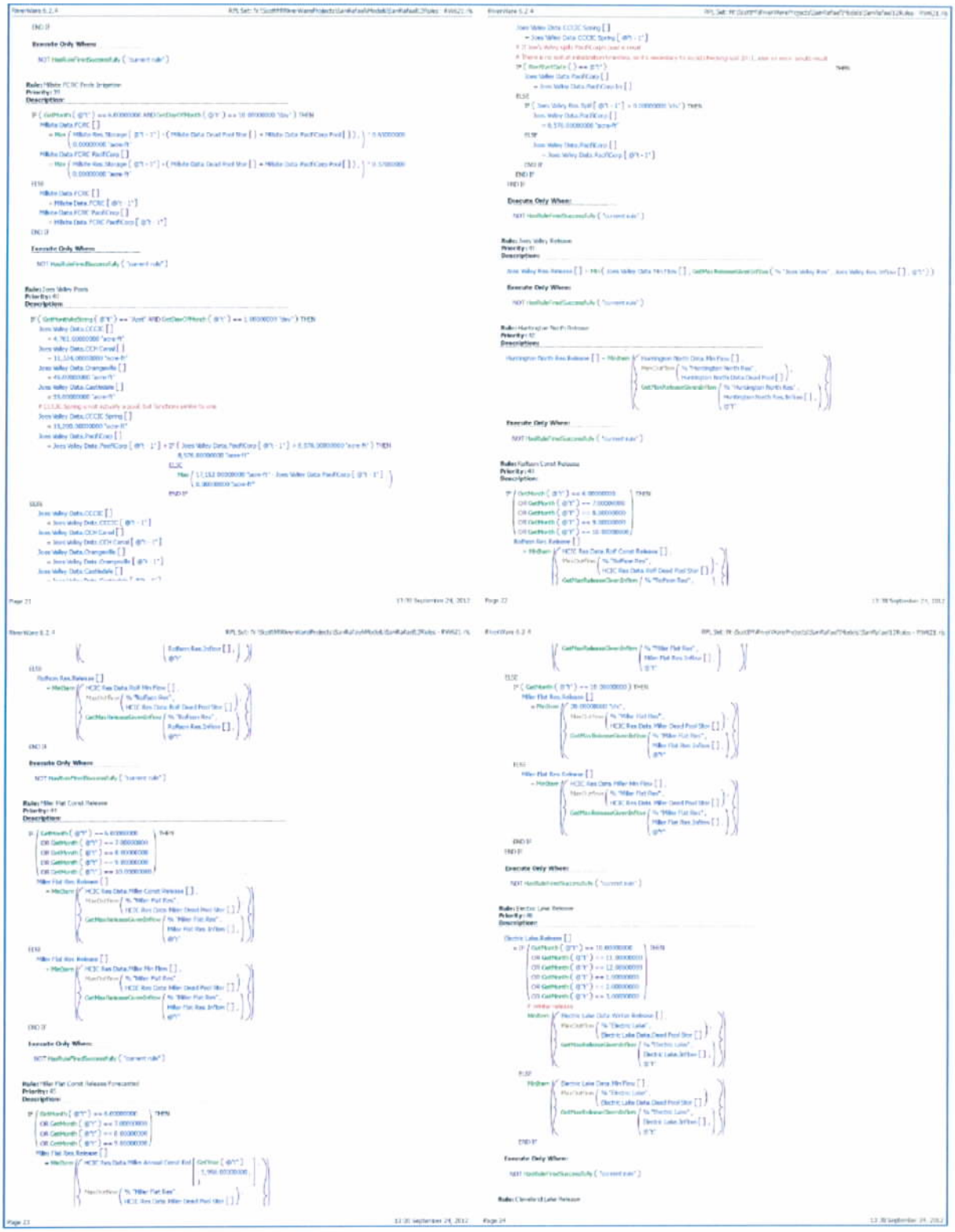
WATER YEAR APR 2011 TO MAR 2012												
	COTTONWOOD CREEK				MILLSITE				SNOWLAKE	TOTAL WATER REMAINING AT MONTHS END	ACTUAL DEMAND IN ACRE FEET	PROJECTED DEMAND IN ACRE FEET
MONTH	PRIMARY		PROJECT		PRIMARY		LEASED		STORAGE			
	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED	ALLOCATED	USED				
YEAR END BALANCES			0						1739			
APR	3478	500	8576	0	2968	235	7000	0	1398		1076	1600
MAY		1011		0		881		0	1763		1527	1600
JUN	(987)	980		0		618		0	2032		1329	1600
JUL	797	797		0	(670.00)	564		0	1931		1462	1600
AUG	852	852		1232	2968	586		0	1833		1914	1600
SEP	674	674		0		649		0	1739		1417	1600
OCT	78	78		1111	(925.00)	808		0	2032		1997	1600
NOV		0		520		0		644	2032		1164	1600
DEC		0		1291		0		740	2032		2031	1600
JAN		0		283		0		821	1931		1205	1600
FEB		0		77		0		885	1649		1244	1600
MAR		0		67		0	(3206.00)	704	1438		982	1600
TOTALS	4892	4892	8576	4581	4341	4341	3794	3794	1438	5433	17348	19200
Water remaining at months end	Cottonwood Primary	**0**	Cottonwood Project	3995	Millsite Primary	0	Millsite Leased	0	958	**4953**		

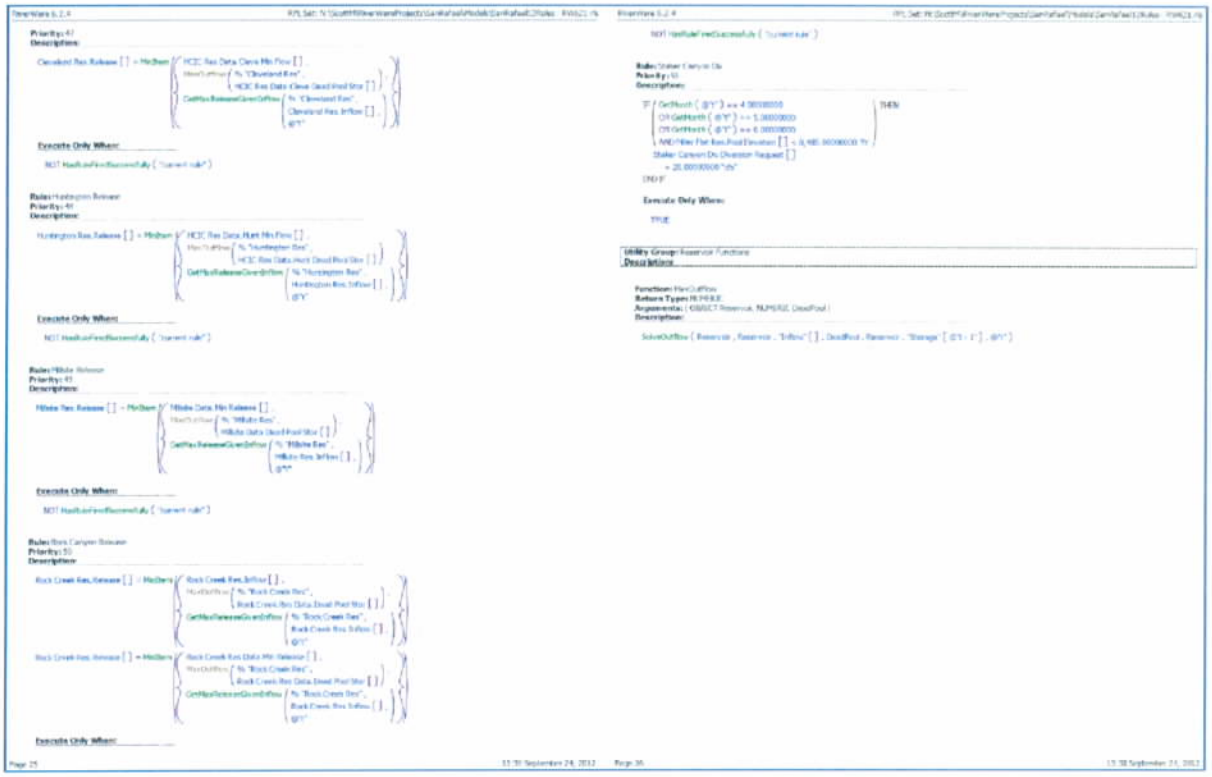
San Rafael River Model Rules



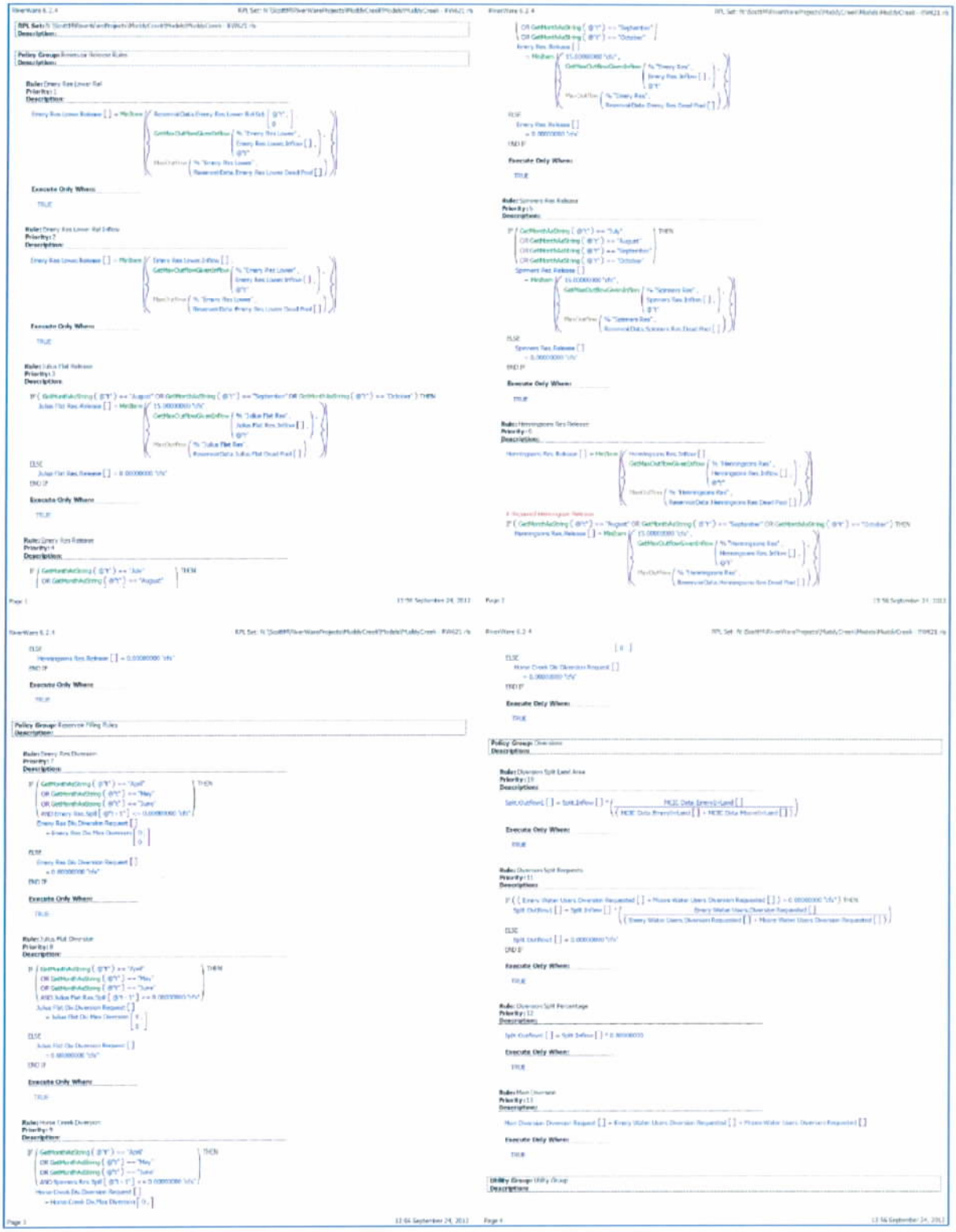








Muddy Creek Model Rules



Additional Appendix Items

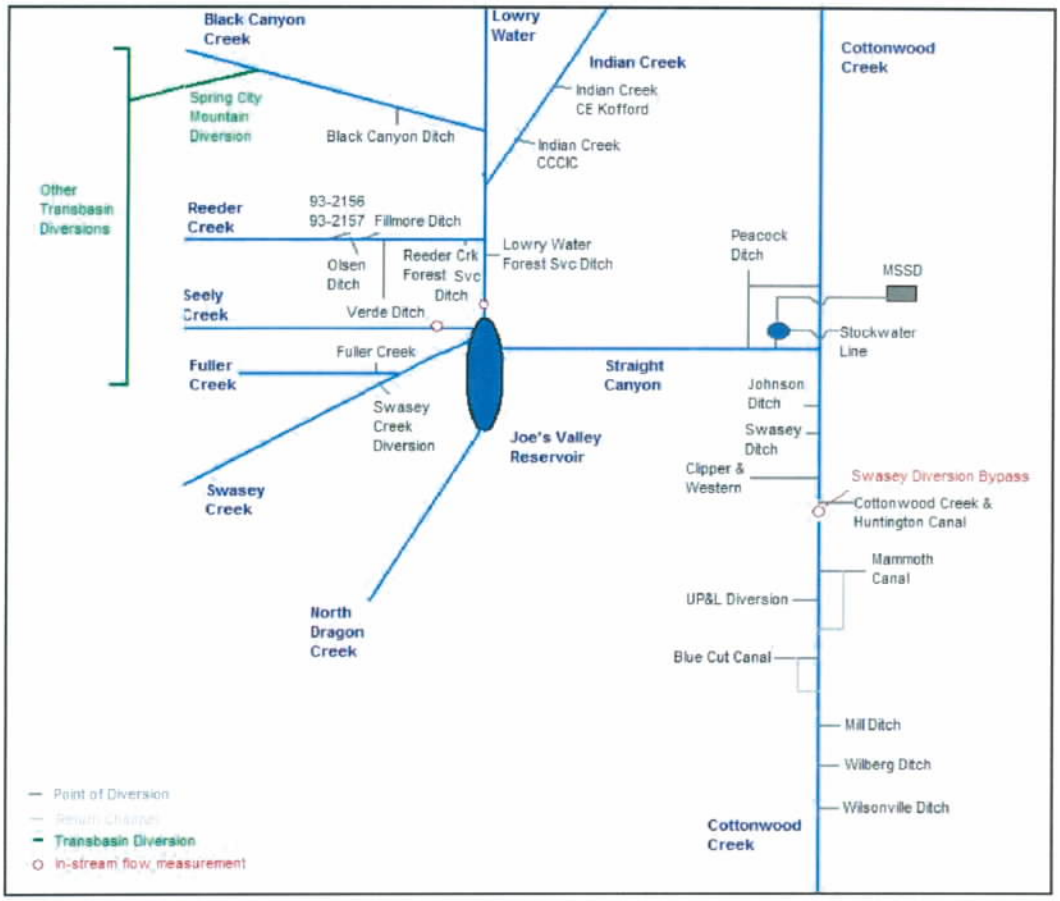
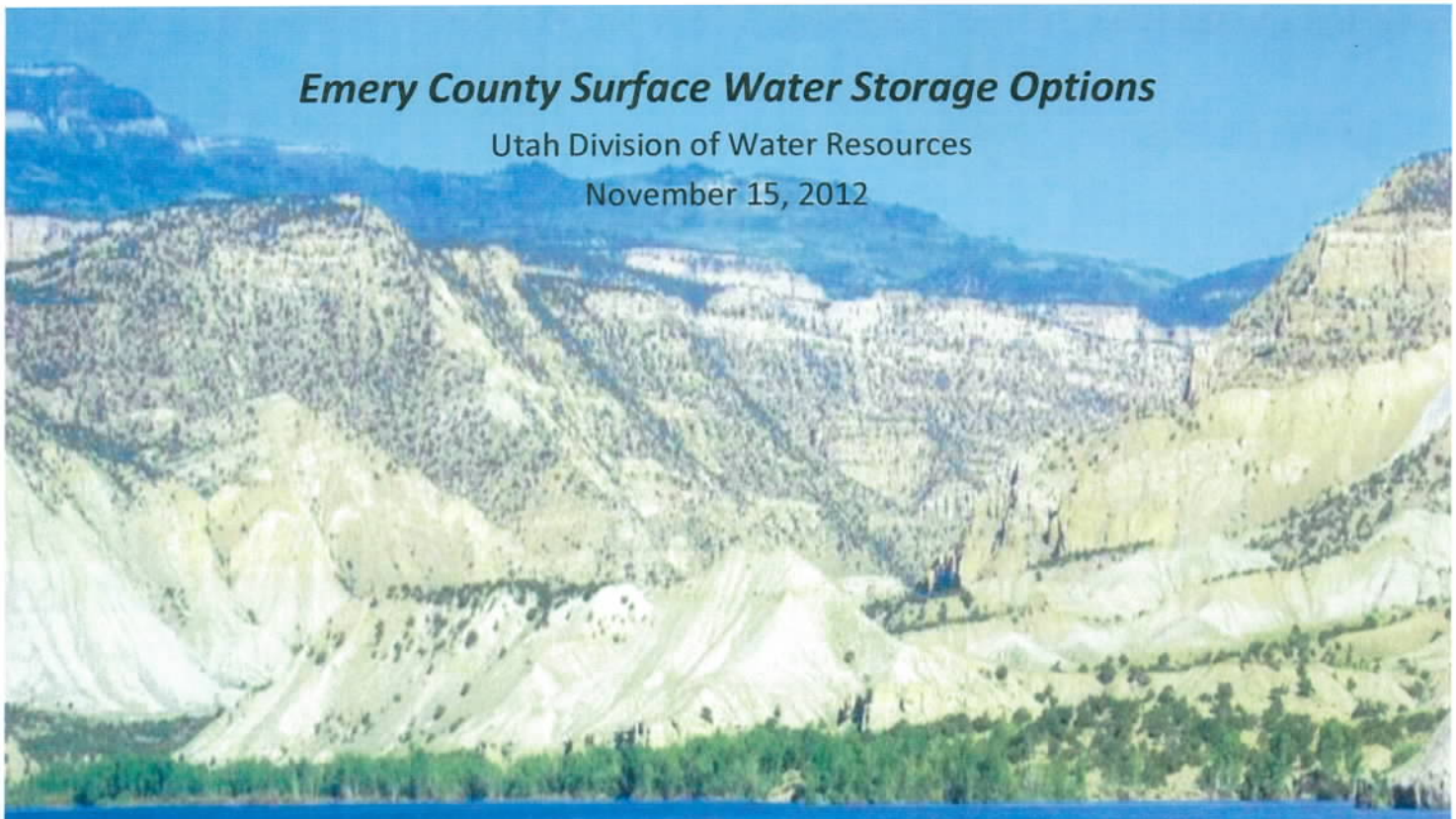


Figure 56 - Cottonwood Creek Service Area Canal Map

Emery County Surface Water Storage Options

Utah Division of Water Resources

November 15, 2012



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SURFACE WATER
STORAGE OPTIONS

INTRODUCTION

This study looks at potential dam and reservoir sites within the San Rafael River/Muddy Creek Watershed Study area. Increasing the storage capacity of any water supply system is an effective way to enhance the utilization of available water. Water that otherwise might exit the watershed for downstream destinations can be captured, stored, then used as needed.

Specific objectives of this report include the process of first identifying potential sites then assessing their feasibility to host surface water storage facilities. Utilizing a screening process, potential sites are subjected to an increasingly rigorous series of standards that allow the better sites to move forward and the less feasible sites to drop out. Central to this process is the input from and support of water users throughout the study area.

Background

Since Castle Valley was first settled the need to improve availability of water, often referred to as the "life blood of the west", has been recognized and attempts to move in that direction have been ongoing. Over time, federal, state, and local entities have investigated sites, within the San Rafael River and Muddy Creek drainage basins, where dams and reservoirs might be constructed. Up to this time, only a modest number of these sites have been pursued beyond cursory evaluation and fewer still have progressed through preliminary design and cost estimation. Only the most favored or feasible storage sites have been built to date for a variety of reasons, including compromising geological or geotechnical conditions, inadequate water supply, complicated environmental permitting, public opposition, land ownership, and cost.

Current Study

For this study, the Utah Division of Water Resources was asked to identify potential on-stream and off channel sites suitable for water storage. This was achieved by identifying multiple locations dependent on such considerations as site physiography, geology, land ownership, hydrology, and estimated cost based on an assumed simplified dam configuration and design. With the exception of wilderness lands within the San Rafael Swell, all other areas within the San Rafael River and Muddy Creek basins, upstream of their confluence with the Green River were examined for potential dam and reservoir sites, including terrain outside Emery County limits.

Methodology

As with any study of this nature, dam and reservoir site selection is a step by step process whereby potential sites are first identified, then screened using certain criteria related to geological, geotechnical, engineering, economic, social, and environmental considerations. Those with fatal flaws or too many unfavorable characteristics to overcome are eliminated; those

sites remaining are progressively screened using more rigorous criteria such as dam size compared to storage, utility, and cost benefit to prospective users. In this manner, a final group of sites exhibiting the most favorable characteristics is obtained. For this study, we essentially followed a multi-step process; beginning with identification of prospective sites, then proceeding through several screenings to eliminate those with immediately obvious issues, and concluding with a final phase involving cursory cost estimation and final ranking. A brief summary of each step in the process is listed below, referring to the subsequent five sections of the report where pertinent figures and details summarized in data tables will be found.

1. Site Identification

Potential dam and reservoir sites were identified from several sources. Researching reports from state and federal agencies and discussions with local water users yielded multiple sites of interest. Additional sites were identified using USGS 7.5 minute quadrangle mapping at a scale of 1:24,000 (See Figure 1). These topographic maps served as a basis for identifying potential dam and reservoir sites based on favorable physiography. At this phase, dam and reservoir sizes were simply maximized in accordance with the terrain attributes with no regard to water availability. A total of ninety-one sites at the locations shown on Figure 2 and itemized in Table 1 were selected for further evaluation. For each of these, an illustration of the embankment location and size, reservoir configuration, and land ownership were prepared but not included in this report.

2. Preferred Site Selection

Due to the large number of sites identified, maps showing the locations of all ninety-one potential reservoirs and a copy of Table 1 were sent to each of the four irrigation companies. Their decision concerning which sites were of greatest interest to them was an important next step in the screening process. Tables 2A-2D provide information concerning the forty "preferred" sites that resulted from this effort. Irrigation Company preference is noted on the Tables.

Section 2 provides a written summary of the location, dimensions, potential storage, land ownership, geology, and foundation and other considerations for each of the forty sites. Individual maps for each site accompanies the text. The tables in this section provide a summary of the embankment's pertinent physical characteristics, anticipated reservoir storage, and embankment volume to reservoir storage ratios, this last providing a qualitative means of comparing relative feasibility of the sites.

3. Screening Process

In section 3, each of the forty dam and reservoir sites were examined with respect to the criteria already mentioned (geological including natural hazards, geotechnical, engineering, economic, social, land ownership, environmental considerations, and embankment volume compared to reservoir storage). A number of the sites were

eliminated due to fatal flaws such as having the Joes Valley fault in the abutment or being located on land administered by the U.S. Forest Service or for having too many unfavorable characteristics to overcome such as a lack of available water supply, remote location relative to diversion points, too large of a dam relative to expected reservoir storage, or any combination of these and other factors.

Based on this screening, fourteen of the sites were eliminated from further evaluation leaving twenty-six to move into the next phase. Table 3 lists the remaining twenty-six sites and reflects the changes to some sites based on water supply (see Section 4).

4. Water Supply and Cursory Cost Estimation

In this section, the hydrology upstream of each dam site, whether on-stream or off channel was evaluated to determine the available upstream contribution to the water supply for each reservoir. In addition, the feasibility of diversion from the nearest source as a means of filling the off channel reservoirs to maximum capacity was considered. Once the maximum reservoir storage was determined by evaluating the water supply, the dam structure was re-sized. Table 4 lists seven of the twenty-six screened sites where limited water supply resulted in our downsizing the dams and reservoirs. Individual site maps and accompanying text for the seven downsized dams and reservoirs, showing their revised configuration in accordance with water availability are located in this section. Map configurations and text of the other nineteen sites did not change and thus are not repeated in this section.

A cursory estimate of construction costs was calculated for each of the twenty-six remaining sites for comparison purposes and to serve as the basis for the next level of screening (see Table 5). Locations of the twenty-six sites appear on Figure 3.

5. Final Site Selection

For final screening of the remaining sites, cursory costs developed in step 4 were reviewed based on estimates of water availability within the river system as a whole and the feasibility of delivering water to each of the proposed off-channel reservoir locations. Known demands on water in the San Rafael River/Muddy Creek system from existing diversions and requirements for certain base flow, for endangered fish will limit the amount of water available for reservoir storage beyond that considered in the preceding phase. When these restrictions are taken into account, a number of the remaining sites no longer appear feasible, either from the standpoint of water availability, cost, or both. Specifically, some appear cost-prohibitive when evaluated on the basis of cost-per-acre-foot of usable storage. Based on this evaluation, a number of the dam sites no longer warrant further consideration. Table 6 presents a summary of the cost estimates developed for the twenty-six dam sites. Economics will constrain the feasibility of these sites. Based on cost-per-acre-foot, the sites are ranked in this table from the most favorable to the least favorable.

Section 1
Site Identification

The ninety-one sites, identified in this section, are ranked in Table 1 based on the ratio between embankment volume in cubic-yards and reservoir storage in acre-feet. As the table demonstrates, Mexican Bend site, on the San Rafael River, has the lowest ratio (2.1) while the Lower Ferron F, an off-stream site, has the highest ratio (580.2). Three sites have a ratio less than 10.0, forty-six sites have a ratio less than 100.0, and sixty-seven have a ratio less than 200.0. For comparison, the size and storage values for six existing or planned surface water storage facilities are provided. Of these, Caineville Wash has the lowest ratio at 15.0, while Clay Draw has the highest ratio of the six at 203.1. Neither of these two dams have been constructed to date. Locally, Joes Valley and Millsite dams have ratios of 21.0 and 132.7 respectively.

Figure 1 - USGS topographic map index coverage of the San Rafael River/Muddy Creek watershed study area

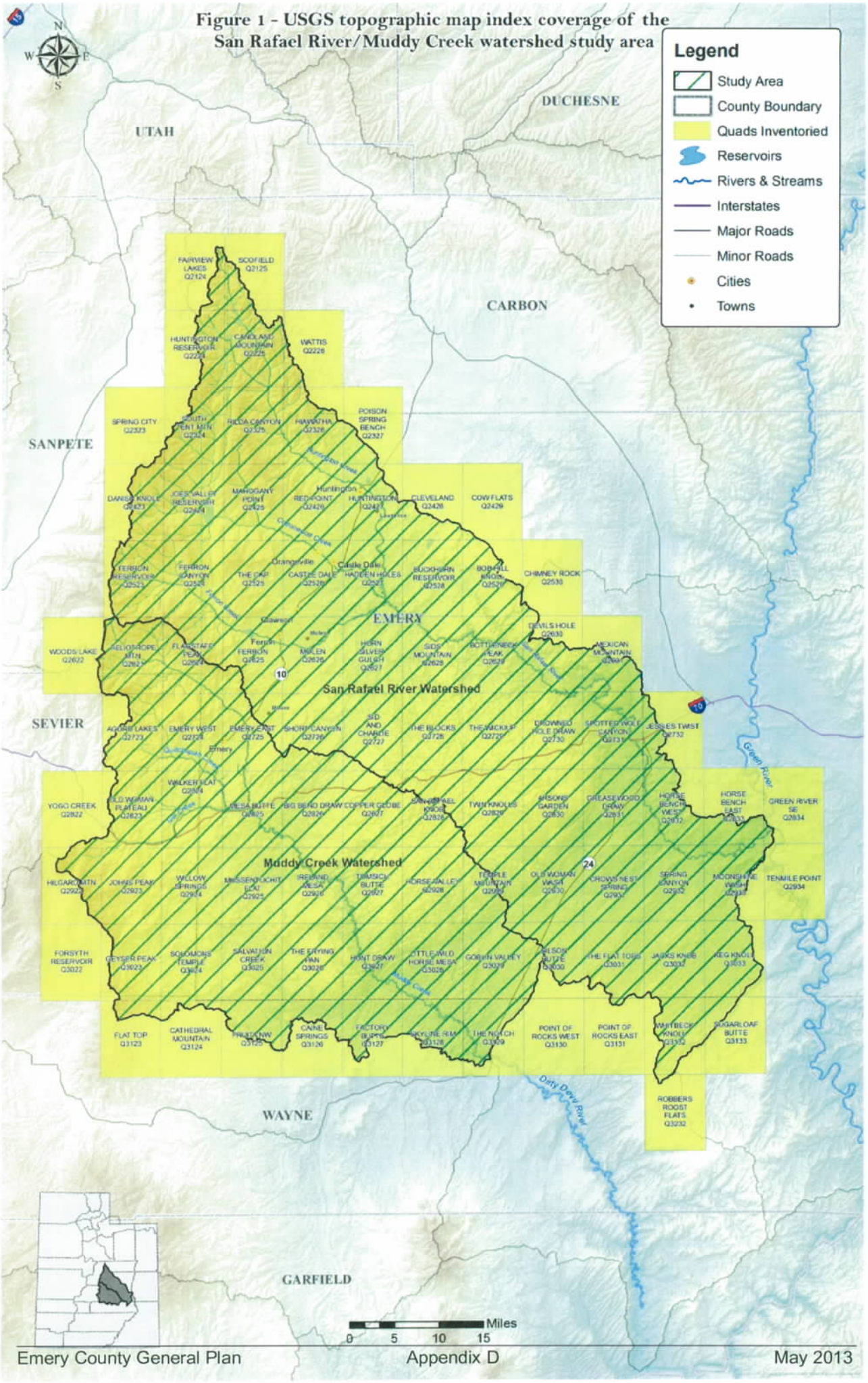


Figure 2 - 91 potential dam and reservoir sites of the San Rafael River/ Muddy Creek watershed study area

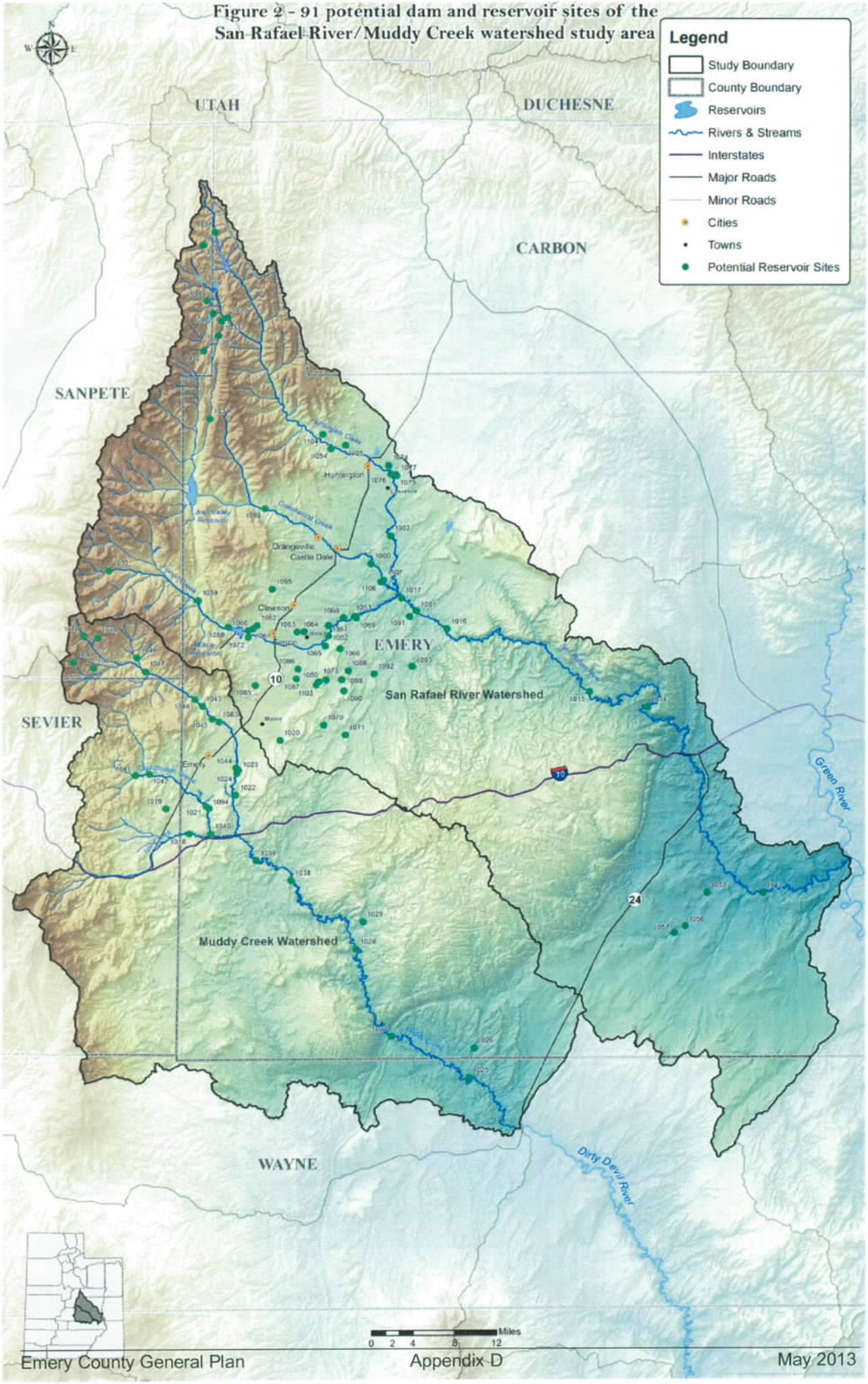


Table 1
San Rafael River & Muddy Creek Potential Reservoir Site Study

Site Number & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Emb. Volume (cy) / Res. Storage (acft)	Land Ownership At Damsite	Land Ownership Of Reservoir Basin
1014 Mexican Bend	38,144	18,350	2.1	BLM	BLM
1016 Fuller Bottom	81,184	8,771	9.2	BLM	UDWR,BLM,SITLA
1017 Cat Canyon 1	224,275	22,776	9.8	BLM	UDWR, BLM, Private, SITLA
1015 Black Box	211,550	20,414	10.4	BLM	BLM
1013 San Rafael Valley	114,028	10,317	11.0	BLM	BLM, UDWR, SITLA
1027 Muddy Creek 9	90,065	8,032	11.2	BLM	BLM, SITLA
1044 Emery	158,603	11,084	14.3	BLM	BLM, Private
1002 Hadden Hills	95,614	6,465	14.8	Private	Private, BLM
1052 The Box	273,114	17,562	15.6	BLM, Private	Private, BLM, SITLA
1024 Muddy Creek 5	771,237	48,578	15.9	BLM	Private, BLM
1020 Dry Wash 1	261,803	16,329	16.0	BLM	Private, BLM
1089 Lower Molen Seep	362,781	22,343	16.2	BLM	BLM, SITLA
1001 Hambrick Bottom	889,932	47,428	18.7	BLM	BLM, UDWR, Private, SITLA
1107 Jorgensen	148,384	7,898	18.8	Private, BLM	Private, BLM
1092 Horn Silver 2	348,871	18,037	19.3	BLM	BLM, SITLA
1106 Rock Canyon Creek	284,492	13,741	20.7	BLM	BLM, Private
1053 Lower Ferron Creek	223,892	10,650	21.0	BLM, SITLA	Private, SITLA, BLM
1025 Muddy Creek 10	649,584	23,665	27.4	BLM	BLM, SITLA
1018 Ivie Creek	297,710	10,785	27.6	Private	Private, BLM
1000 The Breaks	431,780	14,452	29.9	Private	Private, BLM, SITLA
1021 Quitchupah 1	220,127	6,991	31.5	Private	Private
1093 North Salt Wash	128,985	3,792	34.0	BLM	BLM
1026 Wild Horse Creek	584,142	15,641	37.3	BLM	BLM
1068 Lower Ferron A	372,930	8,957	41.6	Private, BLM	BLM, SITLA, Private
1069 Lower Ferron L	273,798	6,378	42.9	SITLA	SITLA, BLM
1090 Molen Tanks	91,588	2,040	44.8	BLM	BLM
1038 Muddy Creek 7	440,388	8,491	51.8	BLM	BLM, SITLA
1028 Muddy Creek 8	153,398	2,906	52.7	BLM	BLM, SITLA
1103 Molen Seep B	291,540	5,354	54.5	BLM	BLM
1094 Quitchupah 1A	101,078	1,668	60.6	Private, BLM	Private, BLM
1039 Muddy Creek 6	2,182,470	36,008	60.6	BLM	BLM

Site Number & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Emb. Volume (cy) / Res. Storage (ac.ft)	Land Ownership At Damsite	Land Ownership Of Reservoir Basin
1056 Cottonwood Wash 2	1,157,000	19,040	60.7	SITLA	BLM, SITLA
1037 Mill Set	2,062,560	33,383	61.7	USFS	USFS, Private
1034 Upper Scad Valley	413,105	6,564	62.9	Private, USFS	USFS
1055 Cottonwood Wash 1	647,710	9,751	66.4	BLM	BLM, SITLA
1040 Quitchupah 2	1,231,700	17,875	68.9	Private, BLM	BLM, Private
1077 Blue Slate Hills 2	273,091	3,936	69.3	Private	Private
1031 Koford	483,536	6,772	71.4	USFS	Private, USFS
1057 Cottonwood Wash 3	1,524,310	19,636	77.6	BLM	BLM, SITLA
1070 Short Canyon	678.747	8,693	78.0	BLM	BLM
1074 Cedar Creek	539,126	6,863	78.5	Private	Private, SITLA
1076 Blue Slate Hills 1	92,847	1,012	91.7	Private	Private
1050 Molen Seep C	517,731	5,546	93.4	BLM	BLM
1035 Lower Miller Flat	1,165,000	12,207	95.4	USFS	USFS, Private
1043 Muddy Creek 3	1,262,920	13,032	96.9	USFS	USFS
1075 Huntington Creek	618,285	6,357	97.2	Private	Private
1067 Lower Ferron B	1,723,460	17,040	101.1	Private, BLM	BLM, Private, SITLA
1023 Emery East	224,080	2,079	107.7	BLM	BLM, Private
1071 Dry Wash 2	56,997	525	108.5	BLM	BLM
1032 Paradise Ck. (Bennets)	260, 601	2,351	110.8	USFS	USFS
1065 Lower Ferron M	133,187	1,171	113.7	BLM	BLM
1091 Red Wash	338,323	2,833	119.4	BLM	BLM, Private
1099 Peacock	1,769,190	14,518	121.9	Private, BLM	Private, BLM
1030 Ferron Crk/Georges Fk	444,147	3,597	123.4	USFS	USFS
1087 Dutch Flat 2	169,088	1,337	126.4	SITLA, BLM	BLM, SITLA
1063 Lower Ferron D	511,711	4,037	126.8	Private	Private
1064 Lower Ferron C	464,747	3,615	128.6	Private, BLM	Private, BLM
1095 Rock Canyon	43,581/1,536	319	141.4	BLM	BLM
1047 Muddy Creek 1	26,011,000	176,941	147.0	USFS	USFS
1045 Muddy Creek 4	996,228	6,664	149.5	BLM, Private, USFS	USFS, Private, BLM
1029 Reds Canyon	819, 954	5,294	154.8	BLM	BLM
1073 Lower Ferron E	4,232,800	25,927	163.3	BLM, SITLA	BLM, SITLA, Private
1054 Johnny Jensen Hollow	635,560	3,814	166.6	SITLA, Private	SITLA
1086 Dutch Flat 1	140,105	815	171.9	Private	SITLA, Private, BLM
1085 South Ferron	470,020	2,561	183.5	BLM	BLM
1042 Quitchupah Creek	4,080,340	21,642	188.5	SITLA, BLM	SITLA, BLM, Private
1046 Muddy Creek 2	1,676, 010	8,502	197.1	USFA	USFS

Site Number & Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Emb. Volume (cy) / Res. Storage (acft)	Land Ownership At Damsite	Land Ownership Of Reservoir Basin
1036 Left Fk. Boulger Creek	2,320,840	10,854	213.8	USFS	USFS
1019 Saleratus Bench	827,769	3,756	220.4	SITLA, BLM	BLM, SITLA
1059 Lower Ferron J	532,122	2,355	226.0	USFS	USFS
1058 Lower Ferron I	502,787	2,160	232.7	SITLA	SITLA
1048 Horse Creek	952,050	3,938	241.7	USFS	USFS
1022 Emery South	4,974,420	20,536	242.2	BLM	BLM
1088 Horn Silver 1	755,722	3,116	242.5	BLM	BLM
1041 Water Hollow	3,483,270	14,085	247.3	Private, BLM	BLM, Private
1105 Otteson Hollow	358,001	1,223	292.7	SITLA	SITLA
1033 Lower Scad Valley	3,534,080	10,987	321.6	USFS, Private	USFS, Private
1066 Lower Ferron N	3,817, 360	11,553	330.4	BLM	BLM
1060 Lower Ferron H	692,928/258,313	2,680	354.9	BLM, Private	BLM, Private
1072 Lower Ferron K	911,931/41,606	3,639	363.7	BLM, Private	BLM
1061 Lower Ferron G	639,554	1,718	372.3	Private, BLM	BLM, Private
1104 Fish Creek	311,050	635	489.8	SITLA	SITLA
1083 Morris Bend	990,047	1,841	537.7	USFS	USFS
1062 Lower Ferron F	1,088,400	1,876	580.2	BLM	BLM
1098 Henningson Dam - Rebuild	Additional 42,457	Additional 365	116.3	USFS	USFS
1096 Raise Rolfson Dam	Additional 108,705	Additional 763	142.5	USFS	USFS
1078 Raise Emery Dam	Additional 85,143	Additional 392	81.1	USFS	USFS
1079 Raise Spinners Dam	Additional 52,970	Additional 366	144.7	USFS	USFS
1080 Raise Julius Flat Dam	Addit. 51,260/12,835	Additional 348	184.2	USFS	USFS
1097 Raise Miller Flat Dam	Additional 242,680	Additional 4,176	58.1	USFS	USFS
1108 Raise Little Madsen	Insufficient Information	Insuff. Information	Unknown	USFS	USFS
Comparison – Millsite*	2,390,000	18,000	132.7	Private, BLM	Private, BLM
" - Adobe Wash**	214,399	1,354	158.3	Private, BLM	BLM, Private
" - Joes Valley*	1,290,000	61,538	20.96	USFS	USFS
" - Jackson Flat**	831,290	4,200	197.9	Private	Private
" - Clay Draw	650,000	3,200	203.1	BLM	BLM, USFS
" - Caineville Wash	300,000	20,000	15.0	BLM	BLM

91 Total Sites
For Locations See Figure 1

*Built
**Under Construction

Section 2
Preferred Site Selection

Of the ninety-one sites identified for further scrutiny, forty were selected and information concerning each of them is found in this section. Tables 2A – 2D list the sites that were selected by the four irrigation companies to move forward through the screening process. The sites, in each of the four tables, are organized based on irrigation company preference. Within each table, the sites are ranked based on the ratio of embankment volume to reservoir storage.

Two of the irrigation companies, Muddy Creek Irrigation Company (Table 2C) and Huntington/Cleveland Irrigation Company (Table 2D) added to their list of preferred sites a number of high elevation, existing dams they wanted reviewed in terms of raising the dams and increasing the storage. In the tables, these modifications are identified and the values listed indicate the number of additional cubic yards of material it would take to raise each dam and the resulting increase or additional acre-feet of storage that would result. The ratio of embankment volume to reservoir storage, is only based on new material and additional water. Therefore, they are listed separate in the tables and are not included in the overall ranking that is applied to all other sites.

The bulk of this section contains individual location maps and text. The text provides information concerning the geology, foundation, and other conditions that are defined for each of the forty preferred sites. These sites are arranged in order based on the ratio of embankment volume to reservoir storage. The critical items discussed within the foundation and other conditions sections are an attempt to identify potential issues that will need to be addressed if serious consideration is given to any of these sites. The identification of these issues was necessary to provide input for the development of cursory cost estimates as determined in Section 4.

Table 2A

San Rafael & Muddy Creek Potential Reservoir Study

Preferred Sites Selected By

Cottonwood Creek Consolidated Irrigation Company

Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Dam/Dike Height (ft)	Dam/Dike Length (ft)	Emb. Volume (cy) / Res. Storage (acft)
Fuller Bottom	81,184	8,771	55	395	9.2
Hadden Hills	95,614	6,465	45	775	14.8
Hambrick Bottom	889,932	47,428	125	1,025	18.7
Jorgansen	148,384	7,898	58	670	18.8
Rock Canyon Creek	284,492	13,741	80	855	20.7
The Breaks	431,780	14,452	125	775	29.9
Koford	483,536	6,772	118	1,030	71.4
Peacock	1,769,190	14,518	140	1,675	121.9

Damsites in green – are those which require downsizing to match available water supply (compare to downsized values on Table 3).

Table 2B

San Rafael & Muddy Creek Potential Reservoir Study

Preferred Sites Selected By

Ferron Canal & Reservoir Company

Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Dam/Dike Height (ft)	Dam/Dike Length (ft)	Emb. Volume (cy) / Res. Storage (acft)
The Box	273,114	17,562	82	1,600	15.6
Lower Molen Seep	362,781	22,343	105	630	16.2
Lower Ferron A	372,930	8,957	85	1,405	41.6
Lower Ferron L	273,798	6,378	90	615	42.9
Molen Seep B	291,540	5,354	103	590	54.5
Molen Seep C	517,731	5,546	108	975	93.4
Lower Ferron B	1,723,460	17,040	115	2,655	101.1
Dutch Flat 2	169,088	1,337	71	945	126.4
Lower Ferron D	511,711	4,037	80	1,310	126.8
Lower Ferron C	464,747	3,615	68	1,375	128.6
Rock Canyon	43,581/1,536	319	48/7	365/220	141.4
Lower Ferron I	502,787	2,160	88	1,625	232.7
Lower Ferron H	692,928/258,313	2,680	90/90	1,295/590	354.9
Lower Ferron K	911,931/411,606	3,639	132/83	1,165/1,195	363.7
Lower Ferron G	639,554	1,718	113	960	372.3
Lower Ferron F	1,088,400	1,876	135	1,145	580.2

Damsites in green - are those which require downsizing to match available water supply (compare to downsized values on Table 3).

Table 2C

San Rafael & Muddy Creek Potential Reservoir Study

Preferred Sites Selected By

Muddy Creek Irrigation Company

Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Dam/Dike Height (ft)	Dam/Dike Length (ft)	Emb. Volume (cy) / Res. Storage (acft)
Emery	158,603	11,084	90	380	14.3
Muddy Creek 3	1,262,920	13,032	164	855	96.9
Muddy Creek 4	996,228	6,664	124	925	149.5
Quitchupah Creek	4,080,340	21,642	225	1,765	188.5
Emery South	4,974,420	20,536	303	1,165	242.2
Morris Bend	990,047	1,841	123	1,060	537.7
Henningson Dam - Replacement	Additional 42,457	Additional 365	Raise 21	960	116.3
Raise Emery Dam	Additional 85,143	Additional 392	Raise 31	1,040	81.1
Raise Spinners Dam	Additional 52,970	Additional 366	Raise 23.7	1,615	144.7
Raise Julius Flat Dam	Addit. 51,260/12,835	Additional 348	Raise 18	1,110	184.2

Damsites in green - are those which require downsizing to match available water supply (compare to downsized values on Table 3).

Table 2D

San Rafael & Muddy Creek Potential Reservoir Study

Preferred Sites Selected By

Huntington/Cleveland Irrigation Company

Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Dam/Dike Height (ft)	Dam/Dike Length (ft)	Emb. Volume (cy) / Res. Storage (acft)
Johnny Jensen Hollow	635,560	3,814	118	825	166.6
Otteson Hollow	358,001	1,223	68	1,300	292.7
Fish Creek	311,050	635	91	820	489.8
Raise Rolfson Dam	Additional 108,705	Additional 763	Raise 11.7	1,500	142.5
Raise Little Madsen	Insufficient information	Insufficient information	Raise 20	?	Unknown
Enlarge Miller Flat Dam	Additional 242,680	Additional 4,176	Raise 25	2,070	58.1

Section 3
Screening Process

In section 3, each of the forty dam and reservoir sites were examined with respect to important screening criteria such as the geology of the site including natural hazards, geotechnical, engineering, economic, social, land ownership, environmental considerations, and the ratio of embankment volume compared to reservoir storage. As a result of this process, a number of the sites were eliminated due to fatal flaws (such as having the Joes Valley fault at or near the site, being located on land administered by the U.S. Forest Service, or for having too many unfavorable characteristics to overcome (such as a lack of available water supply, remote location relative to diversion points, too large of a dam relative to expected reservoir storage, or any combination of these and other factors).

Based on this screening, fourteen of the sites were eliminated from further evaluation as follows:

#1031 Koford is located on land administered by the U.S. Forest Service and one or both strands of the Joes Valley Fault transect the site.

#1087 Dutch Flat 2 is located on a drainage that has very little water supply (50 acre-feet per year) and the remote location is too far from diversion points.

#1058 Lower Ferron I is located immediately upstream of Millsite reservoir. The ratio of embankment volume compared to reservoir storage is excessively high and portends an unreasonable cost per acre-foot.

#1060 Lower Ferron H is located immediately downstream of Millsite Reservoir. The ratio of embankment volume compared to reservoir storage is excessively high for a dam at this site and points to an unreasonable cost per acre-foot.

#1072 Lower Ferron K both dike and reservoir are located against a thin bedrock ridge and potential seepage lose could be high. The ratio of embankment volume compared to reservoir storage is excessively high and will lead to an unreasonable cost per acre-foot.

#1061 Lower Ferron G has a ratio of embankment volume compared to reservoir storage that is excessively high and portends an unreasonable cost per acre-foot.

#1062 Lower Ferron F has the highest ratio of embankment volume compared to reservoir storage of any of the other forty sites. This means a large dam would impound a small amount of water. The cost per-acre-foot would be unreasonably high.

#1043 Muddy Creek 3 is located on land administered by the U.S. Forest Service. The Joes Valley system of faults is located near this site. Seismic risk will be high.

#1045 Muddy Creek 4 is located, in part on land administered by the U.S. Forest Service and the Bureau of Land Management. The Joes Valley system of faults is located near this site. Seismic risk will be high.

#1022 Emery South is located on a drainage that has very little water supply (120 acre-feet per year) and the remote location is too far from diversion points. This site has a ratio of embankment volume compared to reservoir storage that is excessively high and will lead to an unreasonably high cost per acre-foot.

#1083 Morris Bend South is located on a drainage that has very little water supply (100 acre-feet per year). This site has a ratio of embankment volume compared to reservoir storage that is excessively high and points to an unreasonable cost per acre-foot.

#1105 Otteson Hollow would require imported water to fill. It's location is remote compared to the nearest diversion point and the conveyance system would be very expensive. This site has a ratio of embankment volume compared to reservoir storage that is excessively high and will lead to an unreasonable cost per acre-foot.

#1104 Fish Creek has the second highest ratio of embankment volume compared to reservoir storage among the forty sites. This means a large dam would impound a small amount of water. The cost per-acre-foot would be unreasonably high.

#1108 For the Little Madsen Raise there is no available information, concerning the existing dam. It is not possible to characterize the work needed at the site or enough to prepare a cost estimate at this time.

Table 3 contains information which characterizes each of the remaining twenty-six dam sites and reflects the changes to some sites based on water supply (see Section 4).
As with each of the preceding tables, the sites listed in Table 3 are ranked based on the ratio of embankment volume to reservoir storage, excluding the sites where the raising or rebuilding of an existing dam is evaluated.

Fuller Bottom

Location: NW¼ Sec 8, T20S, R10E, SLB&M; Main channel site on San Rafael River just below Fuller Bottom as it enters another narrow canyon about 16 miles southeast of Castle Dale, Utah.

Land Ownership: Dam will be on BLM land. Reservoir is located on mix of SITLA, UDWR, and BLM land.

Dam Embankment: Height: 55 ft.: Length: 395 ft.: Vol. 81,184 cu. yds.: Crest El.: 5,285

Reservoir: High Water El.: 5,280: Capacity: 8,771 acre-ft.

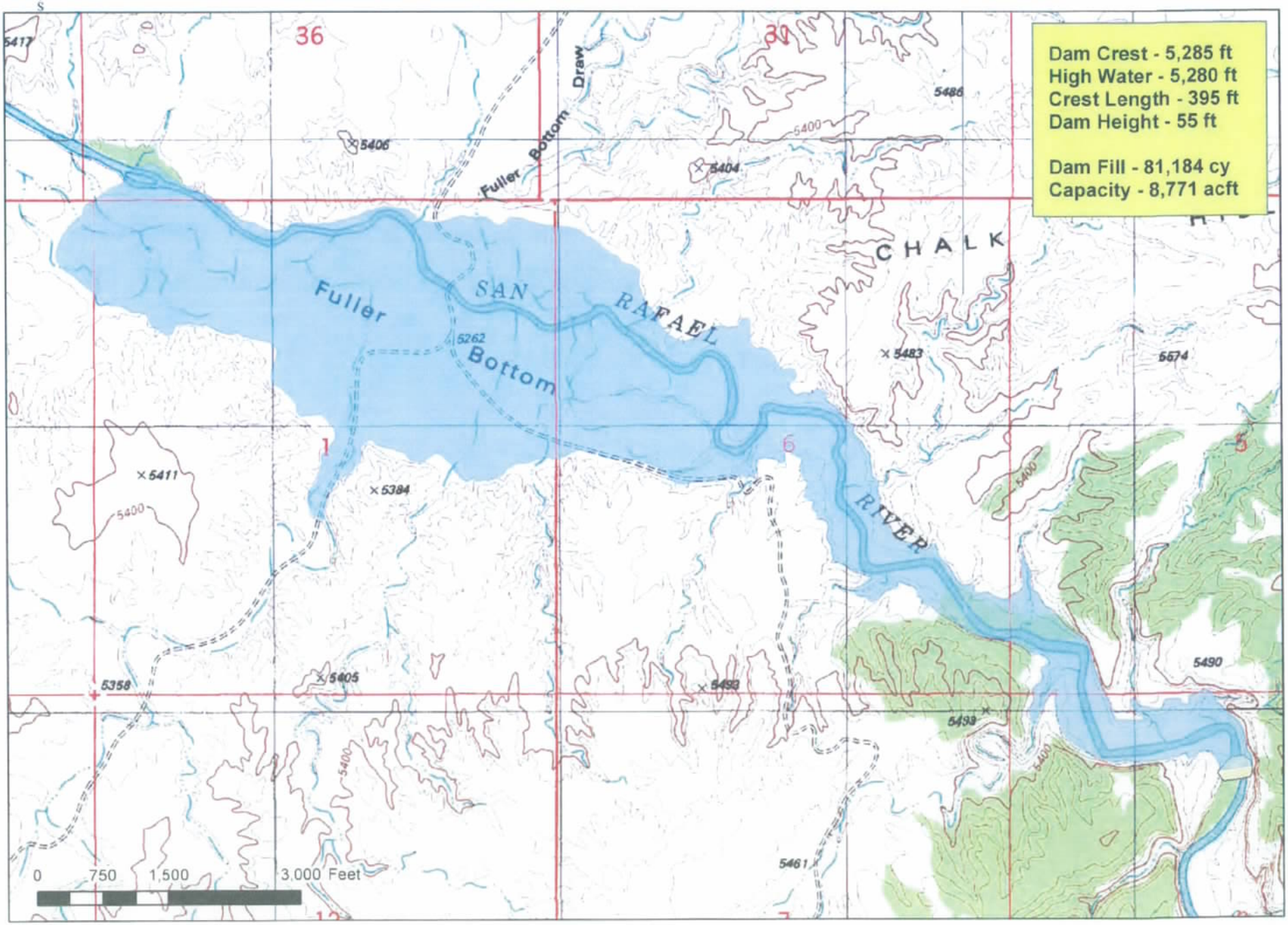
Rating Factor (embankment volume/reservoir capacity): 9.2

Geology: Setting is within incised reach of the San Rafael River about 2 miles downstream of Fuller Bottom and 16 miles southeast of Castle Dale, UT. Canyon walls at the dam site are cut into Jurassic-Upper Triassic Navajo Sandstone, a thick bedded to massive deposit of eolian sandstone that forms massive cliff faces and rounded knolls. Navajo Sandstone is described by Witkind et. al. (1987) as a light-brown to light-grey cemented to friable, clean, fine grained quartzose sandstone. It is relatively strong rock, jointed in wide spaced sets and exhibits deep trough cross-bedded sets, a feature characteristic of many of southern Utah national parks. Resultant reservoir behind the dam will back up through the narrow canyon out onto the broad alluvial valley of Fuller Bottom.

Foundation Design Considerations: Sandstone rock of the Navajo Sandstone should provide adequate support for main dam foundation and abutments. However, permeability through primary porosity in the sandstone or secondary fracturing may lead to leaking foundation conditions and may require designed grout program within the abutments and possibly the main dam center section as well. Seep vertical walls of the canyon will have to be cut back at a 1.5:1 slope to allow construction equipment to dig cutoff trench. Deep alluvium along the centerline of the river is also possible and may require deep excavation to extend dam foundation, or at least a cut-off trench across the entire alignment. If weathered rock and alluvium is beyond reasonable depth of excavation, other forms of dam construction may be required, such as a slurry trench, or a concrete structure. River diversion during construction will also be an important consideration.

Other Considerations: Alluvium and some of the clay bearing formations within the reservoir basin should provide ample source of clay for core of dam. Sources of sand and gravel should be available through the formations within and around the dam foundation. Sources for rip-rap may be more problematic unless some of the sandstone layers are well-enough cemented to retain integrity for use as such. Angle exploration holes should be drilled to characterize joint density, orientation, and permeability. Site access will need to be improved. Tunnel by-pass may be required at this site during construction. Fish passage may require special construction features. Due to the steep vertical walls, unknown thickness of the alluvium, and other physical properties found at the site, a concrete dam would need to be constructed.

1016 Fuller Bottom T20S R10E Sec 8



Emery

Location: NW¼ Sec. 13, T22S, R6E, SLB&M. Located on Muddy Creek, approximately 3 miles east of Emery, Utah.

Land Ownership: The dam is located on BLM land. The reservoir basin is located on a mixture of private and BLM land.

Dam Embankment: Height: 90 ft. Length: 380 ft. Volume: 158,603 cu.yds.
Crest Elev.: 6,105 ft. asl.

Reservoir: High Water Elev.: 6,100 ft. asl. Capacity: 11,084 ac.ft.

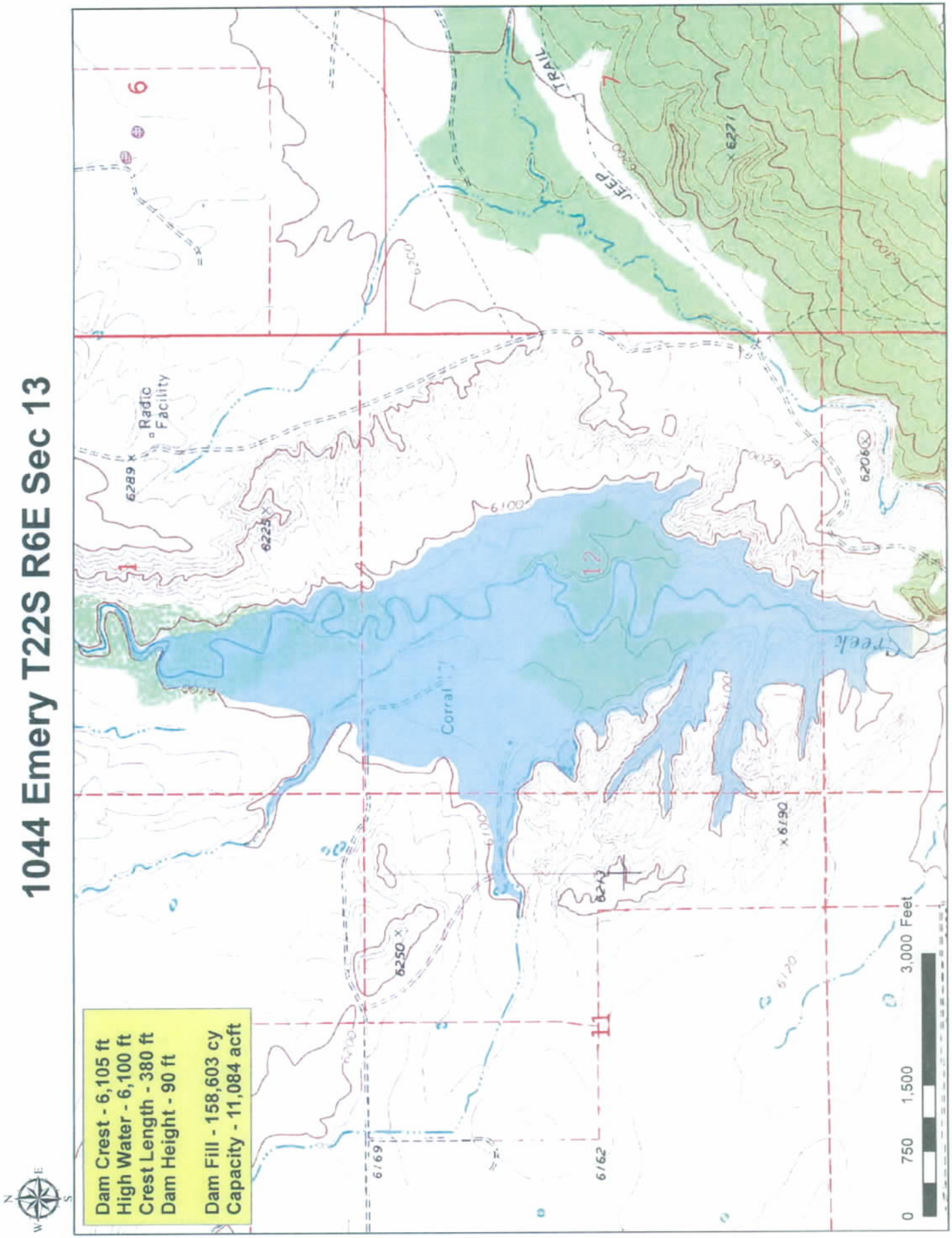
Rating Factor: (embankment volume/reservoir capacity) 14.3 cu.yds./ac.ft.

Geology: This damsite is located on the northwest flank of the San Rafael Swell. Bedrock in this area has a dip of 5° to the northwest. The damsite and reservoir basin are located on alternating yellow-grey, light-brown, and white sandstone, sandy grey shale, grey, carbonaceous shale and coal; mostly fine - to medium-grained sandstone, commonly calcareous; lenticular thin to massive beds; mostly cliff-forming. Unit contains several thicker, mineable coal beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Seep vertical walls of the canyon will have to be cut back at a 1.5:1 slope to allow construction equipment to dig cutoff trench. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rates could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1044 Emery T22S R6E Sec 13



Hadden Hills

Location: NW¼ sec. 28, T18S, R9E, SLB&M. Located on Huntington Creek about 5.5 miles upstream of its confluence with Cottonwood Creek and approximately 5 miles northeast of Castle Dale, Utah.

Land Ownership: The damsite is located entirely on private land while the reservoir basin is located on a mixture of private and BLM land.

Dam Embankment: Height: 45 ft. Length: 775 ft. Volume: 95,614 cu. yds.
Crest Elev.: 5,525 ft. asl.

Reservoir: High Water Elev.: 5,520 ft. asl. Capacity: 6,465 acre-ft.

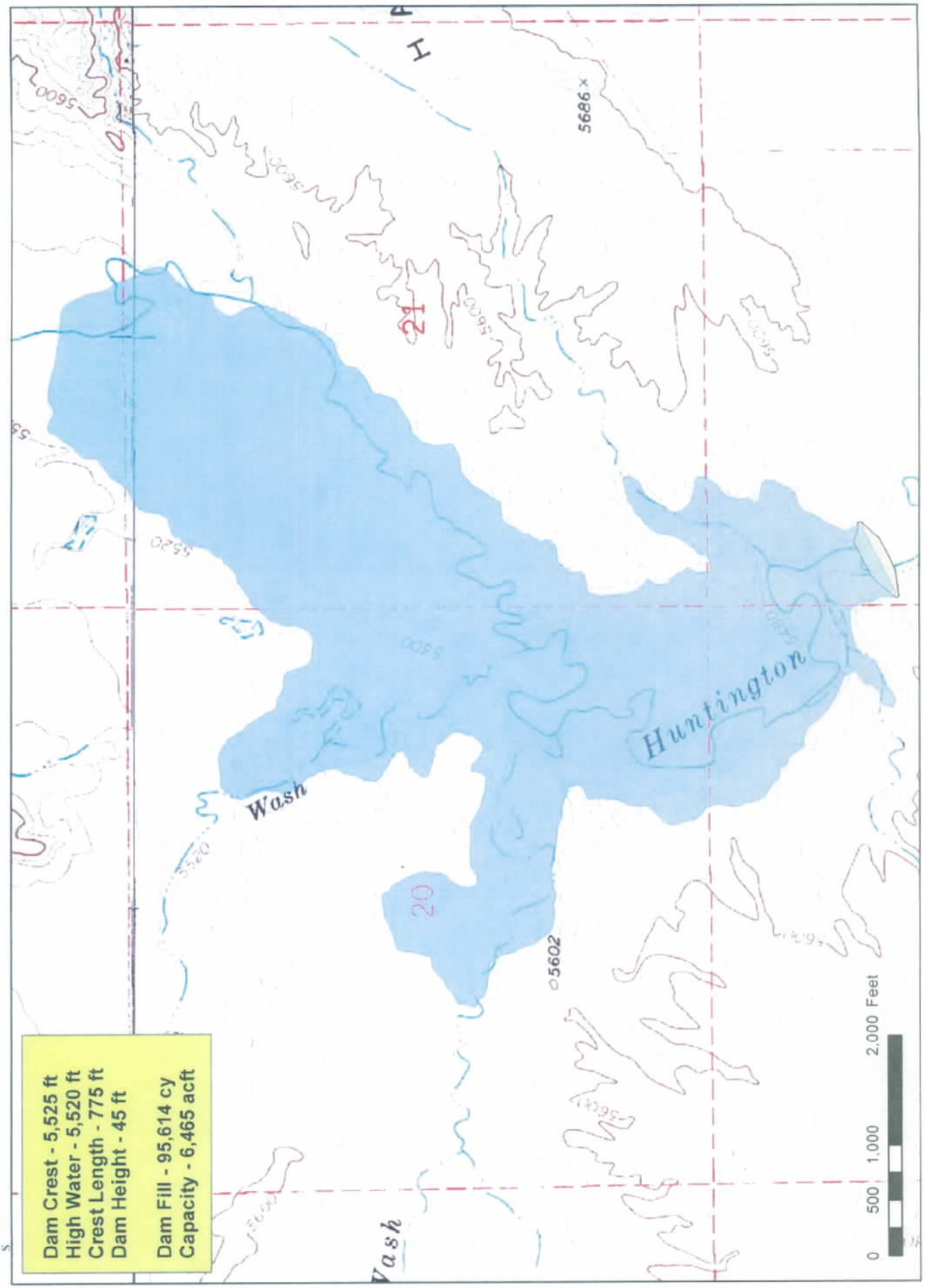
Rating Factor: (embankment volume/reservoir capacity) 14.8 cu.yds./ac.ft.

Geology: Setting is within Castle Valley with the Wasatch Plateau to the west and San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam abutments and center section will rest on or against interbedded sandstone and shale mapped as Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The reservoir basin will be underlain by shale and siltstone of the Blue Gate Member of the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium (perhaps 50 feet) overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1002 Hadden Hills T18S R09E Sec 28



The Box

Location: SW¼ Sec. 9, T20S, R8E, SLB&M. Located on Ferron Creek, approximately 5 miles east of Ferron, Utah.

Land Ownership: Both the dam site and the reservoir basin are located on a mixture of private and BLM land.

Dam Embankment: Height: 82 ft. Length: 1,600 ft. Volume: 273,114 cu. yds.
Crest Elev.: 5,705 ft. asl.

Reservoir: High Water Elev.: 5,700 ft. asl. Capacity: 17,562 ac. ft.

Rating Factor: (embankment volume/reservoir capacity) 15.6 cu.yds./ac.ft.

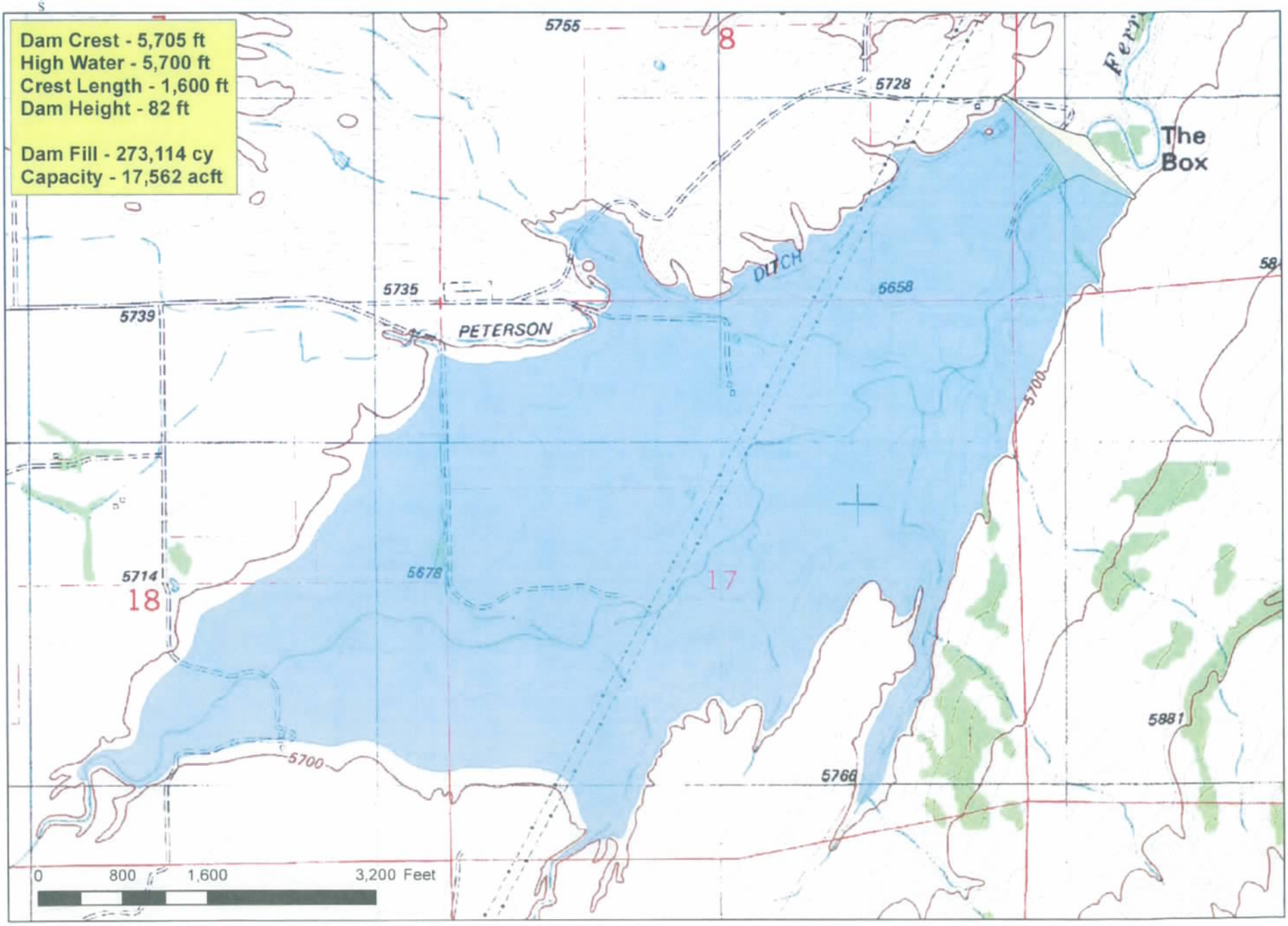
Geology: Setting is within Castle Valley with the Wasatch Plateau to the west and San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam abutments and center section will rest on or against interbedded sandstone and shale mapped as Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The reservoir basin will be underlain by shale and siltstone of the Blue Gate Member of the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench or construction of concrete dam, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Site access needs to be improved. Power transmission lines will need to be relocated that presently occupy the proposed reservoir basin. The size of the dam (embankment volume) and reservoir storage at this site was

downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1052 The Box T20S R8E Sec 9



Lower Molen Seep

Location: NW¼ Sec. 3, T21S, R8E, SLB&M. Located on Molen Seep Wash approximately 2 miles east of Molen Reef.

Land Ownership: Both the dam and reservoir basin are located on BLM land with the reservoir basin making a slight encroachment on SITLA land.

Dam Embankment: Height: 105 ft. Length: 630 ft. Volume: 362,781 cu. yds.
Crest Elev.: 5,865 ft. asl.

Reservoir: High Water Elev.: 5,860 ft. asl. Reservoir Capacity: 22,343 ac.ft.

Rating Factor: (embankment volume/reservoir capacity) 16.2 cu.yds./ac.ft.

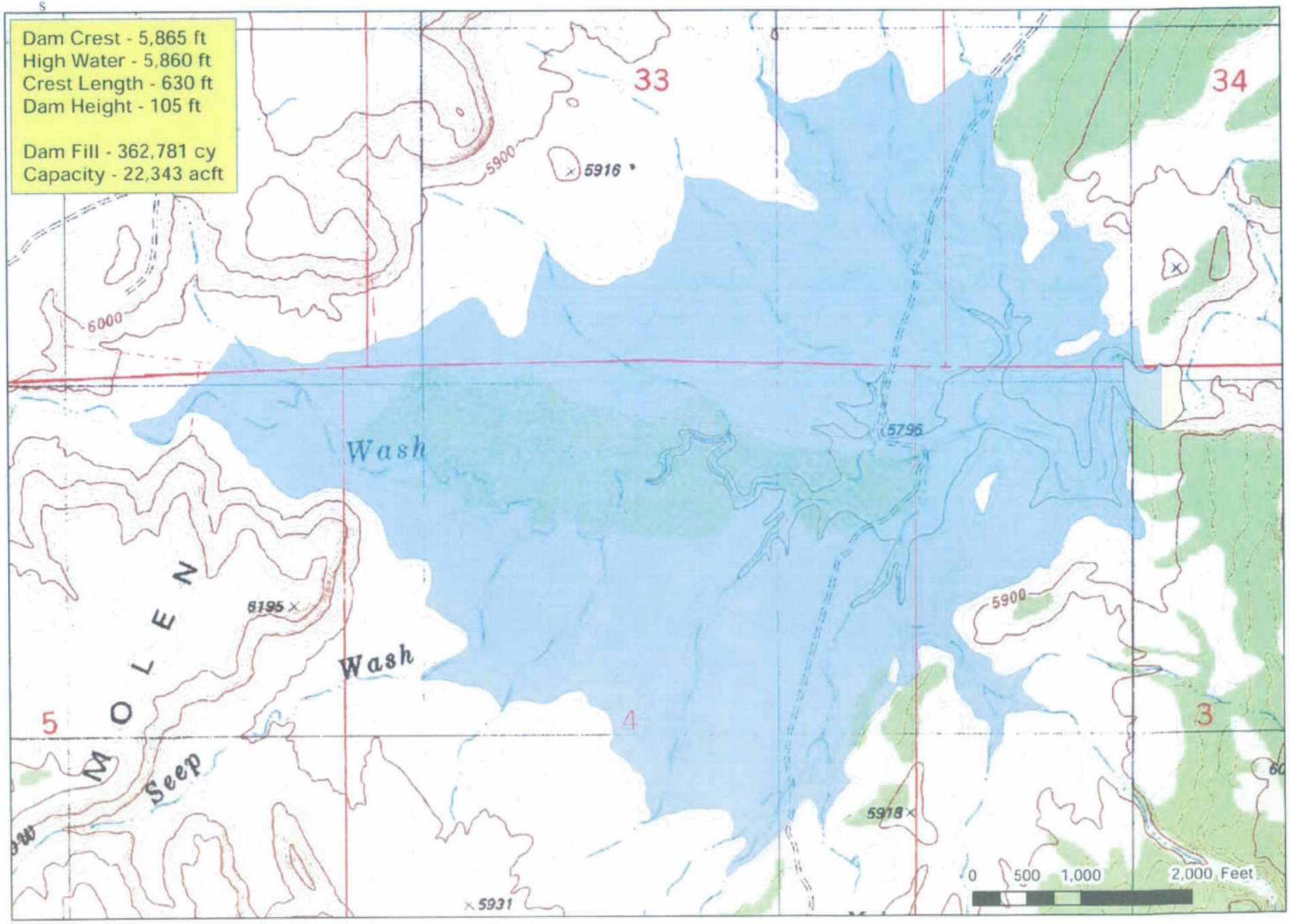
Geology: Setting is within Castle Valley with the Wasatch Plateau to the west and San Rafael Swell to the east. The abutments at this site are formed in the sandstone, mudstone, conglomerate, and conglomeratic sandstone of the lower Cretaceous Dakota Sandstone and Cedar Mountain Formations undivided. The Dakota comprises of sandstone that is tan to light brown, fine - to medium-grained, and cross-bedded. The Cedar Mountain consists of an upper unit of dominantly mudstone variegated in shades of purple, red, grey, and green; and a lower unit of grey, massive to thin-bedded, cross-bedded conglomerate and conglomeratic sandstone. This lower unit forms a resistant ledge. Underlying the center section of the dam and the reservoir basin is an unknown thickness of alluvium, which in turn overlies the variegated, bentonitic claystone and mudstone of the Brushy Basin Member of the Morrison Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Claystones and mudstones and their weathered equivalents may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within the Brushy Basin rocks in disseminated form or as fracture infillings.

Foundation Design Considerations: Clay rich bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Claystone bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately steep to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement or slumping. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap may be found in the Dakota Sandstone Formation. The size

of the dam (embankment volume) and reservoir storage at this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1089 Lower Molen Seep T21S R8E Sec 3



Hambrick Bottom

Location: NW¼ Sec 35, T19S, R9E, SLB&M; Main channel site on San Rafael River just below confluence Huntington, Cottonwood and Ferron Creeks approximately 12 miles southeast of Castle Dale, Utah.

Land Ownership: Dam will be on BLM land. Reservoir is located on mix of SITLA, UDWR, and BLM land.

Dam Embankment: Height: 125 ft.: Length: 1,025 ft.: Vol. 889,932 cu. yds.: Crest El.: 5,405

Reservoir: High Water El.: 5,400: Capacity: 47,428 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 18.7

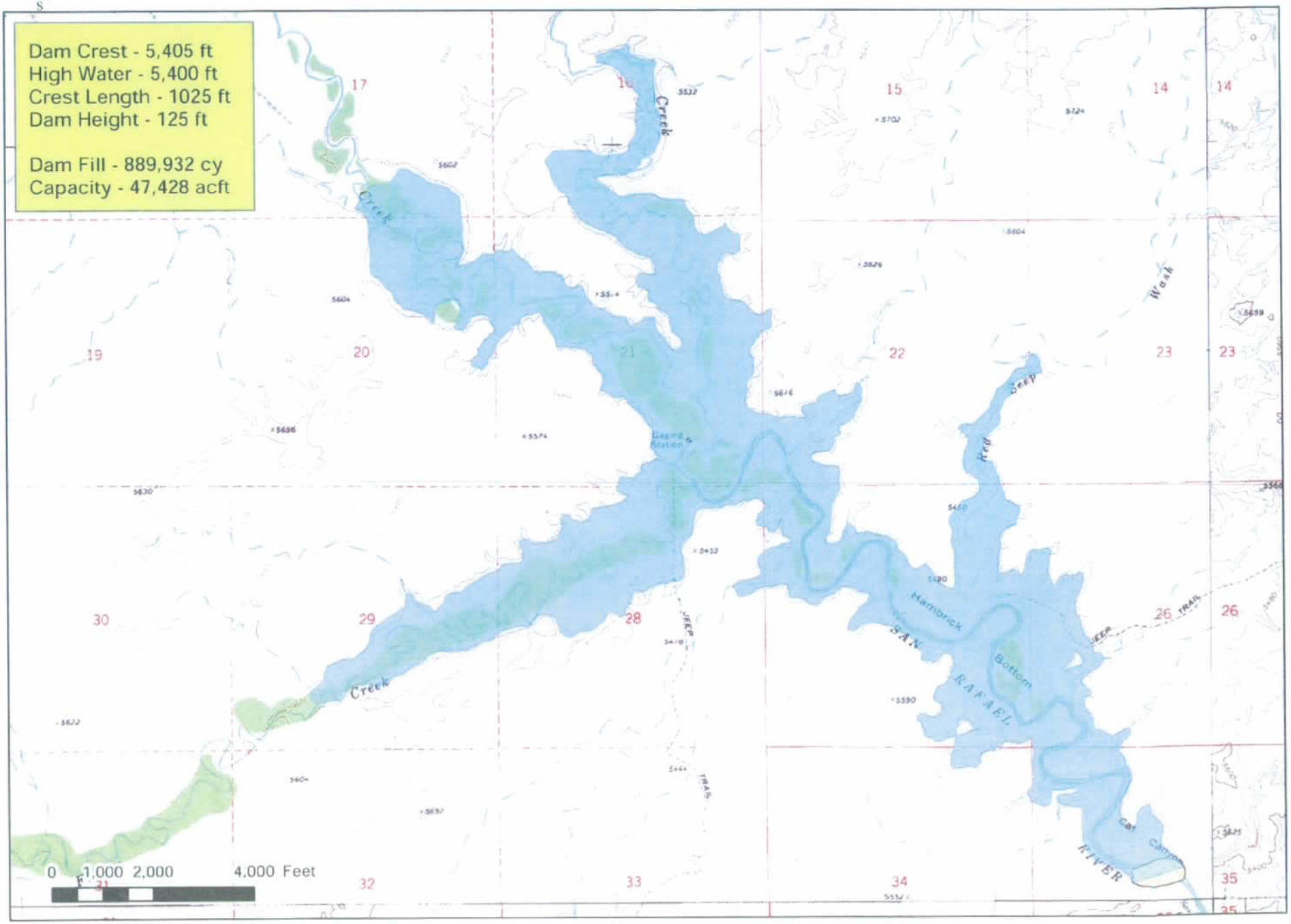
Geology: Setting is within incised reach of the San Rafael River about 2 miles downstream of the confluence of Huntington, Cottonwood, and Ferron Creeks about 12 southeast of Castle Dale, UT. Canyon walls cut progressively down-section through lower members of the Mancos Shale Formation (Ferron Sandstone and Tununk Shale) near the confluence, passing through Dakota Sandstone, both Brushy Basin and Salt Wash members of the Morrison Formation, Summerville Formation, Curtis Formation and finally Entrada Sandstone before the river emerges onto Fuller Bottom below the dam site. Dam foundation and abutments will lie upon rock mapped as Emery Sandstone with the upper abutments possibly placed against the lower portion of Curtis Formation. Entrada sandstone is described by Witkind et. al. (1987), as orange-brown, red-brown and light-brown eolian deposit dominantly fine grained sandstone locally with medium to coarse grained layers. Rock is variably weak and friable to relatively well-cemented and strong forming low rounded knobs with horizontal groves to over-steepened cliffs several tens of feet high. Generally medium to thick bedded with faint cross-bedding. Curtis Formation is likewise comprised predominantly of sandstone. It is described as firmly cemented with carbonate that lends to it forming cap rock and supporting low cliffs. It comprises of a light-grey, light-brown, or greenish-grey fine - to medium-grained, thin to thick-bedded, locally cross-bedded quartzose sandstone. Local beds of siltstone, conglomeratic sandstone, and conglomerate may also be present, and rarely interbeds of reddish shale. Reservoir basin will back up through the stratigraphic section mentioned above.

Foundation Design Considerations: Sandstone rock in both the Entrada Sandstone and Curtis Formation should provide adequate support for main dam foundation and abutments. However, permeability through primary porosity in the sandstone or secondary fracturing may lead to leaking foundation conditions and may require designed grout program within the abutments and possibly the main dam center section as well. Seep vertical walls of the canyon will have to be cut back at a 1.5:1 slope to allow construction equipment to dig cutoff trench. Deep alluvium along the centerline of the river is also possible and may require deep excavation to extend dam foundation, or at least a cut-off to rock across the entire alignment. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section, such as concrete dam structure. River diversion during construction will be an important consideration. Although rock in the vicinity of the dam alignment is

expected to be relatively stable, some of the formations around the reservoir basin upstream contain large amounts of clay-shale, siltstone, and other potentially unstable rock. Hence, slopes around the reservoir basin should be evaluated for potential landslides.

Other Considerations: Alluvium and some of the clay bearing formations within the reservoir basin should provide ample source of clay for core of dam. Sources of sand and gravel should be available through the formations within and around the dam foundation. Sources for rip-rap may be more problematic unless some of the sandstone layers are well-enough cemented to retain integrity for use as such. Angle exploration holes should be drilled to evaluate joint density, orientation, and permeability. Site access will need to be improved. Tunnel by-pass may be required at this site during construction. Fish passage may require special construction features. Due to the steep vertical walls, unknown thickness of the alluvium, and other physical properties found at the site, a concrete dam would need to be constructed. The size of the dam (embankment volume) and reservoir storage at this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1001 Hambrick Bottom T19S R09E Sec 35



Jorgensen

Location: SW¼ Sec 17, T19S, R9E, SLB&M; Main channel site on Cottonwood Creek about 2 miles upstream of confluence with Huntington and Ferron Creeks approximately 5 miles southeast of Castle Dale, Utah.

Land Ownership: Dam and reservoir will lie on mix of BLM and private land.

Dam Embankment: Height: 58 ft.: Length: 670 ft.: Vol. 148,384 cu. yds.: Crest El.: 5,465

Reservoir: High Water El.: 5,460: Capacity: 7,898 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 18.8

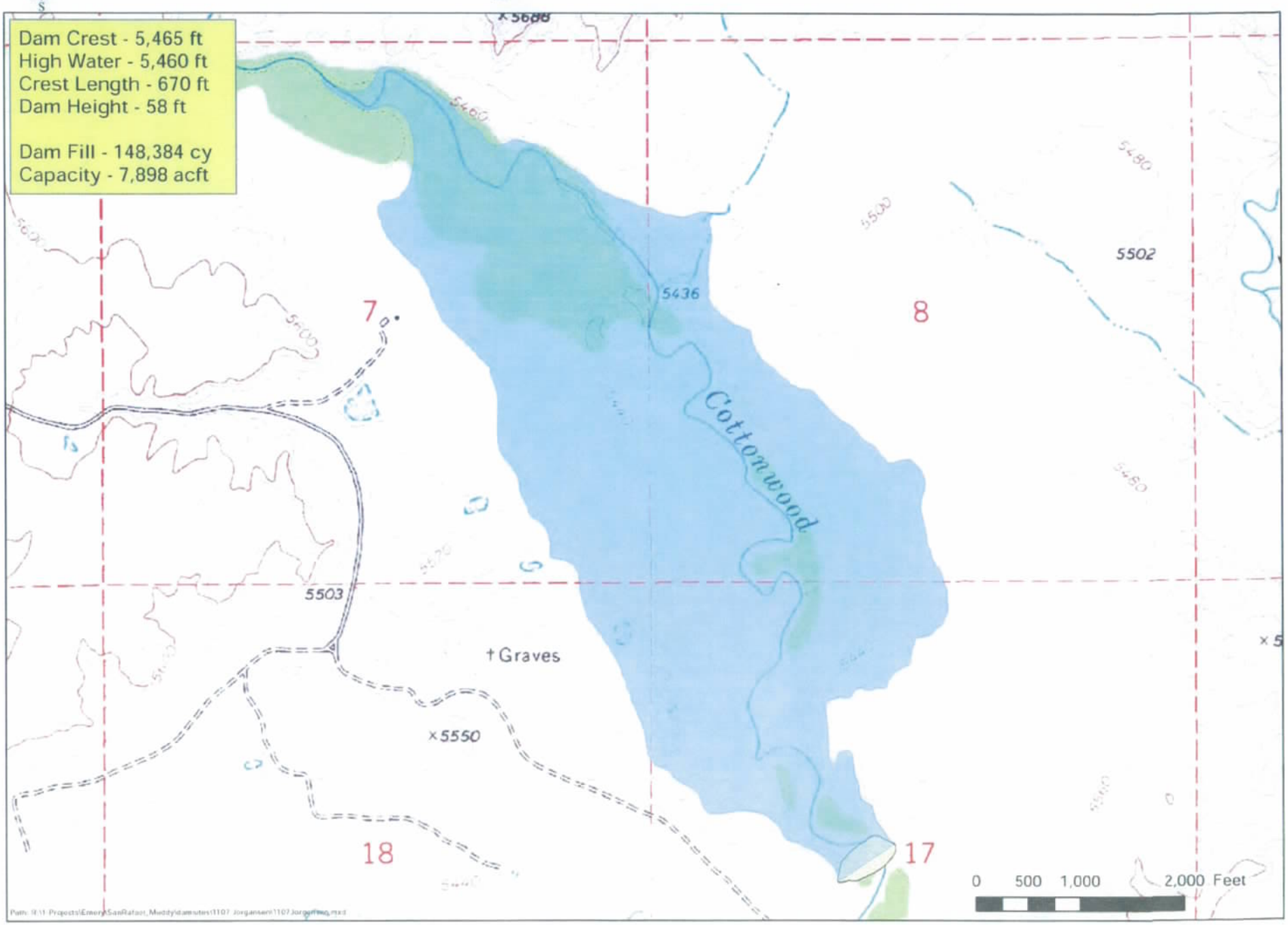
Geology: Setting is on Cottonwood Creek on western edge of San Rafael Swell. Published mapping by Witkind et. al. (1987) shows the vicinity of the proposed dam underlain by bedrock of the Dakota Sandstone Formation through the center section and both abutments although Tununk Member of the Mancos Shale Formation may be exposed in upper abutment areas. Dakota Sandstone Formation is described as thin bedded to cross bedded fine - to medium-grained quartzose sandstone with local carbonaceous layers. Rock is moderately cemented, friable, locally hard, and moderately jointed. Tununk Member comprises light and dark grey shale and thinly bedded shaly siltstone locally with thin silicified shale ledges. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. If present on steep slopes, these materials may be susceptible to development of landslides or other forms of movement. At depth, rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. Beneath center section of dam along creek bottom deep soil profile and alluvium is likely present—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Mancos materials. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels. Pediment gravels will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Sandstone bedrock of the Dakota Sandstone Formation should provide good foundation for dam and abutments. However, permeability through primary porosity in the sandstone or secondary fracturing may lead to leaking foundation conditions and may require designed grout program within the abutments and possibly the main dam center section as well. Shale bedrock of the Tununk Member, if present, may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of mass wasting. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center

section, such as slurry trench, etc. Creek diversion during construction is another important consideration.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Shell material may be available from weathered Dakota Sandstone. Sources of and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Angle exploration holes should be drilled to characterize joint density, orientation, and permeability. Access to the site will need to be improved.

1107 Jorgensen T19S R9E Sec 17



Rock Canyon Creek

Location: SW¼ Sec 17, T19S, R9E, SLB&M; Off channel site on west side of Cottonwood Creek about 2 miles upstream of confluence with Huntington and Ferron Creeks and about 5 miles southeast of Castle Dale, Utah.

Land Ownership: Dam will be on BLM land. Reservoir is located on a mix of BLM and private land.

Dam Embankment: Height: 80 ft.: Length: 855 ft.: Vol. 284,492 cu. yds.: Crest El.: 5,485

Reservoir: High Water El.: 5,480: Capacity: 13,741 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 20.7

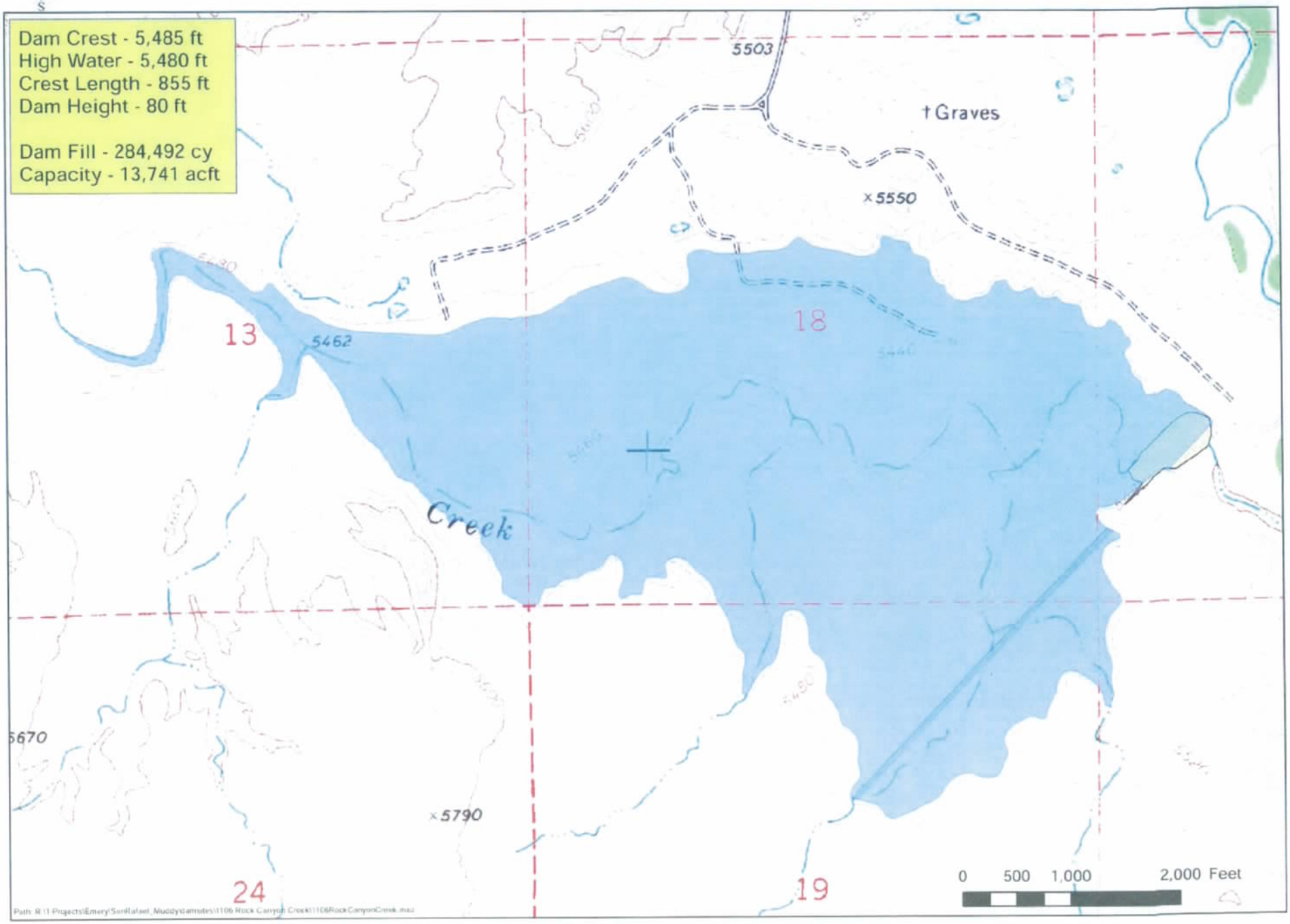
Geology: Setting is proximate to Cottonwood Creek on western edge of San Rafael Swell. Published mapping by Witkind et. al. (1987) shows the vicinity of the proposed dam underlain by bedrock of the Tununk Member of the Mancos Shale Formation on the left abutment and the Dakota Sandstone Formation beneath the center section and right abutment. Tununk Member comprises of a light and dark grey shale and thinly bedded shaly siltstone locally with thin silicified shale ledges. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement. At depth, rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infillings. Dakota Sandstone Formation is described as thin bedded to cross bedded fine - to medium-grained quartzose sandstone with local carbonaceous layers. Rock is moderately cemented, can be friable, locally hard, and is moderately jointed. Beneath center section of dam along creek bottom deep soil profile and alluvium is likely present—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Mancos materials. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels. Pediment gravels will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, and cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of movement. Sandstone bedrock of the Dakota Sandstone Formation should provide good foundation for dam and abutments. However, permeability through primary porosity in the sandstone or secondary fracturing may lead to leaking foundation conditions and may require designed grout program within the abutments and possibly the main dam center section as well. Potential deep weathering of bedrock within the center section may affect depth

of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Shell material may be available from weathered Dakota Sandstone. Sources of rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Angle exploration holes should be drilled to characterize joint density, orientation, and permeability. Access to the site will need to be improved. To fully utilize the storage capacity available at the site, a diversion structure will need to be built on Cottonwood Creek and conveyance facilities constructed.

1106 Rock Canyon Creek T19S R9E Sec 17



The Breaks

Location: SE¼ Sec. 6, T19S, R9E, SLB&M. Located on Cottonwood Creek about 4 miles upstream of its confluence with Huntington Creek and approximately 3.5 miles southwest of Castle Dale, Utah.

Land Ownership: The dam would be built on private land while the reservoir basin lies on a mixture of private, BLM, and SITLA land.

Dam Embankment: Height: 125 ft. Length: 775 ft. Volume: 431,780 cu. yds.
Crest Elev.: 5,565 ft. asl.

Reservoir: High Water Elev.: 5,560 ft. asl. Capacity: 14,452 acre-ft.

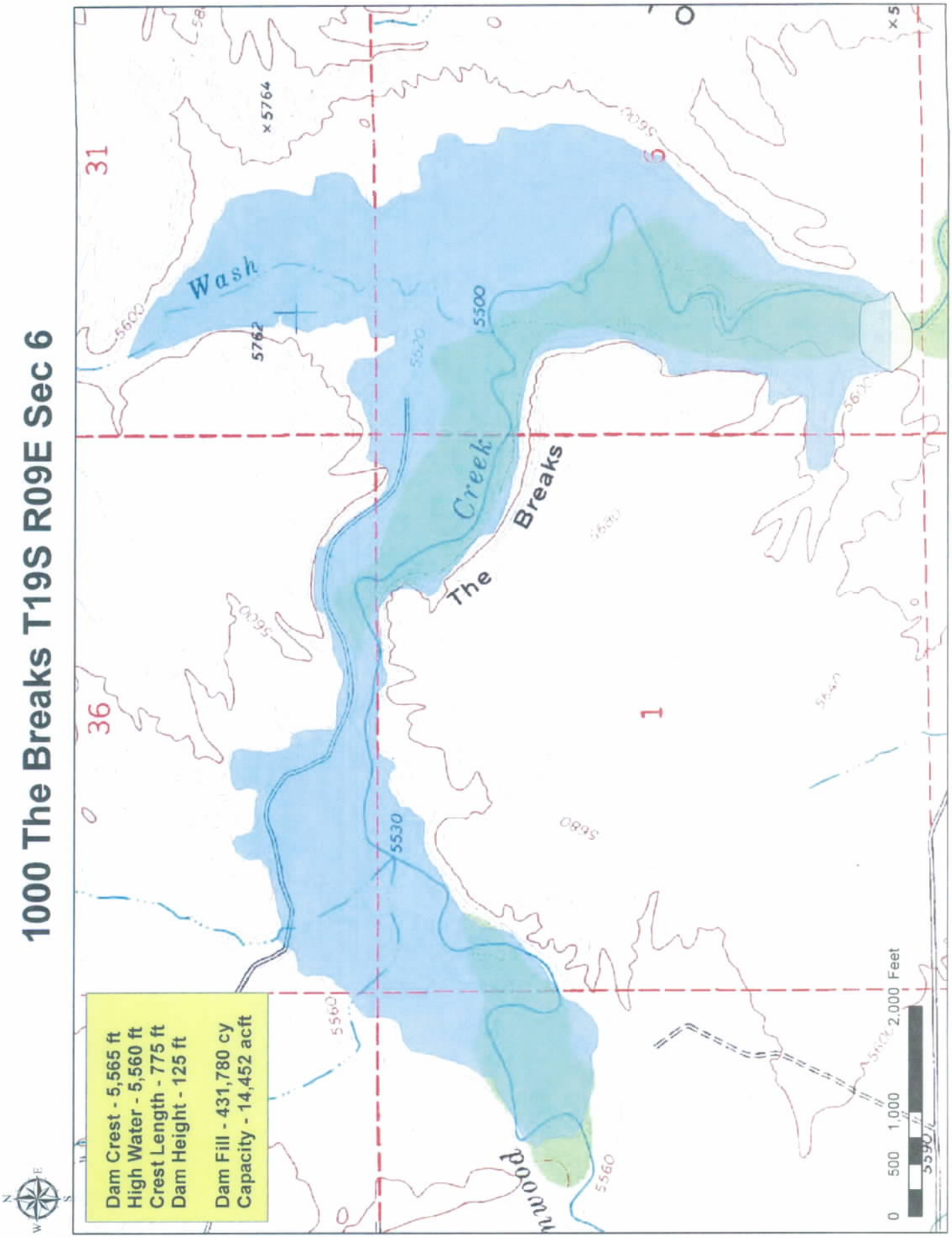
Rating Factor (embankment volume/reservoir capacity): 29.9 cu.yds./ac.ft.

Geology: Setting is within Castle Valley between the Wasatch Plateau to the west and San Rafael Swell to the east. Dam abutments and center section will rest on rock mapped as Tununk Member of the Mancos Shale Formation. The Tununk Member is described as light grey to dark grey, thin to medium bedded, even bedded, shale and shaly siltstone (Witkind, et. al., 1987). Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Seep walls of the canyon will have to be cut back at a 1.5:1 slope to allow construction equipment to dig cutoff trench. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Site access will need to be improved. Portions of an access road will need to be re-aligned.

1000 The Breaks T19S R09E Sec 6



Lower Ferron A

Location: NW¼ Sec. 3, T20S, R8E, SLB&M. This is an off-stream site, adjacent to Ferron Creek, approximately 1 mile north and 6 miles east of Ferron, Utah.

Land Ownership: The dam site and reservoir basin are on a mixture of private and BLM land.

Dam Embankment: Height: 85 ft. Length: 1,405 ft. Volume: 372,930 cu.yds.
Crest Elev.: 5,645 ft. asl.

Reservoir: High Water Elev.: 5,640 ft. asl. Capacity: 8,957 ac.ft.

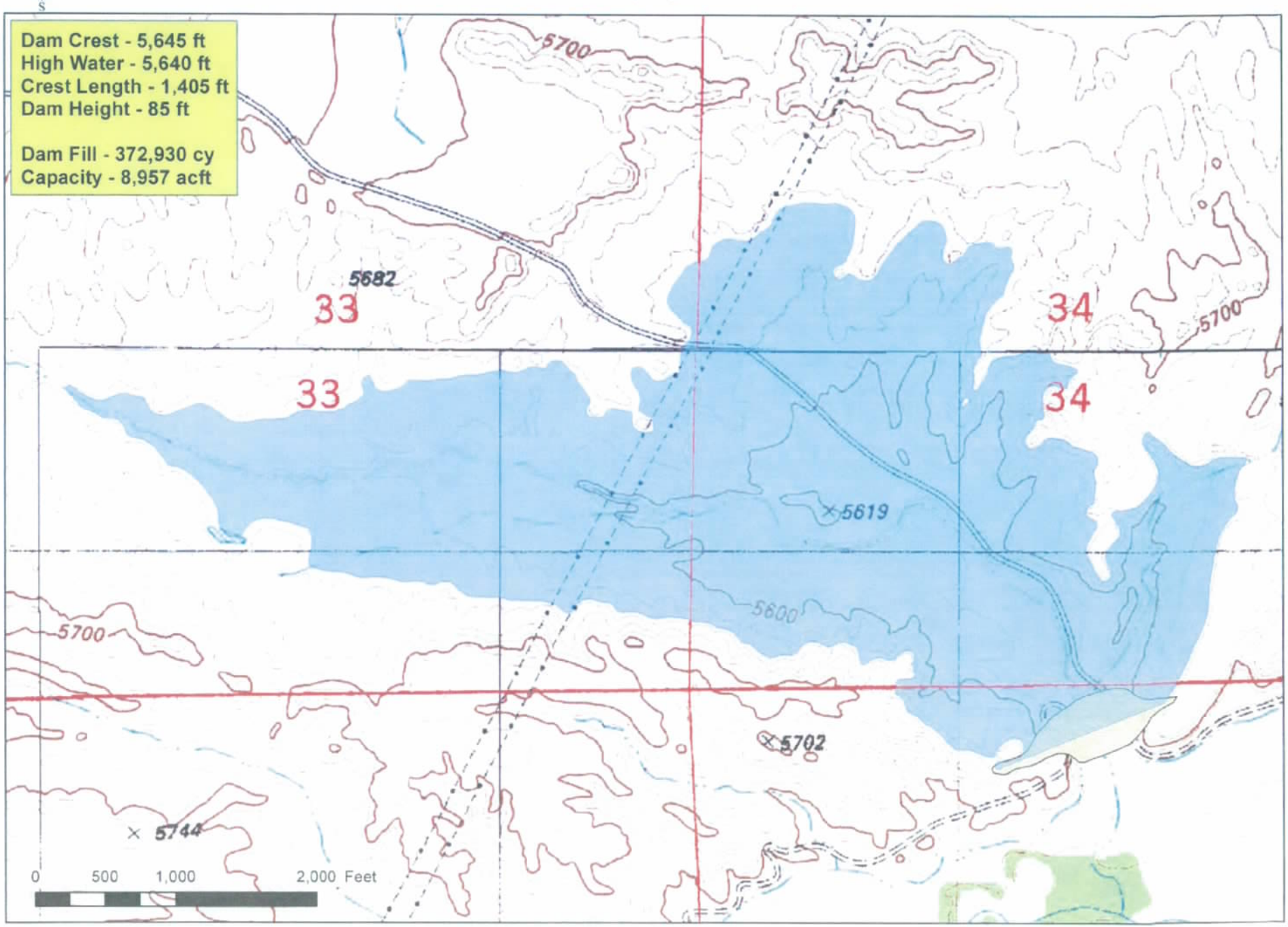
Rating Factor: (embankment volume/reservoir capacity) 41.6 cu.yds./ac.ft.

Geology: This site is located within Castle Valley, east of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The abutments, center section of the dam, and reservoir basin are all mapped within the shale and siltstone of the Blue Gate Member in the Mancos Shale Formation (Witkind et. al., 1987). Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel; however this dam site is located on a minor drainage, so alluvium thickness should be less.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement or slumping. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location and water may need to be imported from Ferron Creek or from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed. Power transmission lines will need to be relocated that presently occupy the proposed reservoir basin.

1068 Lower Ferron (A) T20S R8E Sec 3



Lower Ferron L

Location: NE¼ Sec. 2, T20S, R8E, SLB&M. Located as an off-stream site adjacent to Ferron Creek, eight miles east by northeast of Ferron, Utah.

Land Ownership: The dam site and most of the reservoir basin are located on SITLA land. The southern portion of the reservoir basin inundates BLM land.

Dam Embankment: Height: 90 ft. Length: 615 ft. Volume: 273,798 cu.yds.
Crest Elev.: 5,605 ft. asl.

Reservoir: High Water Elev.: 5,600 ft. asl. Capacity: 6,378 ac.ft.

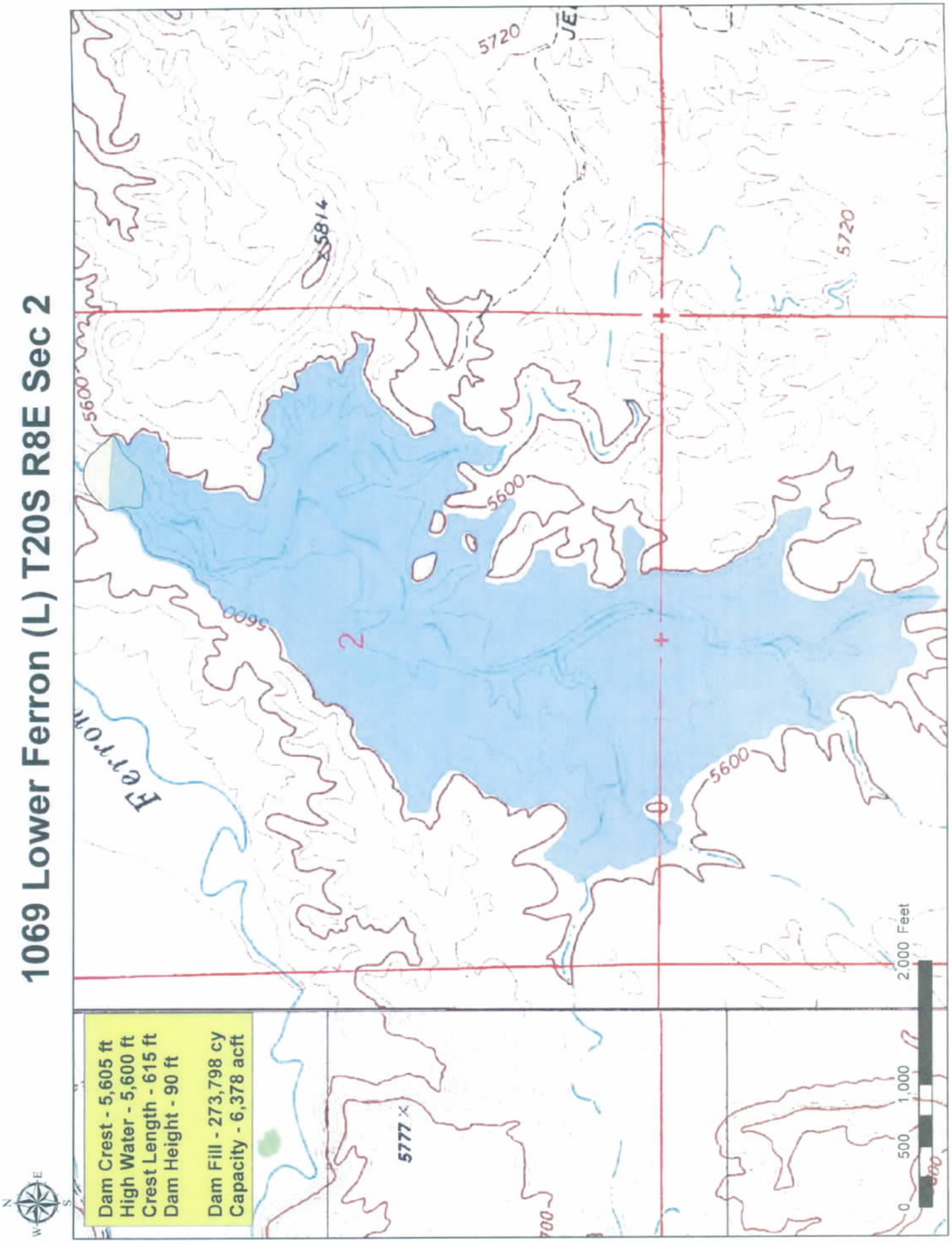
Rating Factor: (embankment volume/reservoir capacity) 42.9 cu.yds./ac.ft.

Geology: This site is located within Castle Valley, east of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The abutments, center section of the dam, and reservoir basin are all mapped within the upper, middle, and lower units of the Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The upper and lower units are predominately sandstone while the middle unit is predominately shale. The sandstones are fine - to very fine-grained, medium to thick bedded, and locally massive or crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location and water will need to be diverted from Ferron Creek or from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed.

1069 Lower Ferron (L) T20S R8E Sec 2



Molen Seep B

Location: NW¼ Sec.6, T21S, R8E, SLB&M. Located on Molen Seep Wash as it cuts through Molen Reef.

Land Ownership: The damsite and most of the reservoir basin are located on BLM land. A small area of the reservoir encroaches on private land.

Dam Embankment: Height: 103 ft. Length: 590 ft. Volume: 291,540 cu.yds.
Crest Elev.: 5,995 ft. asl.

Reservoir: High Water Elev.: 5,990 ft. Capacity: 5,354 ac.ft.

Rating Factor: (embankment volume/reservoir capacity) 54.5 cu.yds./ac.ft.

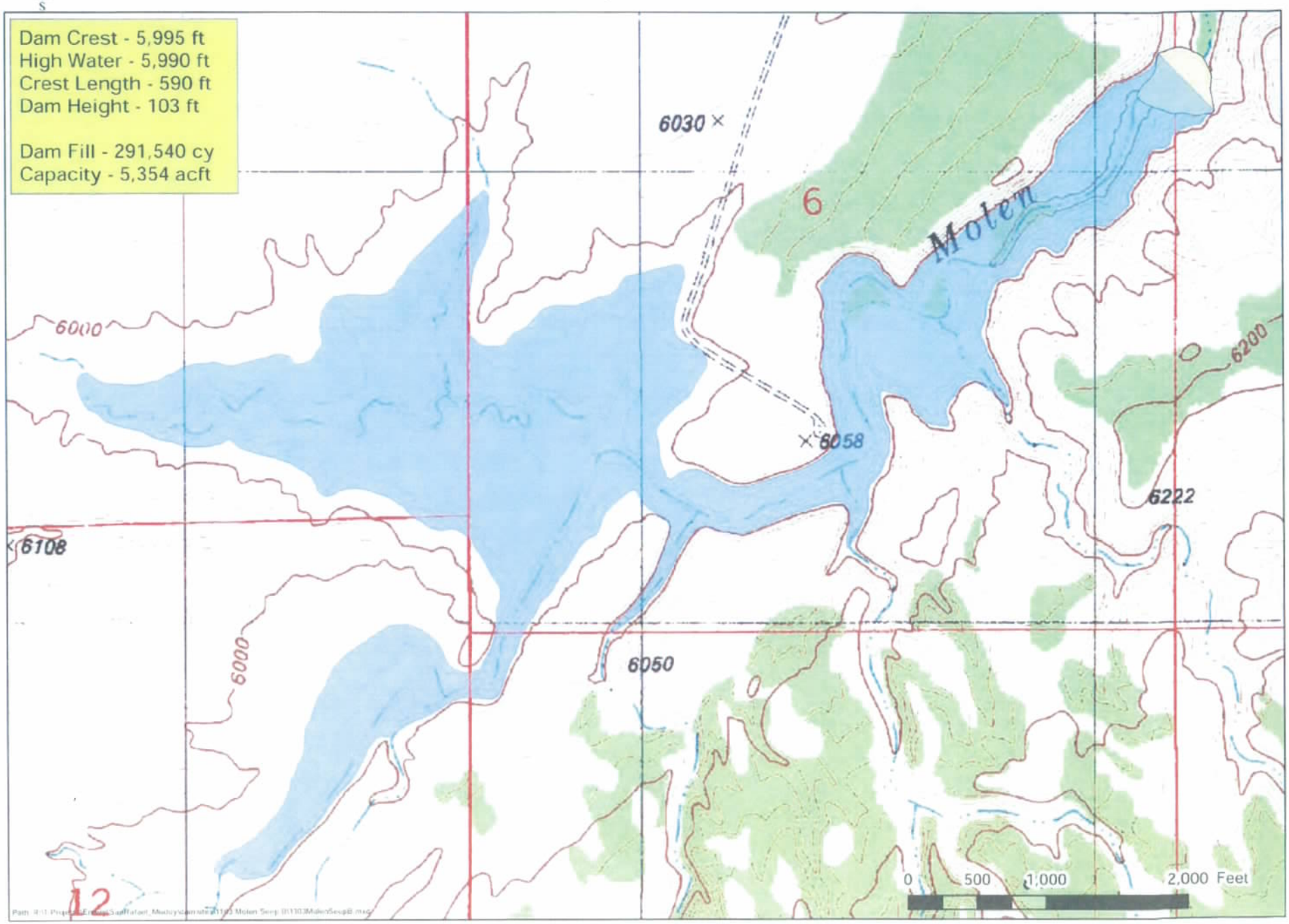
Geology: This site is located within Castle Valley about six miles southeast of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. At this site, the upper abutments are mapped as sandstone within the upper unit of the Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The remainder of the dam rests on mostly shale of the middle unit of the Ferron Sandstone Member. The sandstones are fine - to very fine-grained, medium to thick bedded, and locally massive or crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location. Water will need to be diverted from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed. Site access will need to be improved. The size of the dam

(embankment volume) and reservoir storage at this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1103 Molen Seep B T21S R8E Sec 5



Koford

Location: SE¼ Sec. 28, T16S, R6E, SLB&M. Located in upper Joes Valley on Indian Creek, within the Joes Valley graben.

Land Ownership: The dam site is on USFS public lands, while the reservoir is located on a mixture of private and USFS land.

Dam Embankment: Height: 118 ft. Length: 1,030 ft. Volume: 483,536 cu. yds.
Crest Elev.: 8,565 ft. asl.

Reservoir: High Water Elev.: 8,560 ft. asl. Capacity: 6,772 acre-ft.

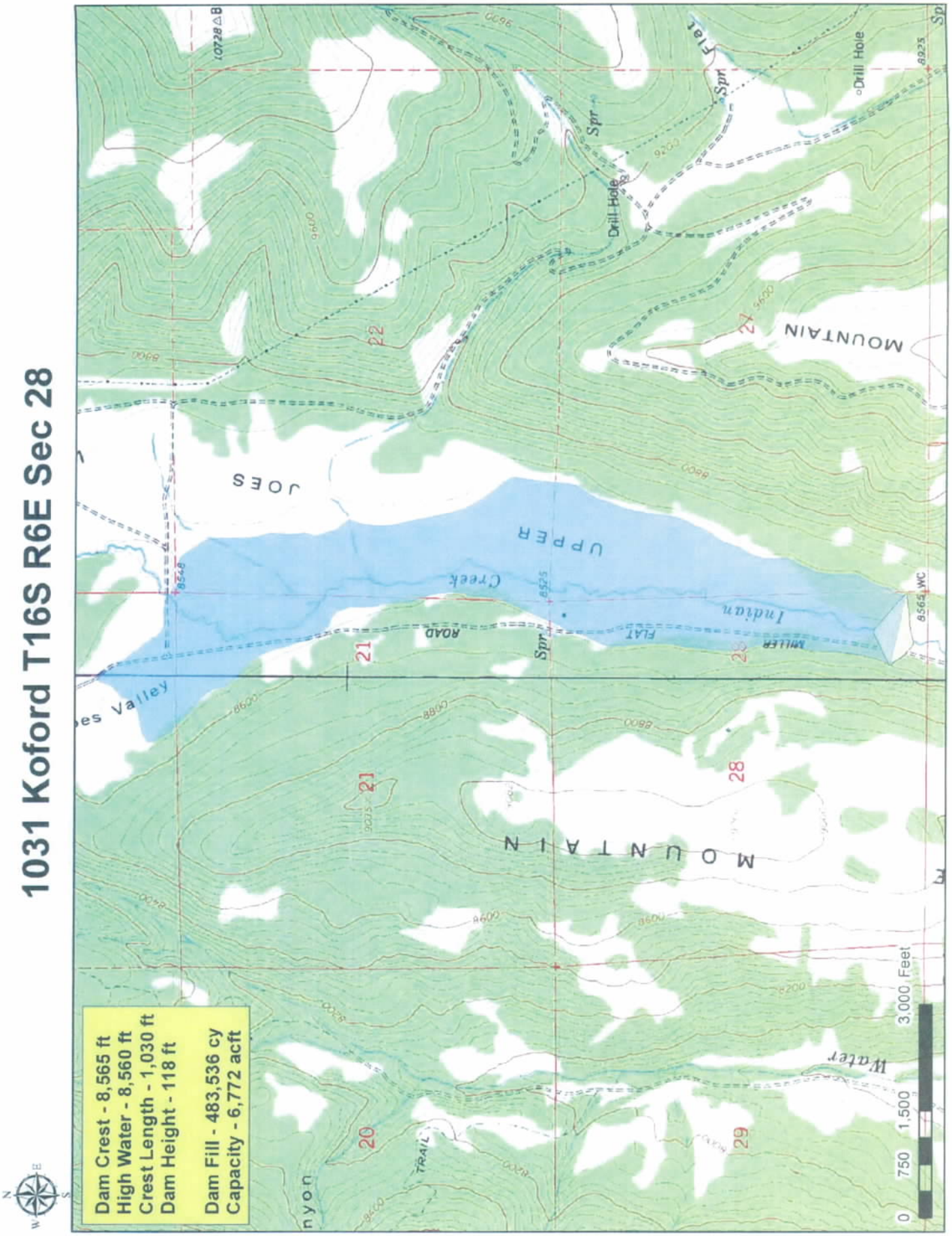
Rating Factor (embankment volume/reservoir capacity): 71.4 cu.yds./ac.ft.

Geology: Setting is within the Joes Valley graben, on the east slope of the Wasatch Plateau. The east strand of the Joes Valley fault is located at the left abutment. Differential offset along the Joes Valley fault system has juxtaposed formations from the right abutment to the left abutment. The right abutment comprises of mudstone, claystone, sandstone, and conglomerate of the North Horn Formation. The left abutment contains sandstone, siltstone, and shale of the Blackhawk Formation and overlying that is sandstone of the Castlegate Formation. The dynamics which led to the formation of the Joes Valley graben may have imparted abundant secondary fractures to the bedrock at this site. Mudstone, claystone, shale, and siltstones are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock could be tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of grout curtain. Although shale is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. This is particularly true as it pertains to the North Horn Formation, which is notorious for spawning landslides. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to this site will need to be improved. Sources of clay for core of the dam, and shell material and rip-rap will need to be evaluated. Angle holes should be drilled to assess the potential for fracturing and secondary permeability in both abutments and the foundation. Site access may need to be improved.

1031 Koford T16S R6E Sec 28



Molen Seep C

Location: Dam NW¼ Sec. 5, Dike NE¼ Sec. 6, T21S, R8E, SLB&M. Located on Molen Seep Wash where it cuts through Molen Reef.

Land Ownership: The dam and most of the reservoir basin are located on BLM land. A small area of the reservoir encroaches on private land.

Dam Embankment: Height: 108 ft. Length: 975 ft. Volume: 517,731 cu.yds.
Crest Elev.: 5,985 ft. asl.

Reservoir: High Water Elev.: 5,980 ft. asl. Capacity: 5,546 ac.ft.

Rating Factor: (embankment volume/reservoir capacity) 93.4 cu.yds./ac.ft.

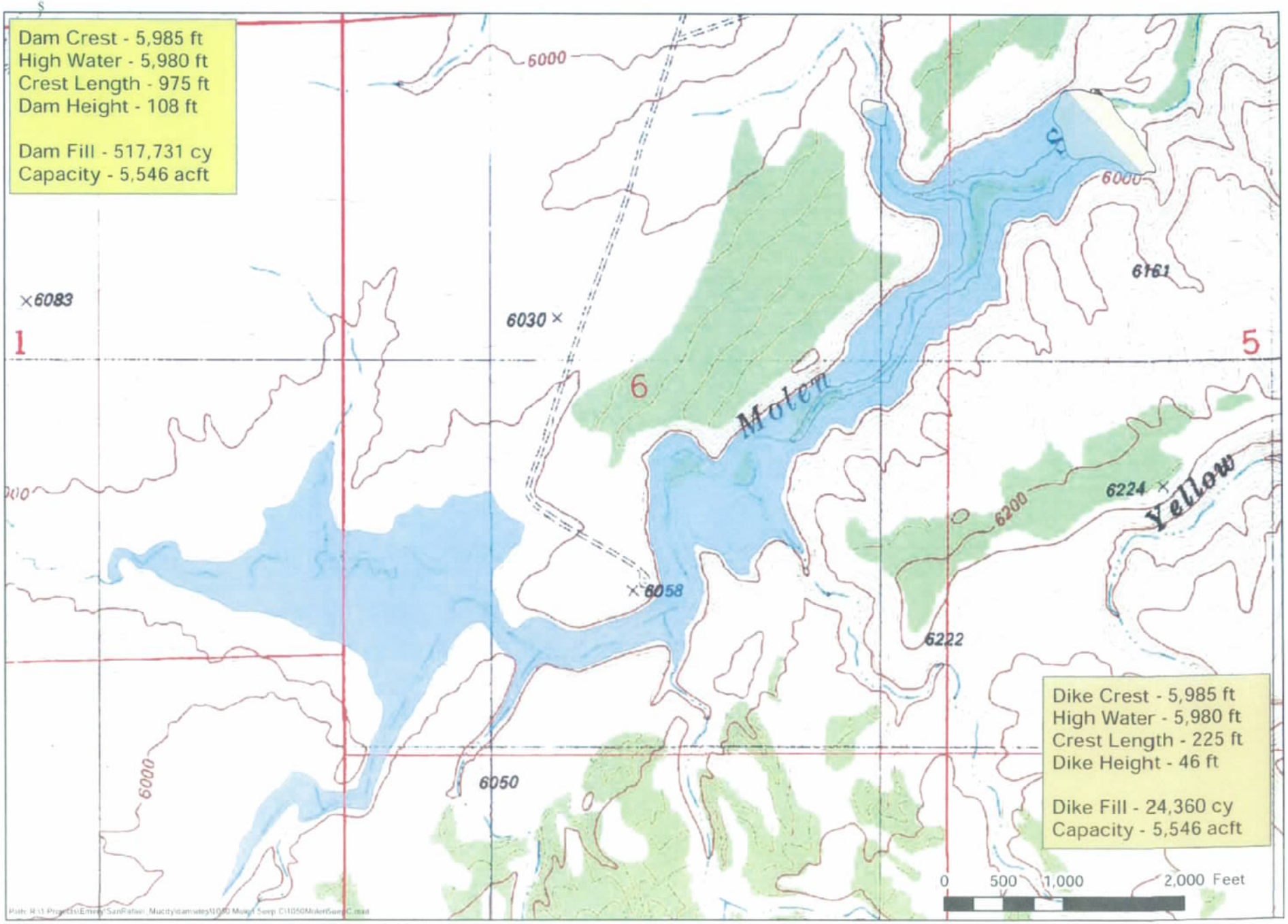
Geology: This site is located within Castle Valley about six miles southeast of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. At this site, the upper abutments are located in sandstone within the upper unit of the Ferron Sandstone Member of the Mancos Shale Formation. The remainder of the dam rests on mostly shale of the middle unit of the Ferron Sandstone Member. The sandstones are fine - to very fine-grained, medium to thick bedded, locally massive, and crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location. Water may need to be diverted from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed. The size of the dam (embankment volume) and reservoir storage at

this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1050 Molen Seep C T21S R8E Sec 5



Muddy Creek 3

Location: NW¼ Sec. 16, T21S, R6E, SLB&M. Located on Muddy Creek about 4.5 miles north of the town of Emery, Utah.

Land Ownership: Both the damsite and the reservoir basin are located entirely on land administrated by the USFS.

Dam Embankment: Height: 164 ft. Length: 855 ft. Volume: 1,262,920 cu.yds.
Crest Elev.: 6,725 ft. asl.

Reservoir: High Water Elev.: 6,720 ft. asl. Capacity: 13,032 ac.ft.

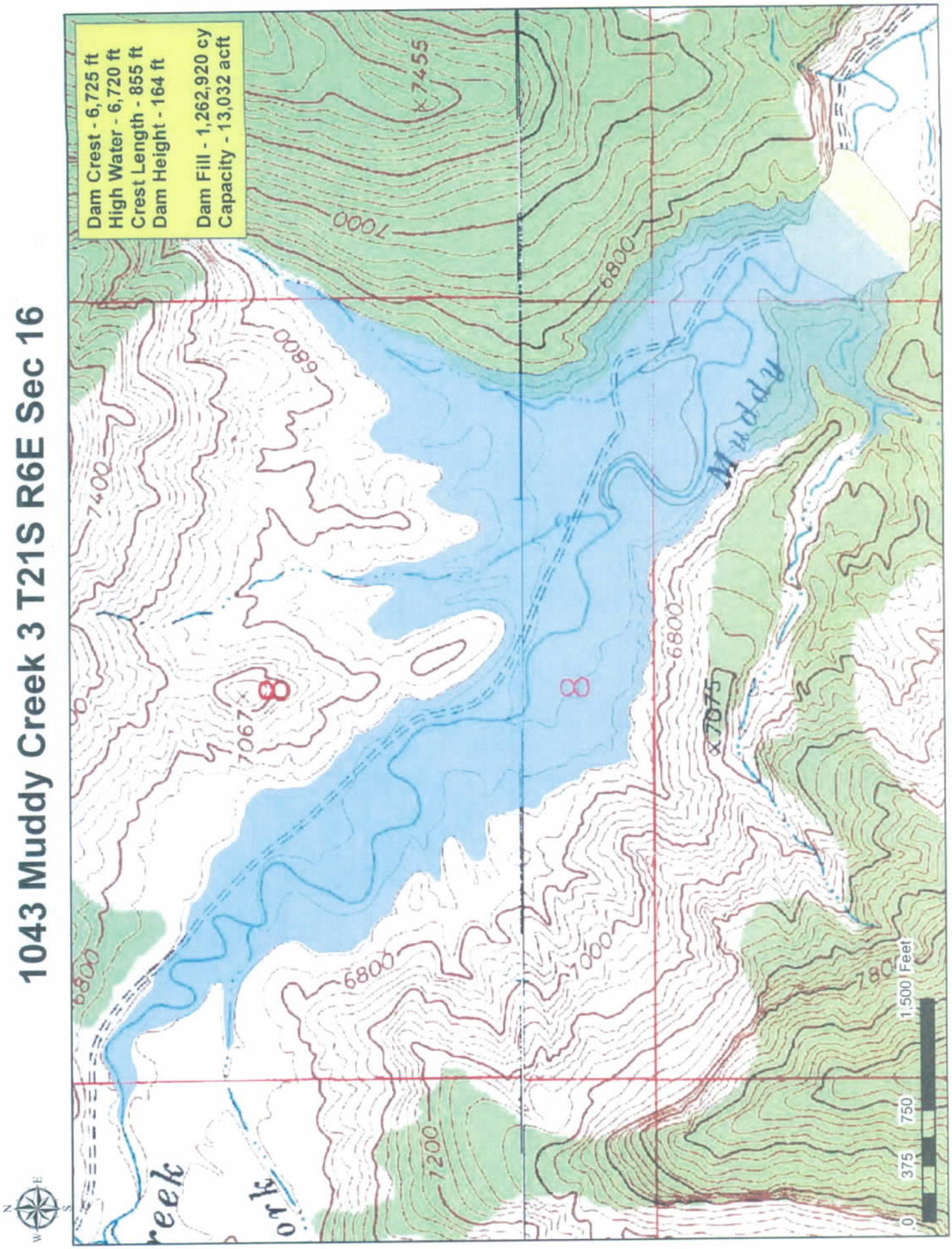
Rating Factor: (embankment volume/reservoir capacity) 96.9 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flanks of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. Portions of three formations have been mapped at this site. Underlying the right side of the dam are medium to dark-blue-grey marine shale, yellow to blue-grey sandy shale, and yellow-grey, fine-grained sandstone of the Upper Blue Gate Member of the Mancos Shale Formation. Located in the lower left abutment is the resistant, cliff-forming, yellow-grey, light-brown, and white, fine - to medium-grained sandstone of the Star Point Sandstone Formation. Higher on the left abutment are the sandstone, conglomeratic sandstone, sandy carbonaceous shale, and coal of the Blackhawk Formation. On steep slopes, some of these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. Nearby north trending normal faults, Joes Valley fault system, may increase the fracture density at the site. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rates could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1043 Muddy Creek 3 T21S R6E Sec 16



Lower Ferron B

Location: SW¼ Sec 4, SE¼ Sec. 5, NE¼ Sec 8, T20S, R8E, SLB&M; off channel site northeast of Ferron Creek about 6 miles east of Ferron, Utah.

Land Ownership: Dam and reservoir are located on mixture of private and BLM land.

Dam Embankment: Height: 115 ft.: Length: 2,655 ft.: Vol. 1,723,460 cu. yds.: Crest El.: 5,725

Reservoir: High Water El.: 5,720: Capacity: 17,040 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 101.1

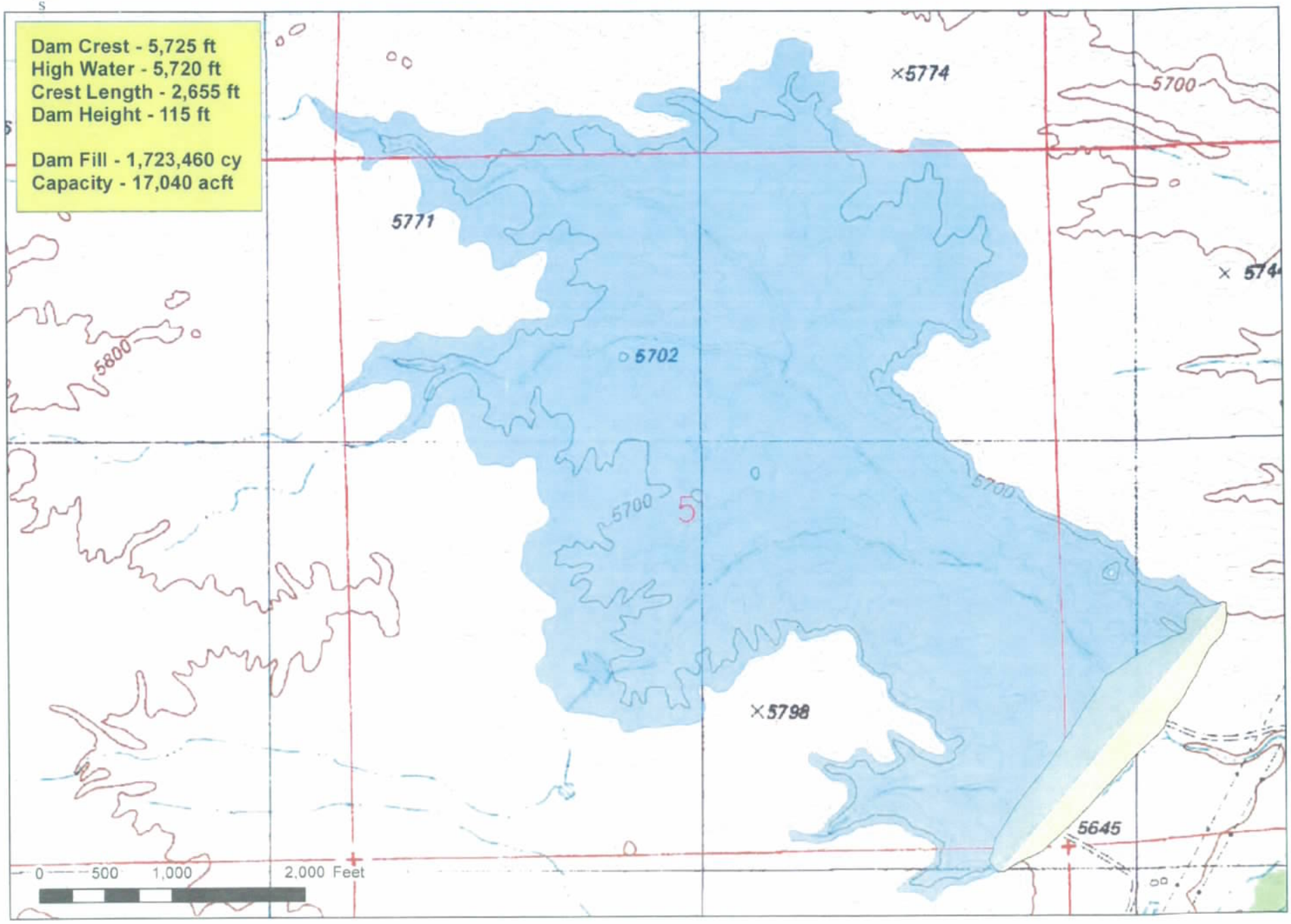
Geology: Setting is within the Castle Valley east of the town of Ferron, between the Wasatch Plateau to the west and San Rafael Swell to the east. Dam abutments and center section will rest on rock mapped as Blue Gate Member of the Mancos Shale Formation. Blue Gate Member is described as consisting of dark grey shale and thinly bedded siltstone with some thin interlayers of sandstone also present (Witkind, et. al., 1987). Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement. At depth, rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Blue Gate member. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels. These will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Although terrain in the vicinity of dam is subdued, slopes should be carefully observed for evidence of landslides or other forms of mass wasting. Deep weathering of bedrock within the center section will affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Reservoir location may be downstream of primary irrigable lands. This may not be an issue if water storage is for fisheries, recreation, or future power generating stations downstream. Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek or water routed to this site from Millsite Dam. Access to the site will need to be improved. The size of

the dam (embankment volume) and reservoir storage at this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1067 Lower Ferron (B) T20S R8E Sec 4



Peacock

Location: SE¼ Sec. 8, SW¼ Sec. 9, T18S, R7E, SLB&M. Located in Straight Canyon, approximately 1 mile below the confluence of Cottonwood Creek and Straight Canyon Creek. This site is about 6.5 miles downstream from Joes Valley Dam.

Land Ownership: Dam and reservoir are located on a mixture of private and BLM land.

Dam Embankment: Height: 140 ft. Length: 1,675 ft. Volume: 1,769,190 cu. yds.
Crest Elev.: 6,325 ft. asl.

Reservoir: High Water Elev.: 6,320 ft. asl. Capacity: 14,518 acre-ft.

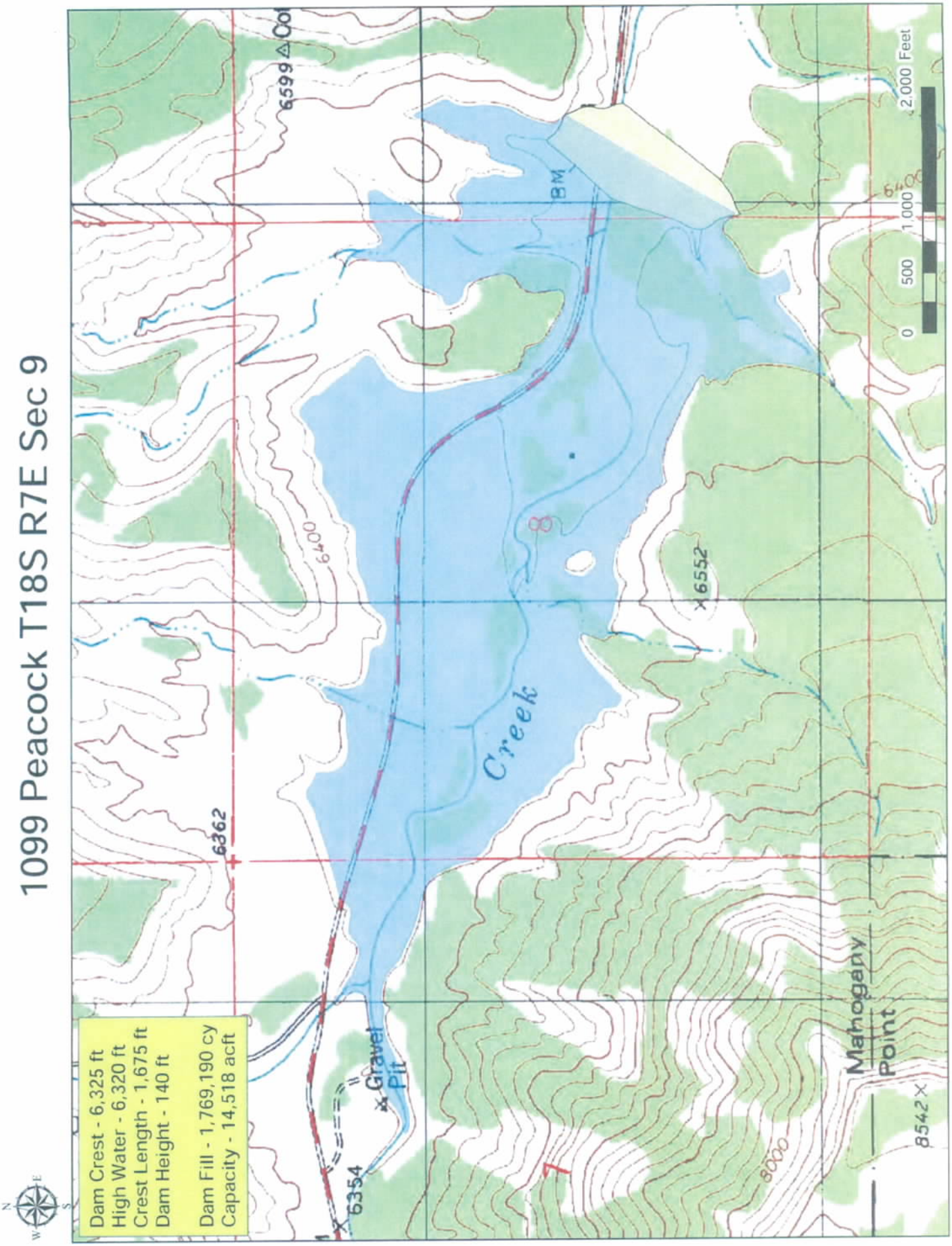
Rating Factor (embankment volume/reservoir capacity): 121.9 cu.yds./ac.ft.

Geology: Setting is low on the eastern flank of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam abutments and center section will rest on or against rock mapped as Masuk Member of the Mancos Shale Formation. The Masuk is described as light grey, bluish grey, and dark grey; thin to medium bedded shale and shaly siltstone, with a few thin interlayered sandstone beds (Witkind, et. al., 1987). Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. Proximity to the Joes Valley graben may have imparted additional fracturing to the bedrock. An unknown depth of alluvium overlies bedrock in the stream channel. However, it is possible the depth of alluvium is similar to what was encountered at Joes Valley Dam.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately steep to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to site is via good paved roads, however, the dam and reservoir will displace more than 1 mile of highway 29. Having steep slopes to contend with, rerouting the highway may present design challenges and construction will disrupt traffic. Sources of clay for core of the dam, and shell material and rip-rap may be of limited supply locally. Hauling materials from some distance may be necessary. Construction of conveyance facilities to route water around the site will be necessary to supply water needed downstream.

1099 Peacock T18S R7E Sec 9



Dutch Flat 2

Location: SE¼ Sec. 35 and SW¼ Sec. 36, T20S, R7E, SLB&M. Located on an unnamed tributary to Ferron Creek.

Land Ownership: Both the dam site and the reservoir basin are located on a mixture of BLM and SITLA land.

Dam Embankment: Height: 71 ft. Length: 945 ft. Volume: 169,088 cu.yds.
Crest Elev.: 6,025 ft. asl.

Reservoir: High Water Elev.: 6,020 ft. asl. Capacity: 1,337 ac.ft.

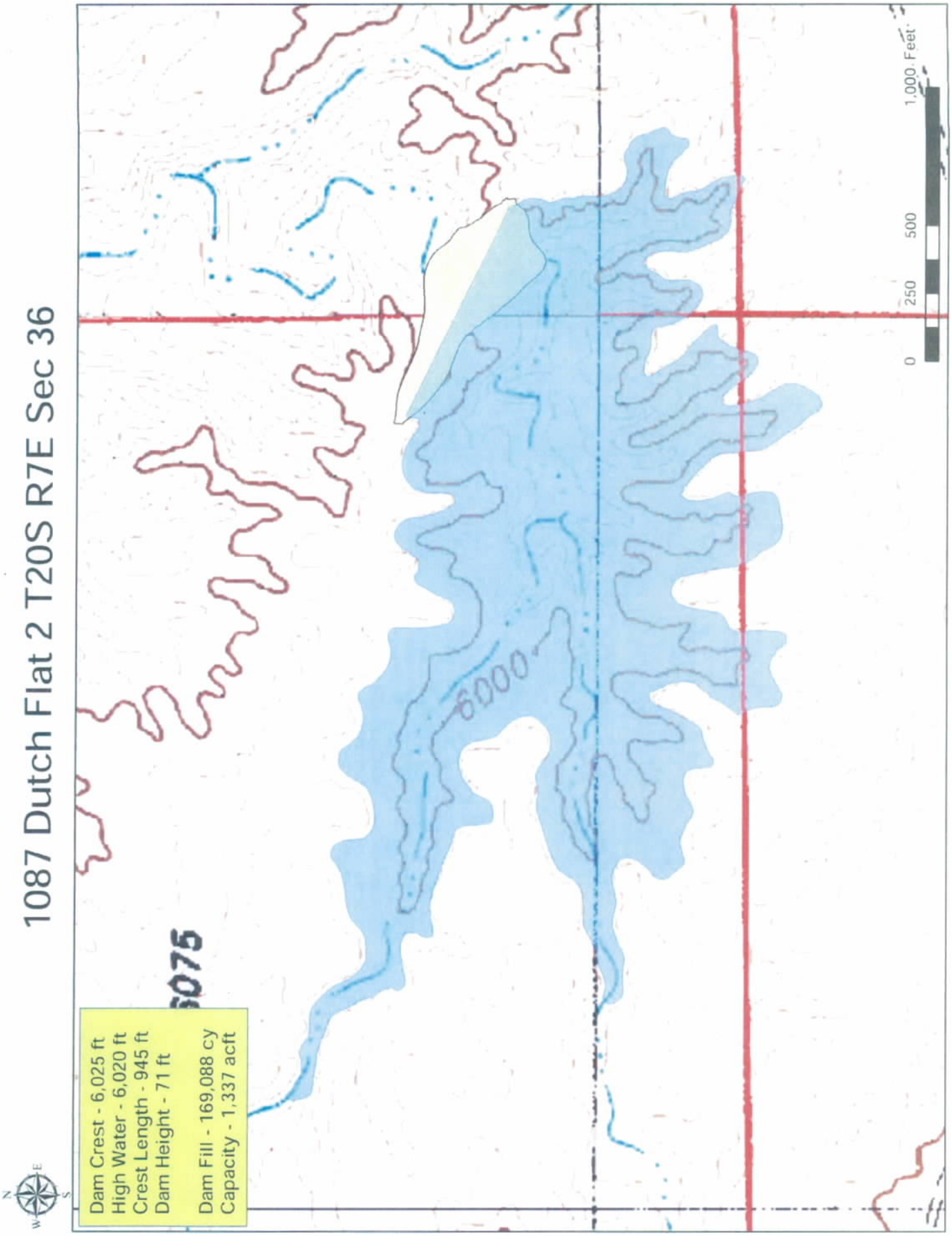
Rating Factor: (embankment volume/reservoir capacity) 126.4 cu.yds./ac.ft.

Geology: This site is located within Castle Valley, approximately five miles southeast of Ferron, Utah, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The abutments, center section of the dam, and reservoir basin are all located within the shale and siltstone of the Blue Gate Member in the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. Anticipate thin or no alluvium in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. The sedimentation rate could be high at this location. Water will need to be imported from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed.

1087 Dutch Flat 2 T20S R7E Sec 36



Lower Ferron D

Location: NW¼ Sec 12, T20S, R7E, SLB&M; off channel site northeast of Ferron Creek about 6 miles east of Ferron, Utah.

Land Ownership: Dam and reservoir are located on private land.

Dam Embankment: Height: 80 ft.: Length: 1,310 ft.: Vol. 511,711 cu. yds.: Crest El.: 5,905

Reservoir: High Water El.: 5,900: Capacity: 4,037 acre-ft.

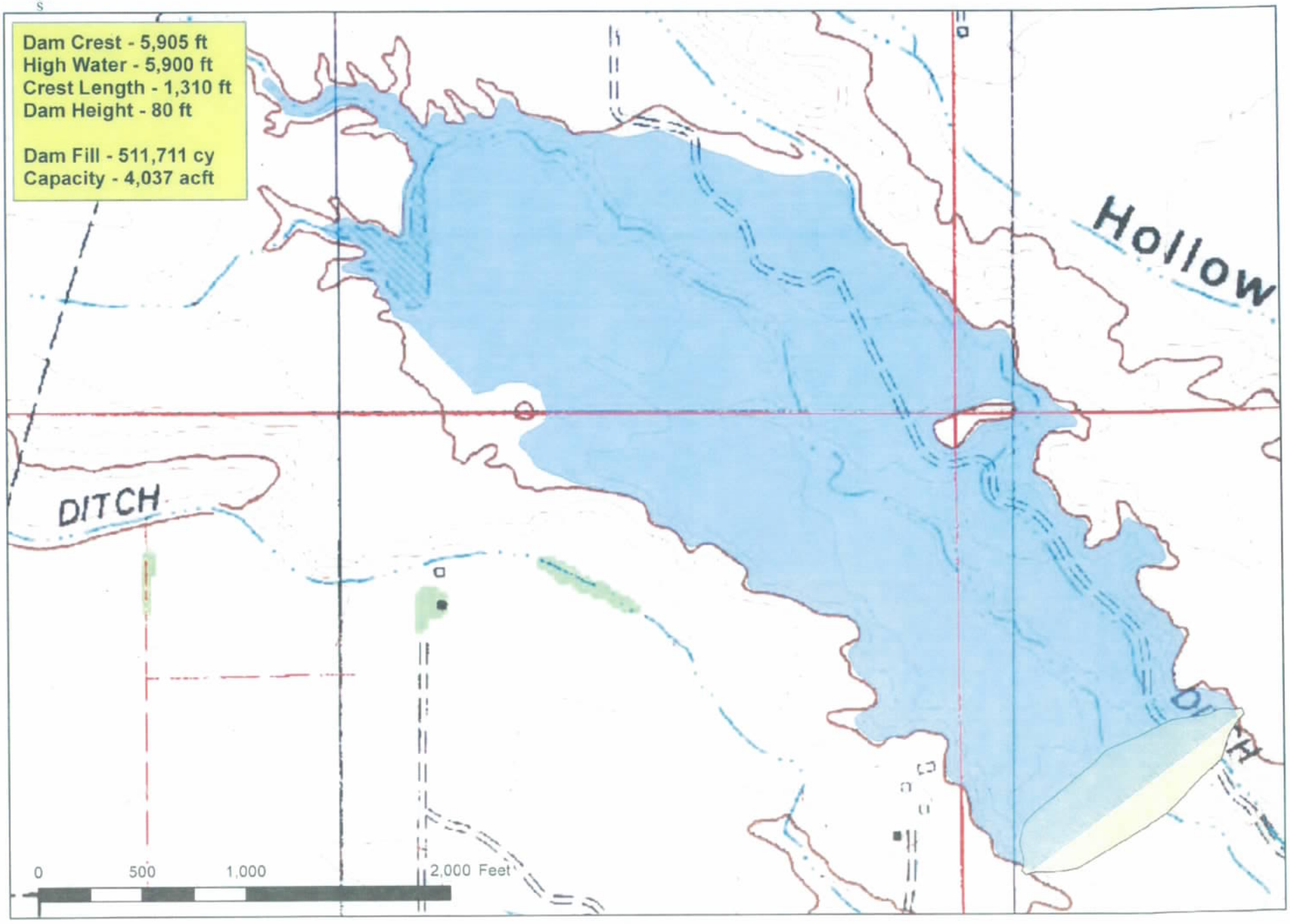
Rating Factor (embankment volume/reservoir capacity): 126.8

Geology: Setting is in essence the same as for Lower Emery Site B within the Castle Valley east of the town of Ferron, between the Wasatch Plateau to the west and San Rafael Swell to the east. Dam foundation will be within grey shale and thinly bedded siltstone of the Blue Gate Member of the Mancos Shale Formation with similar deep weathering and likely presence of alluvial soils through center section.

Foundation Design Considerations: Same as for Lower Emery Site B.

Other Considerations: Reservoir location may be downstream of primary irrigable lands. This may not be an issue if water storage is for fisheries, recreation, or future power generating stations downstream. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek or water routed to this site from Millsite Dam. Site access will need to be improved.

1063 Lower Ferron (D) T20S R7E Sec 12



Lower Ferron C

Location: NE¼ Sec 12, T20S, R7E, SLB&M; off channel site northeast of Ferron Creek about 3 miles east of Ferron, Utah.

Land Ownership: Dam and reservoir are located on mixture of private and BLM land.

Dam Embankment: Height: 68 ft.: Length: 1,375 ft.: Vol. 464,747 cu. yds.: Crest El.: 5,865

Reservoir: High Water El.: 5,860: Capacity: 3,615 acre-ft.

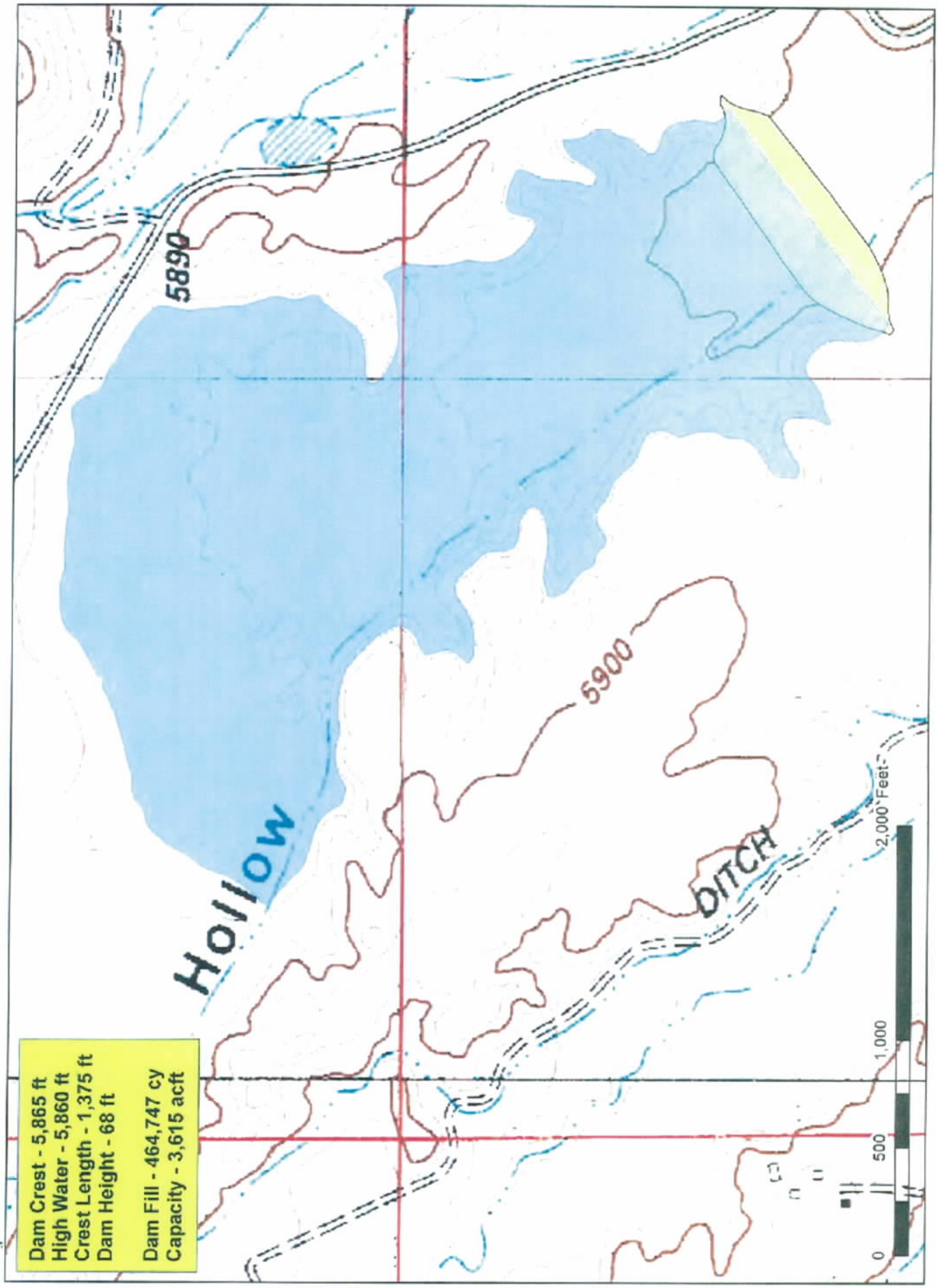
Rating Factor (embankment volume/reservoir capacity): 128.6

Geology: Setting is in essence the same as for Lower Emery Site B within the Castle Valley east of the town of Ferron, between the Wasatch Plateau to the west and San Rafael Swell to the east. Dam foundation will be within grey shale and thinly bedded siltstone of the Blue Gate Member of the Mancos Shale Formation with similar deep weathering and likely presence of alluvial soils through center section.

Foundation Design Considerations: Same as for Lower Emery Site B.

Other Considerations: Reservoir location may be downstream of primary irrigable lands. This may not be an issue if water storage is for fisheries, recreation, or future power generating stations downstream. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek or water routed to this site from Millsite Dam. Site access will need to be improved.

1064 Lower Ferron (C) T20S R7E Sec 12



Rock Canyon

Location: NE¼ Sec. 21, T19S, R7E, SLB&M. Located on Rock Canyon Creek, approximately 4.5 miles north of Ferron, Utah.

Land Ownership: The dam, the dike, and the reservoir basin are located entirely on BLM land.

Dam Embankment: Height: 48 ft. Length: 365 ft. Volume: 43,581 cu.yds.
Dike Embankment: Height: 7 ft. Length: 220 ft. Volume: 1,536 cu.yds.
Crest Elev.: 6,125 ft. asl.

Reservoir: High Water Elev.: 6,120 ft. asl. Capacity: 319 ac.ft.

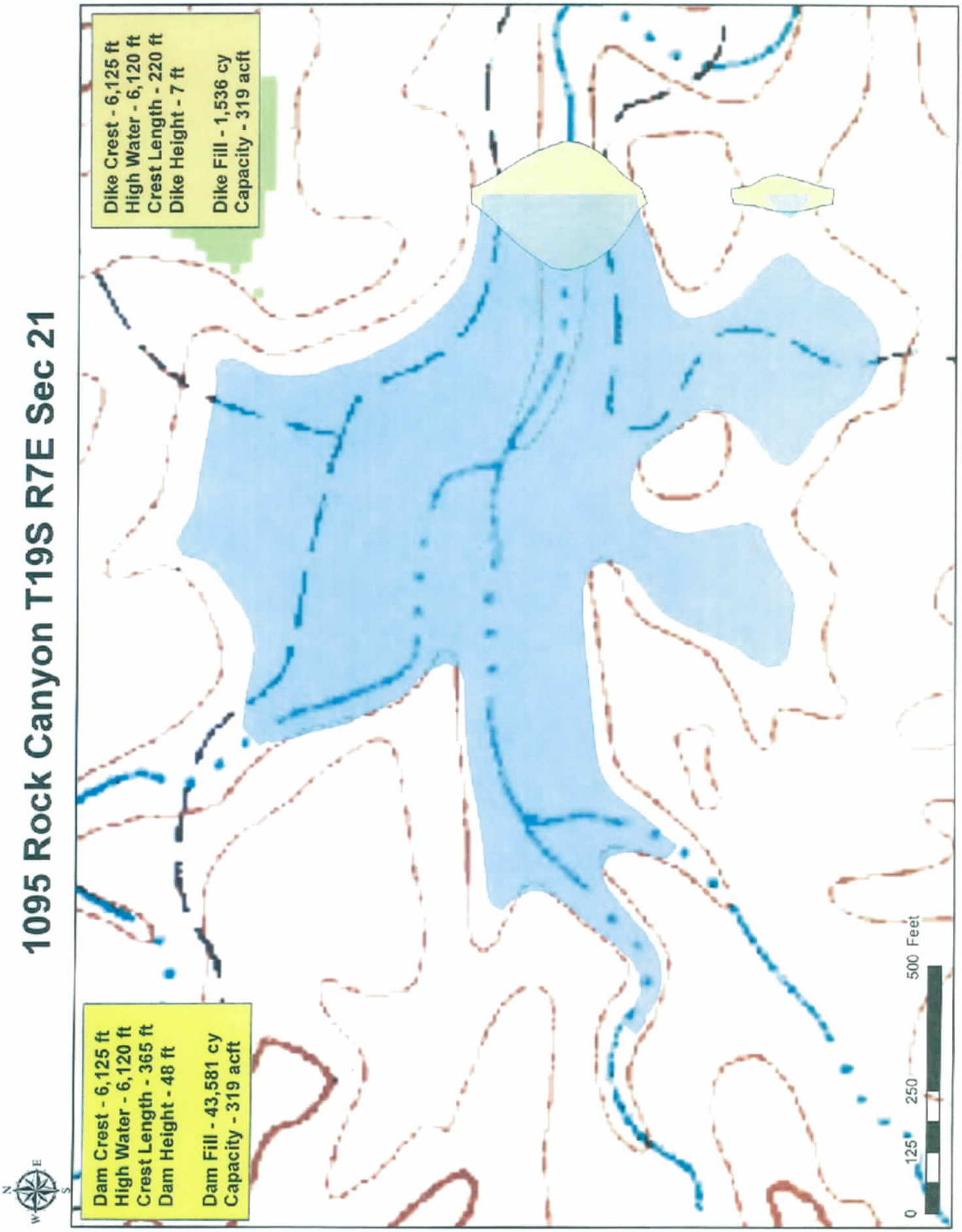
Rating Factor: (embankment volume/reservoir capacity) 141.4 cu.yds./ac.ft.

Geology: This damsite is located on the low eastern flank of the Wasatch Plateau, just west of Castle Valley. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam, dike, and reservoir basin are underlain by the shale and sandstone of the middle and lower units of the Ferron Sandstone Members of the Mancos Shale Formation (Witkind et. al., 1987). The sandstones are fine - to very fine-grained, medium to thick bedded, and locally massive or crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. This drainage produces water in excess of that needed to fill this reservoir, therefore special spillway design will be necessary. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. No diversion is feasible.

1095 Rock Canyon T19S R7E Sec 21



Muddy Creek 4

Location: NE¼ Sec. 21 and NW¼ Sec. 22, T21S, R6E, SLB&M. Located on Muddy Creek 3.5 miles north of Emery town.

Land Ownership: The damsite sits on a mixture of BLM, private, and USFS land. The reservoir basin also occupies a mixture of private, BLM, and USFS land.

Dam Embankment: Height: 124 ft. Length: 925 ft. Volume: 996,228 cu.yds.
Crest Elev.: 6,505 ft. asl.

Reservoir: High Water Elev.: 6,500 ft. asl. Capacity: 6,664 ac.ft.

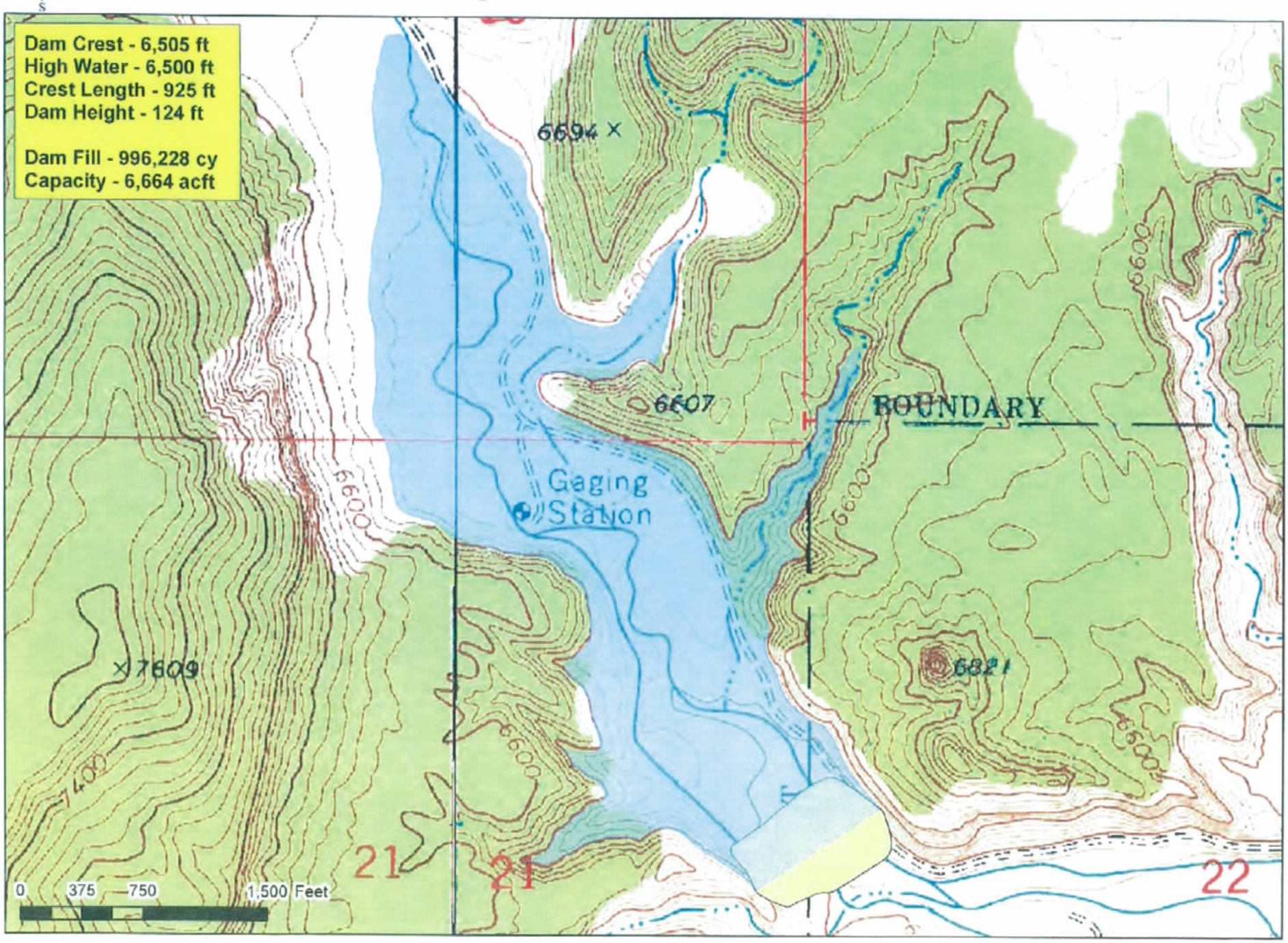
Rating Factor: (embankment volume/reservoir capacity) 149.5 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flanks of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The damsite and reservoir basin are located in the pale blue-grey shale and nodular, irregular bedded mudstone and siltstone of the Blue Gate Member and overlying yellow-grey, friable, fine - to medium-grained sandstone of the Emery Sandstone Member both of the Mancos Shale Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. Nearby north trending normal faults may increase the fracture density at the site. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site may need to be improved. Sedimentation rates could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1045 Muddy Creek 4 T22S R6E Sec 21



Johnny Jensen

Location: SW¼ Sec 9, T17S, R8E, SLC B/M; off channel site south of Huntington Creek about 3.5 miles northwest of Huntington, Utah.

Land Ownership: Dam lies on both private and SITLA land; reservoir wholly within SITLA land.

Dam Embankment: Height: 118 ft.: Length: 825 ft.: Vol. 635,560 cu. yds.: Crest El.: 6,115

Reservoir: High Water El.: 6,110: Capacity: 3,814 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 166.6

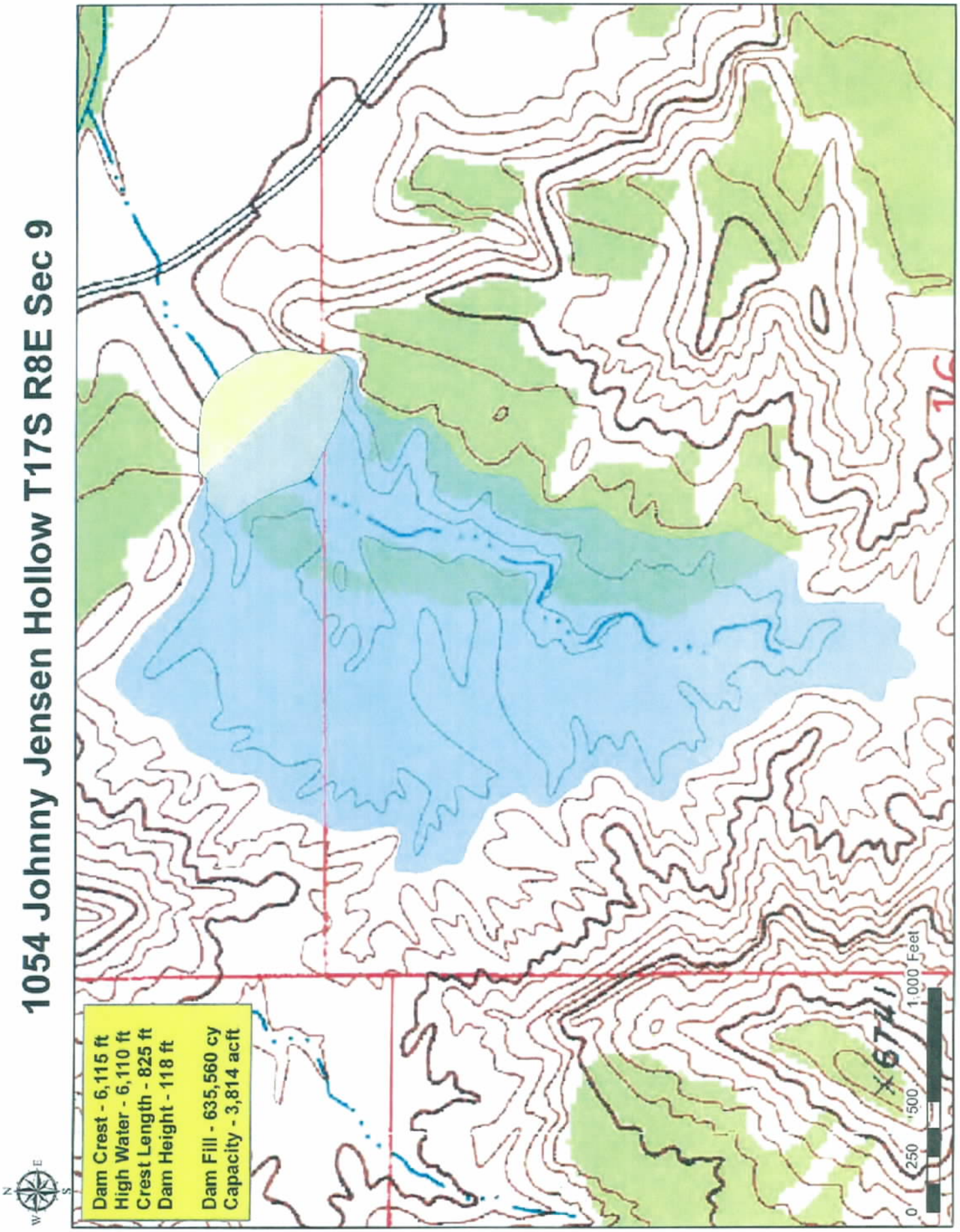
Geology: Setting is within lower reach of the Huntington Creek watershed as it exits the Wasatch Plateau near Huntington, Utah. Dam foundation and reservoir will lie upon rock mapped as Blue Gate Member of Mancos Shale Formation through the center section and lower unit of the Emery Sandstone Member within the abutments. As described by Witkind et. al. (1987), Blue Gate Member comprises dark grey shale and thinly bedded siltstone with some thin interlayers of sandstone. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. Feasibility report on Johnny Jensen site by RB&G (2003) indicates Blue Gate Member at site location consists of grey and muddy siltstones. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement although none were identified in the feasibility report (RB&G, 2003). At depth, rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. Lower unit of Emery Sandstone Member is described as consisting of light brown, thin to medium bedded, very fine to fine-grained quartzose sandstone (Witkind, et. al., 1987). Rock is moderately hard and ledge-forming creating several prominent mesa tops in the vicinity of the dam site. The RB&G feasibility report notes the ridges on both abutments are capped by a yellow brown to grey fine-grained sandstone with interbedded siltstone of the Lower Emery Member. At least 30 feet of alluvium (silt and fine-grained sand) was reported from test holes drilled by RB&G (2003) within the center section of the dam. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels, resistant sandstone layers of the lower unit of the Emery Sandstone Member of the Mancos Shale Formation, or both. Pediment gravels will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, and cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of mass wasting. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of

excavation, other foundation treatment may be needed through the center section such as slurry trench or RCC, etc.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Huntington Creek. Angle drill holes should be specified to investigate joint density, orientation, and permeability. Site access will need to be improved. Site has also been drilled and investigation has been completed.

1054 Johnny Jensen Hollow T17S R8E Sec 9



Quitchipah Creek

Location: SW¼ Sec. 15, and SE¼ Sec. 16, T22S, R5E, SLB&M. Located on Quitchipah Creek approximately 500 feet downstream of its confluence with North Fork.

Land Ownership: The damsite is located on BLM and SITLA land. The reservoir basin occupies a mixture of SITLA, BLM, and private land.

Dam Embankment: Height: 225 ft. Length: 1,765 ft. Volume: 4,080,340 cu.yds.
Crest Elev.: 6,605 ft. asl.

Reservoir: High Water Elev.: 6,500 ft. asl. Capacity: 21,642 ac.ft.

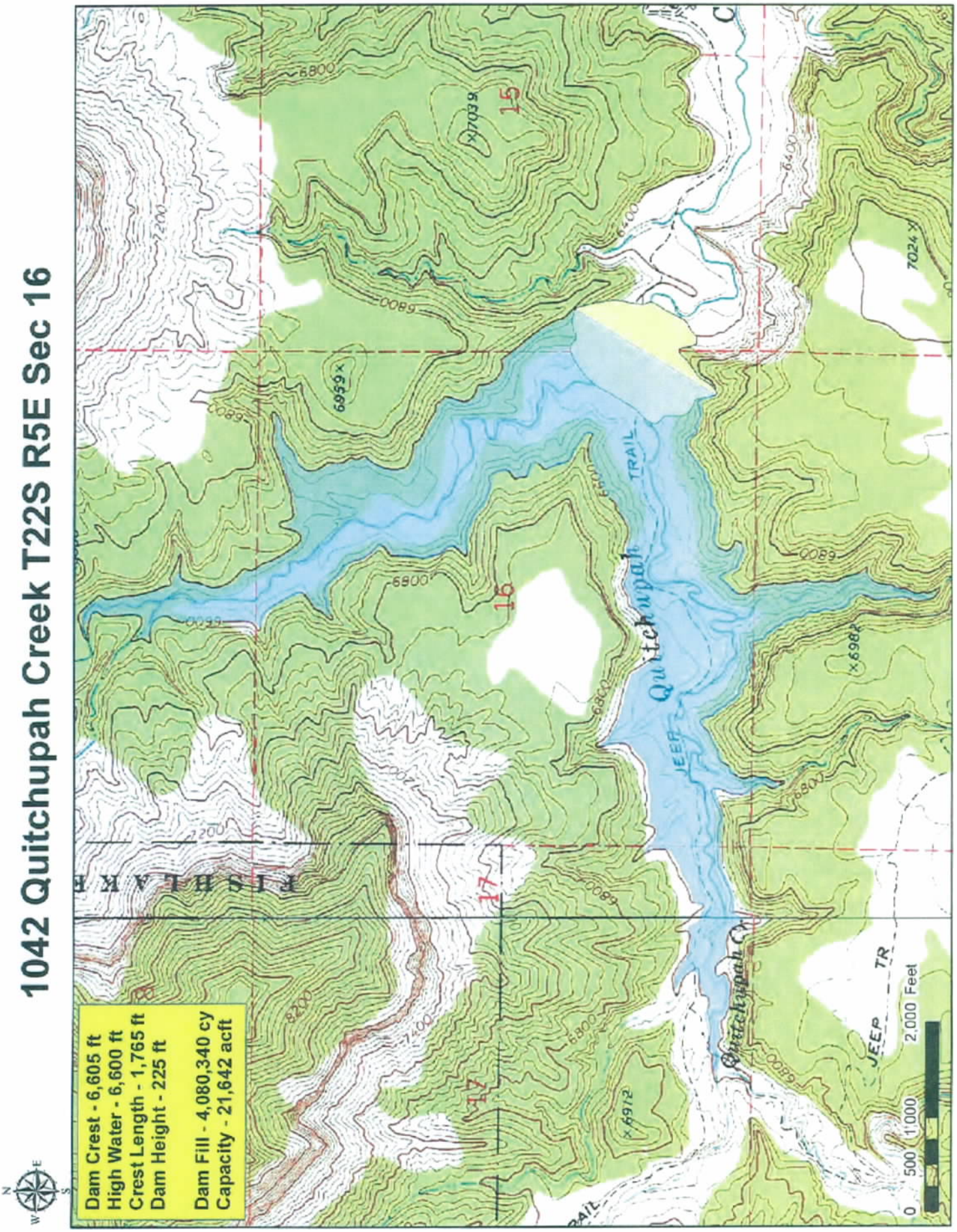
Rating Factor: (embankment volume/reservoir capacity) 188.5 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flank of the Old Woman Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The abutments and foundation at this site are in the yellow-grey, fine - to medium-grained, cliff and ledge forming, and friable sandstone of the Emery Sandstone Member of the Mancos Shale Formation. Minor interbeds of grey sandy shale are also located within the Emery Sandstone Member. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. An unknown thickness of alluvium is located in the stream channel.

Foundation Design Considerations: The bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it might slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rates could be high at this location. This site could host a storage facility that greatly exceeds the amount of water this drainage produces. Thus a smaller facility will be cited to match average annual water supply. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Spillway will likely have to be designed to go over the dam. The size of the dam (embankment volume) and reservoir storage at this site was downsized to conform to available water supply. See Section 4 for the revised map and text which reflects this change.

1042 Quitchupah Creek T22S R5E Sec 16



Lower Ferron I

Location: SW¼ Sec 2, T20S, R6E, SLB&M; off channel site north of Ferron Creek immediately upstream of Millsite Reservoir 5 miles west of Ferron, UT.

Land Ownership: Dam and reservoir both lie on SITLA land.

Dam Embankment: Height: 88 ft.: Length: 1,625 ft.: Vol. 502,787 cu. yds.: Crest El.: 6,325

Reservoir: High Water El.: 6,320: Capacity: 2,160 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 232.7

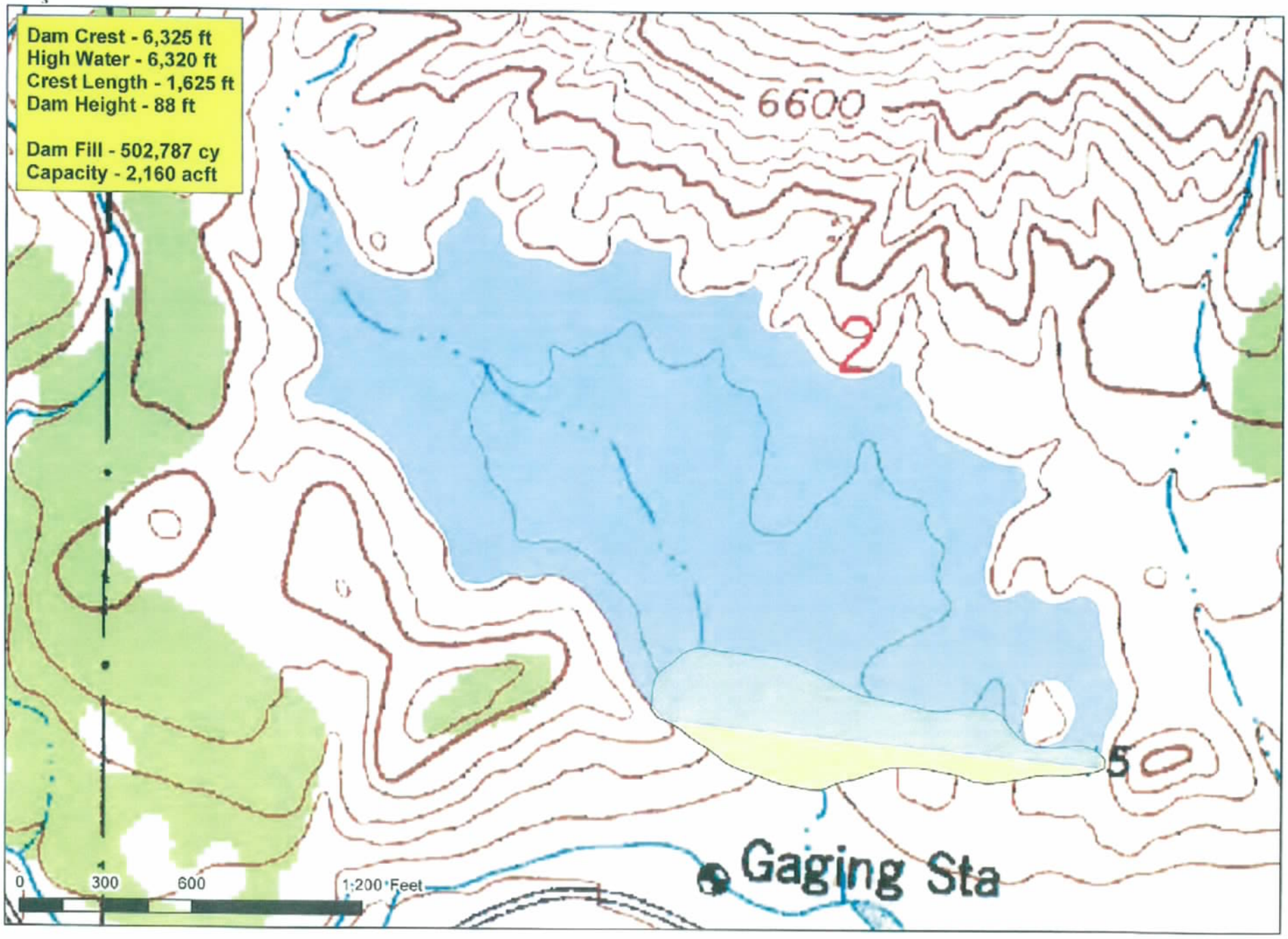
Geology: Setting is within lower reach of the Ferron Creek watershed as it exits the Wasatch Plateau before discharging into Castle Valley. Dam foundation and reservoir will lie upon rock mapped as Masuk Member of Mancos Shale Formation. As described by Witkind et. al. (1987), Masuk Member comprises light to dark grey shale and thinly bedded shaly siltstone with few thin interlayers of brown sandstone and sparse discontinuous layers of siliceous shale. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement. At depth, rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Masuk member. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels, resistant sandstone layers of the upper unit of the Emery Sandstone Member of the Mancos Shale Formation, or both. Pediment gravels will consist of crudely layered to massive fluvial deposits composed of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines. Sandstone layers comprising the upper unit of the Emery Sandstone Member will be bedded to massive, moderately hard, and ledge forming. These will likely lie above crest elevation of the dam.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of the damsite should be carefully observed for evidence of landslides or other forms of mass movement. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Alluvium and weathered bedrock should provide an ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate

could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek. Site access will need to be improved.

1058 Lower Ferron (I) T20S R6E Sec 2



Emery South

Location: SW¼ Sec. 25, T22S, R6E, SLB&M. Located on an unnamed tributary to Muddy Creek, east of Miller Canyon.

Land Ownership: Both the damsite and reservoir basin are located on BLM land.

Dam Embankment: Height: 303 ft. Length: 1,165 ft. Volume: 4,974,420 cu.yds.
Crest Elev.: 6,205 ft. asl.

Reservoir: High Water Elev.: 6,200 ft. asl. Capacity: 20,536 ac.ft.

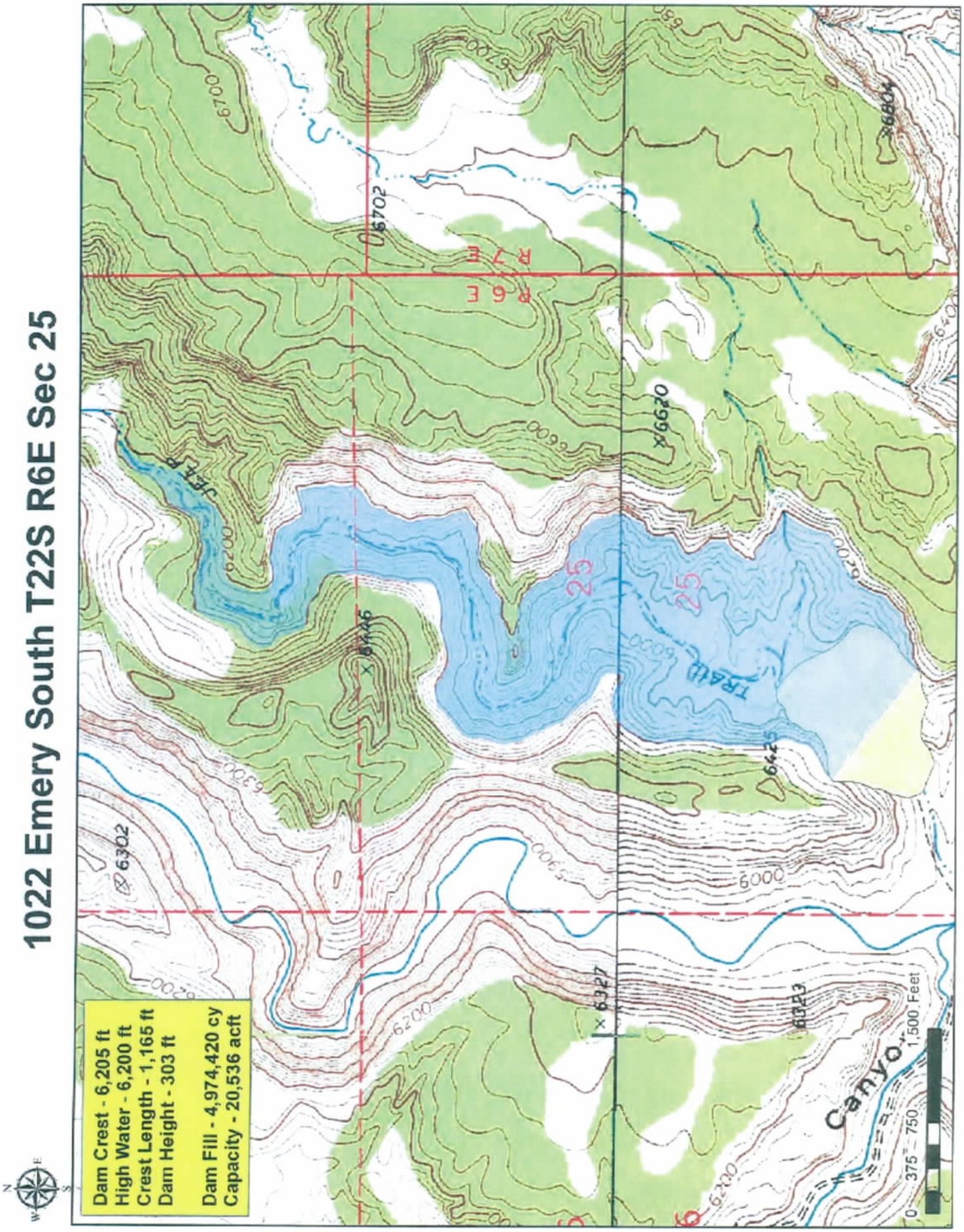
Rating Factor: (embankment volume/reservoir capacity) 242.2 cu.yds./ac.ft.

Geology: This proposed damsite is located in Castle Valley, between the San Rafael Swell to the east and the Wasatch Plateau to the west. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The damsite and reservoir basin are in the medium to dark-grey shale of the Tununk Member of the Mancos Shale Formation. The right abutment is mapped as a landslide. On steep slopes, these materials may be susceptible to further development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location and water for storage will have to be imported via a diversion structure, on Muddy Creek, and transmission pipeline. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1022 Emery South T22S R6E Sec 25



Otteson Hollow

Location: SE¼ 10, T17S, R8E, SLB&M; off channel site north of Huntington Creek about 3 miles northwest of Huntington, UT.

Land Ownership: Dam and reservoir will both lie on SITLA land.

Dam Embankment: Height: 68 ft.: Length: 1,300 ft.: Vol. 358,001 cu. yds.: Crest El.: 6,045

Reservoir: High Water El.: 6,040: Capacity: 1,223 acre-ft.

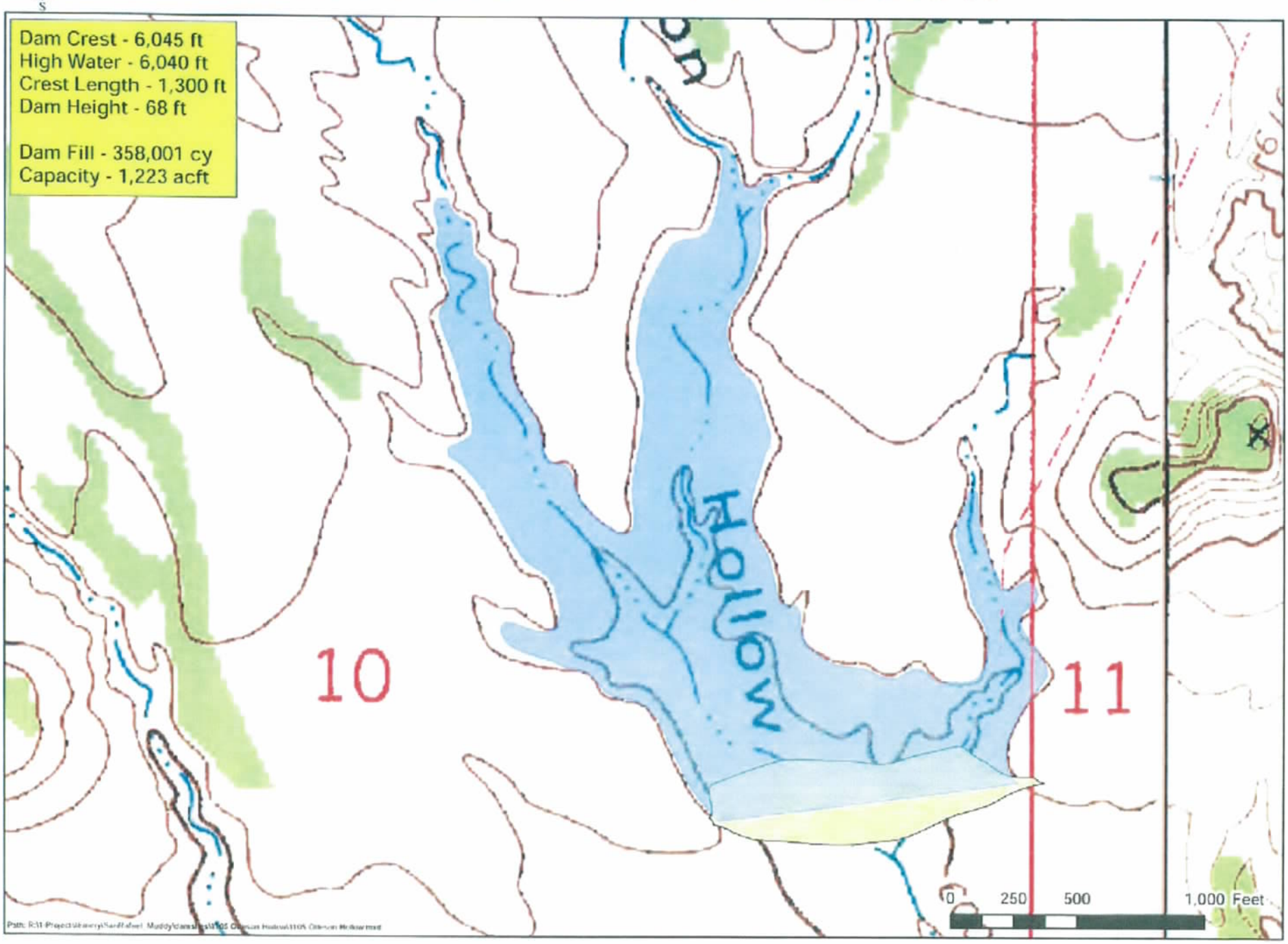
Rating Factor (embankment volume/reservoir capacity): 292.7

Geology: Setting is within lower reach of the Huntington Creek watershed as it exits the Wasatch Plateau before discharging into Castle Valley near Huntington, Utah. Dam foundation and reservoir will lie upon rock mapped as Blue Gate Member of Mancos Shale Formation with possible presence of alluvial soils through the center section. As described by Witkind et. al. (1987), Blue Gate Member comprises dark grey shale and thinly bedded siltstone with some thin interlayers of sandstone. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. At depth, rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Blue Gate member. Ridgelines above abutments are capped with late Tertiary/Quaternary pediment gravels composed of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of mass movement. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed, this may prove to be a fatal flaw, as diversion sites are so far distant. Current site access is through an operating gravel pit. Other access will need to be constructed.

1105 Otteson Hollow T17S R8E Sec 10



Morris Bend

Location: SE¼ Sec. 22, T21S, R6E. SLB&M. This is an off-stream site. Water delivery is by diversion from the Emery Canal.

Land Ownership: The damsite is located on private land. The reservoir basin is located mostly on private land and on some land administered by the BLM.

Dam Embankment: Height: 123 ft. Length: 1,060 ft. Volume: 990,047 cu.yds.
Crest Elev.: 6,465 ft. asl.

Reservoir: High Water Elev.: 6,460 ft. asl. Capacity: 1,841 ac.ft.

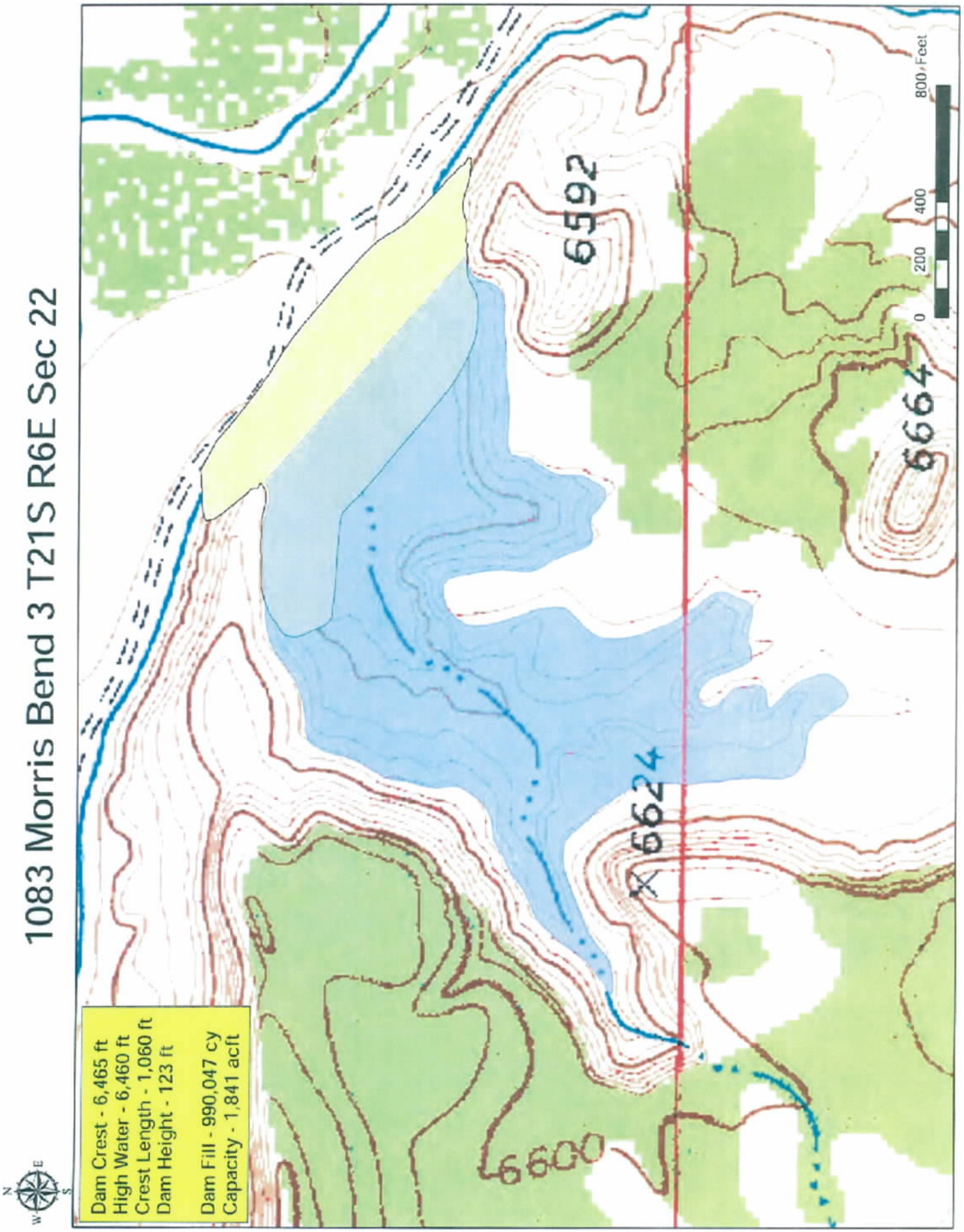
Rating Factor: (embankment volume/reservoir capacity) 537.7 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flank of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The damsite and reservoir basin are located in the pale blue-grey shale and nodular, irregular bedded mudstone and siltstone of the Blue Gate Member and overlying yellow-grey, friable, fine - to medium-grained sandstone of the Emery Sandstone Member both of the Mancos Shale Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. Nearby north trending normal faults may increase the fracture density at the site. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location and water for storage will have to be imported via a diversion structure, on Muddy Creek, and transmission pipeline or canal. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1083 Morris Bend 3 T21S R6E Sec 22



Lower Ferron H

Location: NW¼ Sec. 7, T20S, R7E, SLB&M. This site is located at the mouth of Diversion Hollow, immediately downstream of the right abutment of Millsite Dam. There is a small water retention facility or debris basin at the site.

Land Ownership: The dam and reservoir basin are located on a mixture of BLM and private land.

Dam Embankment: Height: 90 ft. Length: 1,295 ft. Volume: 692,928 cu.yds.
Dike Embankment: Height: 90 ft. Length: 590 ft. Volume: 258,313 cu.yds.
Crest Elev.: 6,205 ft. asl.

Reservoir: High Water Elev.: 6,200 ft. asl. Capacity: 2,680 ac.ft.

Rating Factor: (embankment volume/reservoir capacity) 354.9 cu.yds./ac.ft.

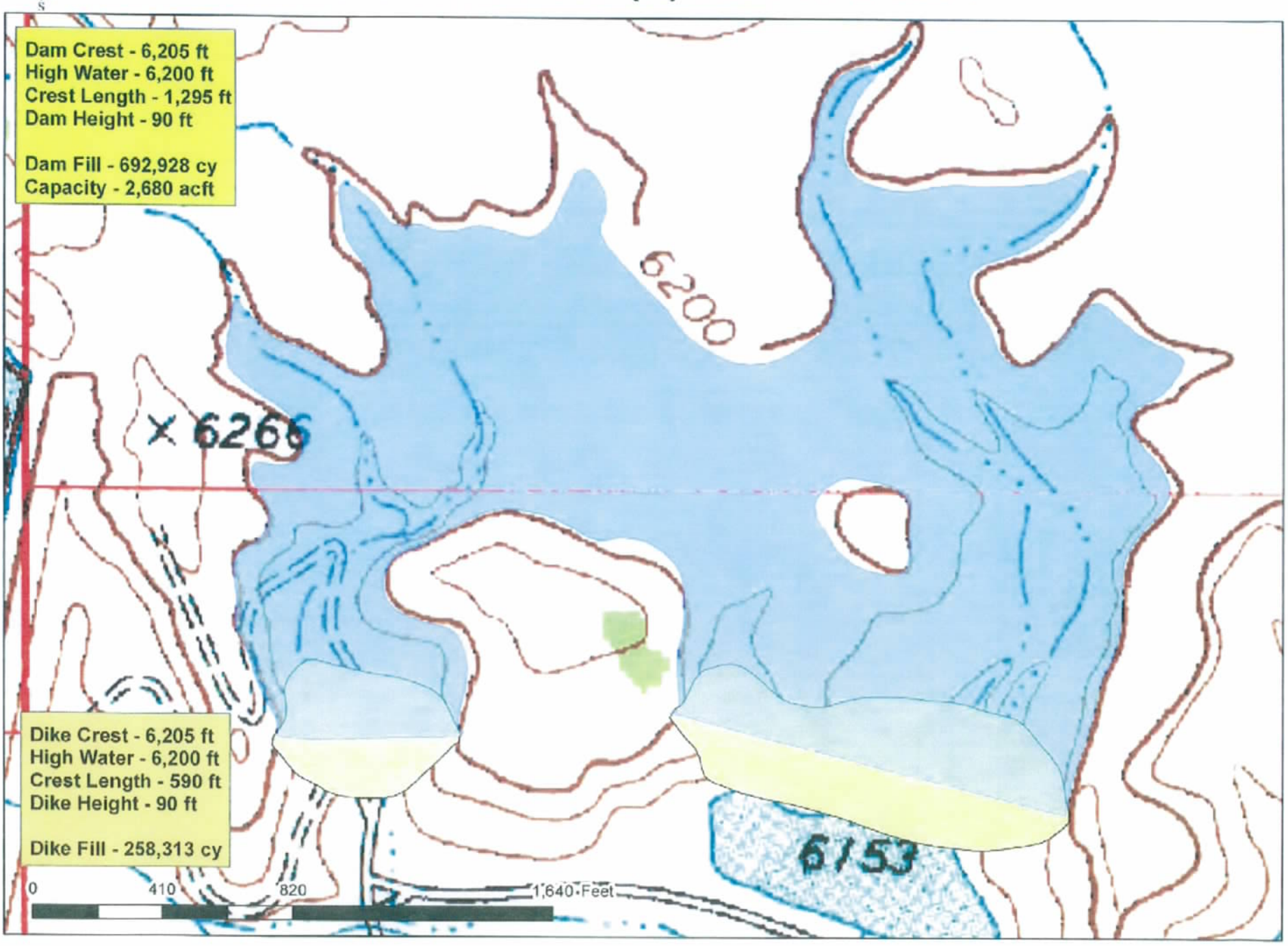
Geology: This damsite is located near the mouth of Ferron Canyon just below and southeast of South Horn Mountain. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam, dike, and reservoir basin are located in lower unit, cliff-forming sandstone of the Emery Sandstone Member and in shale and shaly siltstone of the Blue Gate member of the Mancos Shale Formation. The sandstones are fine - to very fine-grained, medium to thick bedded, and locally massive or crossbedded. The shale is fissile, silty and carbonaceous, and thin to medium bedded. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: This site has good access. Sedimentation rate is not expected to be high at this location and water for storage will have to be imported. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be

hauled in. Diversion structure and transmission facilities will need to be constructed.

1060 Lower Ferron (H) T20S R7E Sec 7



Lower Ferron K

Location: SW¼ Sec 2, T20S, R6E, SLB&M; off channel site south of Ferron Creek immediately downstream of Millsite Reservoir off the right abutment about 4 miles west of Ferron, UT.

Land Ownership: Dam lies on both private and BLM land; reservoir wholly within BLM land.

Dam Embankment: Height: 132 ft.: Length: 1,165 ft.: Vol. 911,931 cu. yds.: Crest El.: 6,285
Dike Embankment: Height: 83 ft.: Length: 1,195 ft.: Vol. 411,606 cu. yds.: Crest El.: 6,285

Reservoir: High Water El.: 6,280: Capacity: 3,639 acre-ft.

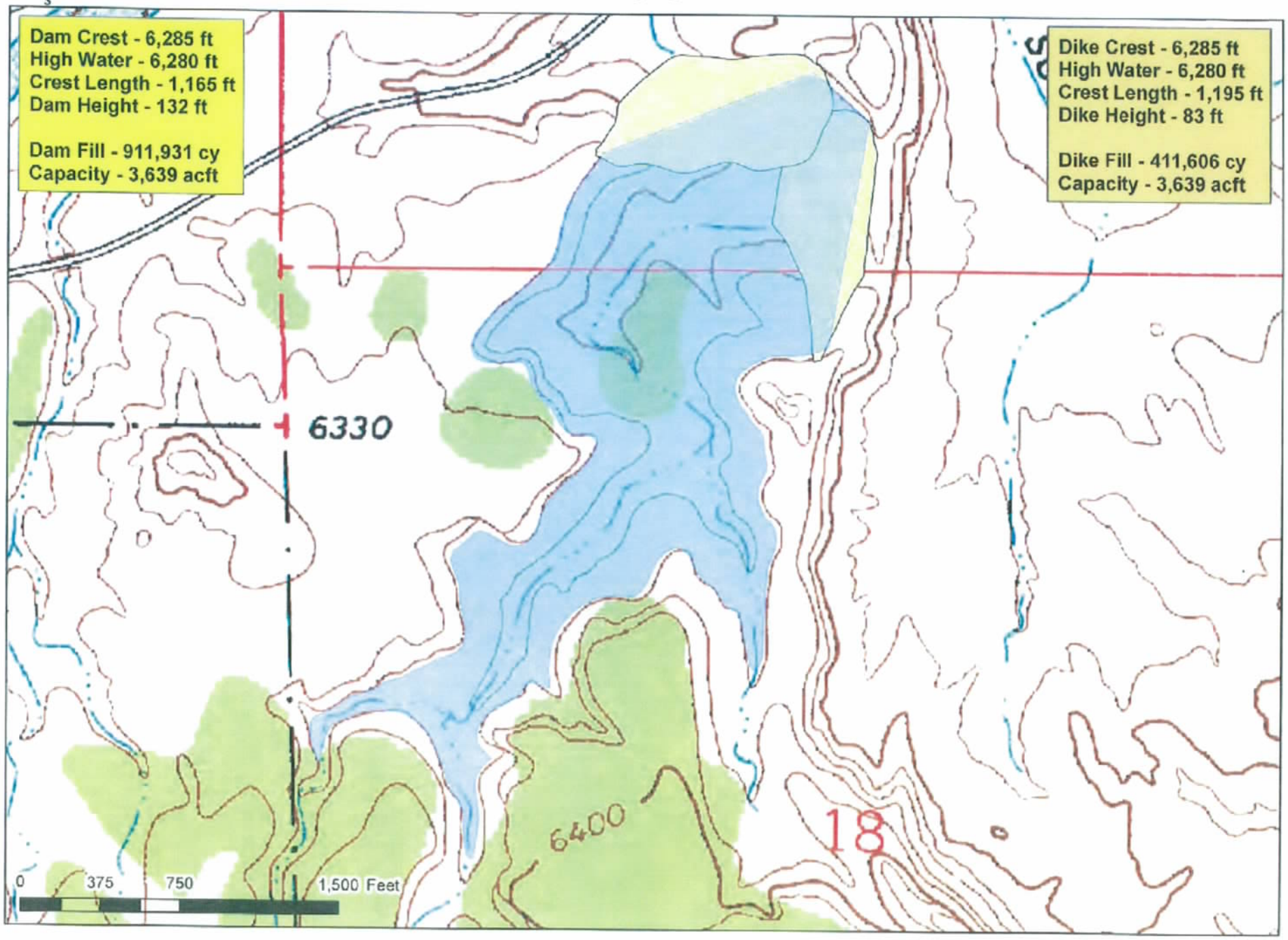
Rating Factor (embankment volume/reservoir capacity): 363.7

Geology: Setting is within lower reach of the Ferron Creek watershed as it exits the Wasatch Plateau before discharging into Castle Valley to the east. Dam foundation and reservoir will lie upon rock mapped as Blue Gate Member of Mancos Shale Formation through the center section and lower unit of the Emery Sandstone Member within the abutments. As described by Witkind et. al. (1987), Blue Gate Member comprises dark grey shale and thinly bedded siltstone with some thin interlayers of sandstone also present. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. At depth, rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Lower unit of Emery Sandstone Member is described as consisting of light brown, thin to medium bedded, very fine - to fine-grained quartzose sandstone (Witkind, 1987). Rock is moderately hard and ledge-forming creating several prominent mesa tops in the vicinity of the dam site. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Blue Gate member. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels, resistant sandstone layers of the lower unit of the Emery Sandstone Member of the Mancos Shale Formation, or both. Pediment gravels will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of mass movement. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Site access will need to be improved. Angle drill holes should be specified to define joint density, orientation, and permeability. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek.

1072 Lower Ferron (K) T20S R7E Sec 7



Lower Ferron G

Location: SW¼ Sec. 5 and NE¼ Sec. 7, T20S, R7E, SLB&M. This is an off-stream site located just east of Lower Ferron H proposed damsite.

Land Ownership: The dam and reservoir basin are located on a mixture of private and BLM land.

Dam Embankment: Height: 113 ft. Length: 960 ft. Volume: 639,554 cu.yds.
Crest Elev.: 6,205 ft. asl.

Reservoir: High Water Elev.: 6,200 ft. asl. Capacity: 1,718 ac.ft.

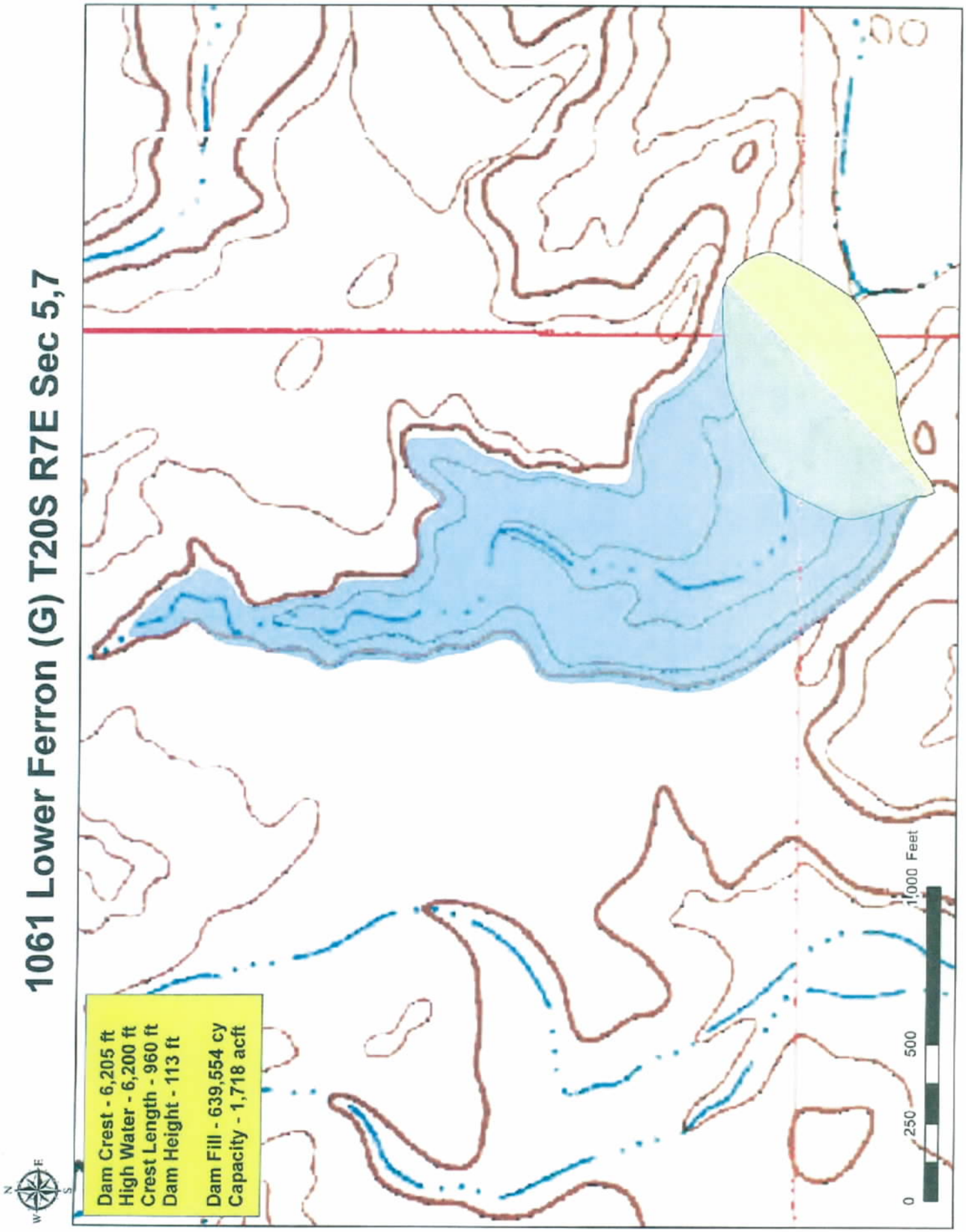
Rating Factor: (embankment volume/reservoir capacity) 372.3 cy.yds./ac.ft.

Geology: This damsite is located near the mouth of Ferron Canyon just below and southeast of South Horn Mountain. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam and reservoir basin are located on grey shale and shaley siltstone of the Blue Gate Member of the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to this site may need to be improved. Sedimentation rate is not anticipated to be high at this location and water for storage will have to be imported from Millsite Reservoir. Angle drill holes should be required to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed.

1061 Lower Ferron (G) T20S R7E Sec 5,7



Fish Creek

Location: SW¼ Sec 5, T17S, R8E, SLB&M; off channel site near the mouth of Huntington Creek about 5 miles northwest of Huntington, UT.

Land Ownership: Dam and reservoir will lie wholly within SITLA land.

Dam Embankment: Height: 91 ft.: Length: 820 ft.: Vol. 311,050 cu. yds.: Crest El.: 6,365

Reservoir: High Water El.: 6,360: Capacity: 635 acre-ft.

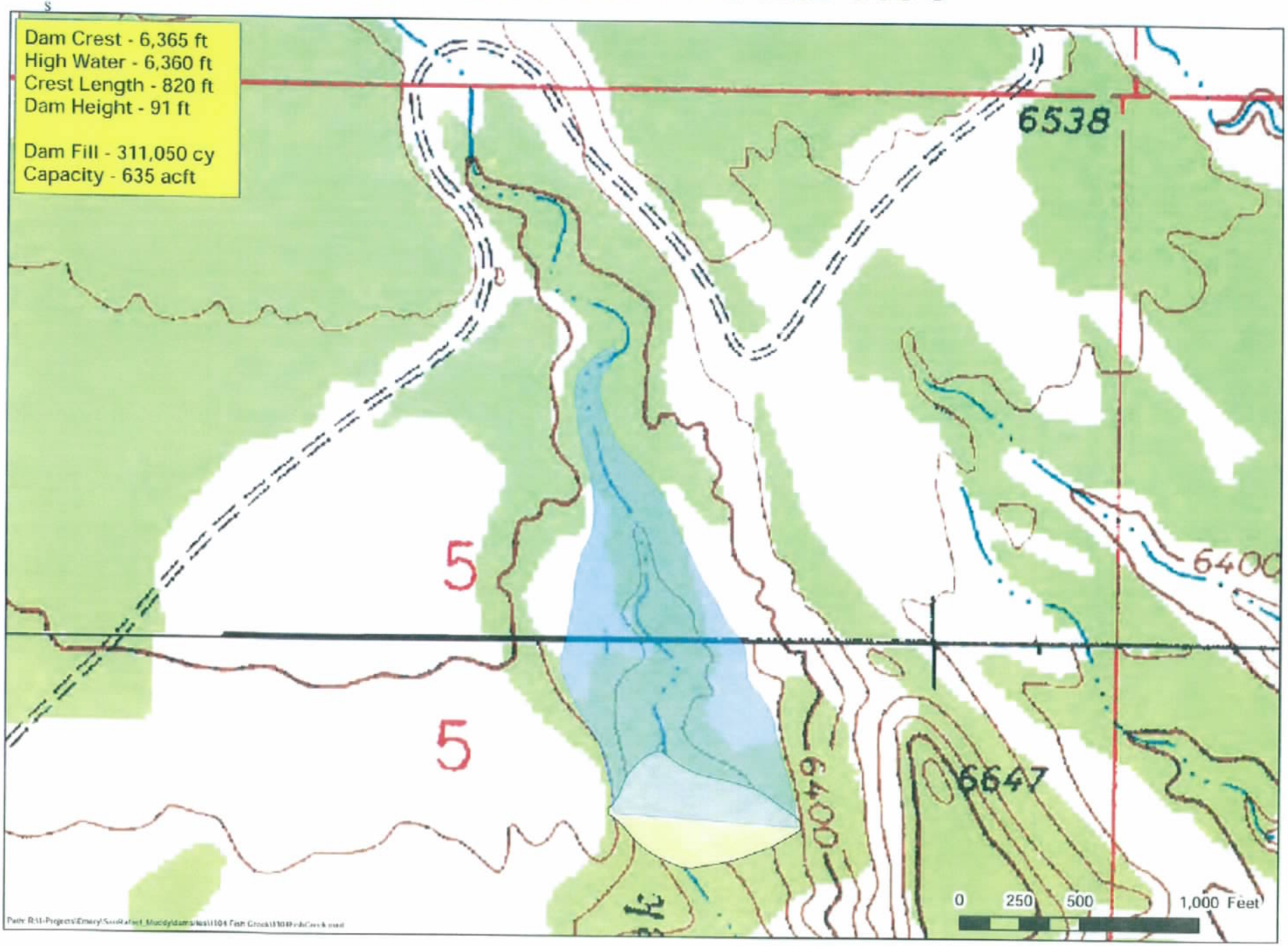
Rating Factor (embankment volume/reservoir capacity): 489.8

Geology: Setting is within lower reach of the Huntington Creek watershed as it exits the Wasatch Plateau before discharging into Castle Valley near Huntington, Utah. Dam foundation and reservoir will lie upon rock mapped as Masuk Member of Mancos Shale Formation. As described by Witkind et. al. (1987), Masuk Member comprises light to dark grey shale and thinly bedded shaly siltstone with few thin interlayers of brown sandstone and sparse discontinuous layers of siliceous shale. Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. At depth, rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Masuk member. Ridgelines above abutments are capped with late Tertiary/Quaternary pediment gravels composed of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Sloping terrain in the vicinity of dam should be carefully observed for evidence of landslides or other forms of mass movement. Potential deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed.

1104 Fish Creek T17S R8E Sec 5



Lower Ferron F

Location: Sw¼ Sec. 5, T20S, R7E, SLB&M. This is an off-stream site located just east of Lower Ferron G proposed damsite.

Land Ownership: Both the dam and reservoir basin are located on BLM land.

Dam Embankment: Height: 135 ft. Length: 1,145 ft. Volume: 1,088,400 cu.yds.
Crest Elev.: 6,255 ft. asl.

Reservoir: High Water Elev.: 6,250 ft. asl. Capacity 1,876 ac.ft.

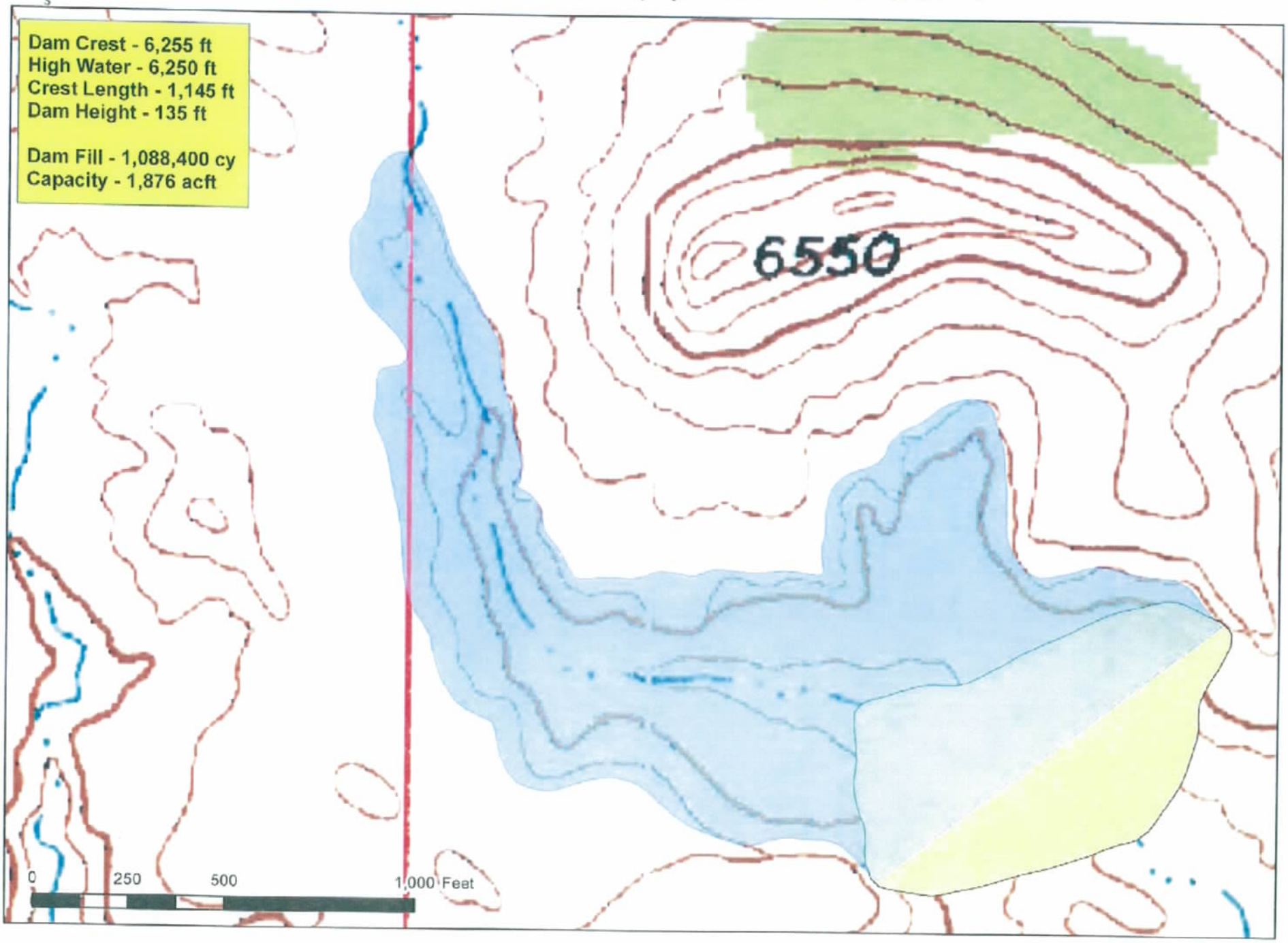
Rating Factor: (embankment volume/reservoir capacity) 580.2 cu.yds./ac.ft.

Geology: This damsite is located near the mouth of Ferron Canyon just below and southeast of South Horn Mountain. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam, dike, and reservoir basin are located on grey shale and shaley siltstone of the Blue Gate Member of the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry, RCC, etc.

Other Considerations: Access to the site will need to be improved. The sedimentation rate is not anticipated to be high at this location. Water for storage will have to be imported from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed.

1062 Lower Ferron (F) T20S R7E Sec 5



Miller Flat Dam Enlargement

Location: SW¼ Sec 3, T15S, R6E, SLB&M; small existing reservoir on Miller Flat Creek in upper watershed of Huntington Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: 73 ft., Length: 835 ft., Crest El.: 8,475 ft.
Embankment with 25 ft. raise: Length: 2,070 ft., Add. Vol. 242,680 cu. yds., New crest El.: 8,495 ft.

Existing Reservoir: High Water El.: 8,470 ft., Existing capacity: 5,250 acre-ft.
Reservoir 25 ft. raise: High Water El.: 8,495 ft., New capacity: 9,426 acre-ft., Add. capacity: 4,176 acre-ft.

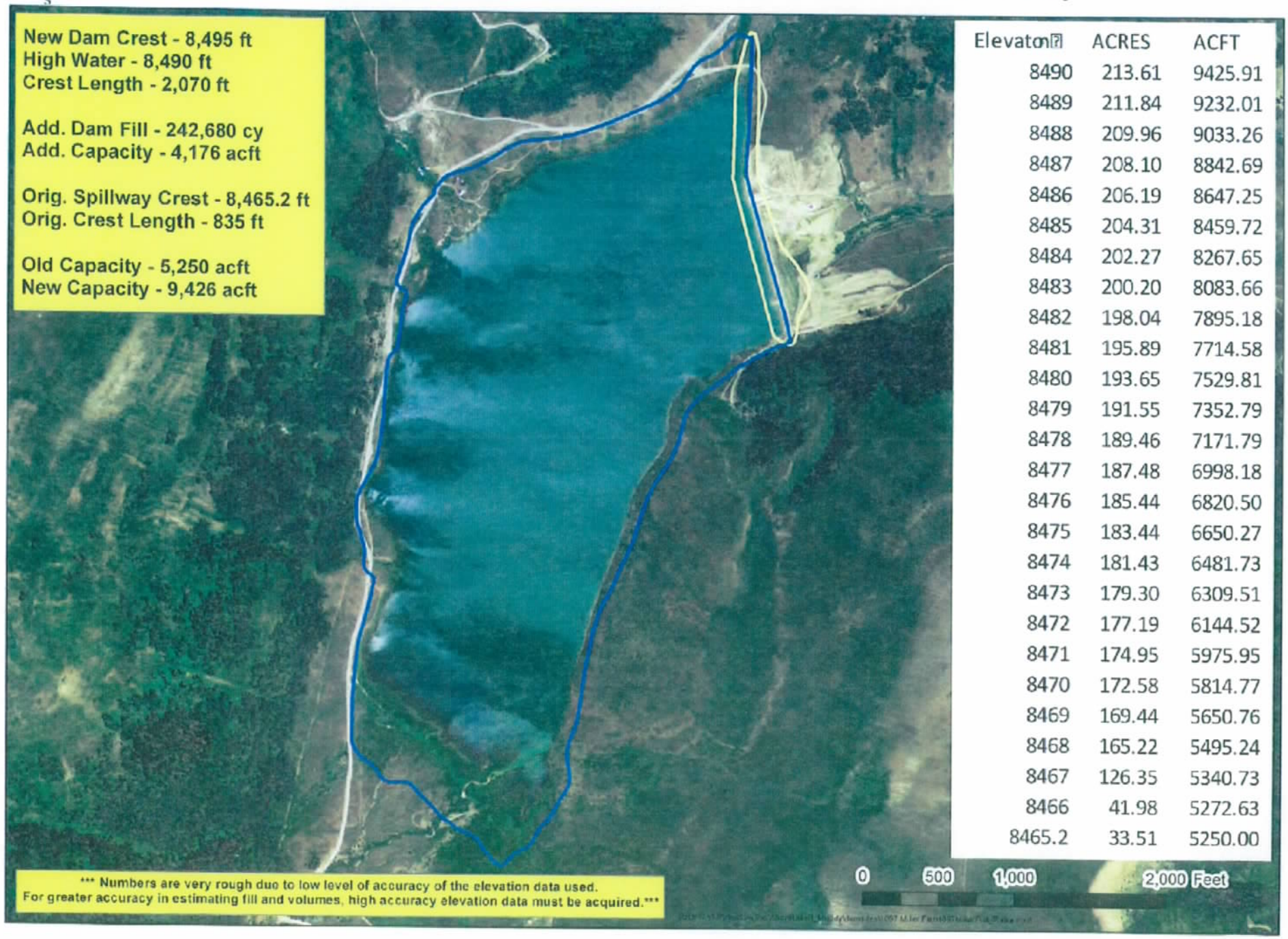
Rating Factor-25 ft. raise (embankment volume/reservoir capacity): 58.1 cu.yds./ac.ft.

Geology: Setting is within Huntington Creek watershed on Miller Flat Creek at high elevation about 3 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within broad valley underlain by surficial deposits of colluvium derived from weathering of nearby exposures of North Horn and Price River Formations (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of mass-wasting throughout the Wasatch Plateau. They are typically deeply weathered, are unstable on over-steepened slopes and may be subject to slow movement. By contrast, Price River Formation consists of grey to light grey, thin to thick bedded, locally massive, typically well cemented conglomerate, conglomeratic sandstone and sandstone that is comparatively indurated and stable. Price River Formation is mapped above and downstream of both abutments. North Horn Formation is found around the upstream perimeter of the reservoir. The dam and reservoir lie with one of the many fault bounded grabens that characterize the high country of the Wasatch Plateau. Some of these faults may exhibit evidence of late Quaternary activity and will deserve consideration in dam enlargement.

Foundation Design Considerations: Local soil materials are derived from mass wasting and weathering of North Horn and Price River Formations and will likely consist of sandy clay soils possibly with some gravel. While these soils will provide adequate source for construction materials, in their natural setting they may be in slow movement, will be unstable if exposed on over-steepened slopes and may exhibit shrink/swell characteristics. Deep soil profile beneath the dam may be expected and may make extending a cut-off for the dam into bedrock impractical as undisturbed rock may probably lie at considerable depth beneath the existing dam.

Other Considerations: Bedrock-derived soils and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of materials adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Investigate the diversion of Staker Canyon creek to augment inflow to this reservoir. Improved access needed.

1097 Miller Flat T15S R6E Sec 3 (24.8 ft Raise)



Elevation	ACRES	ACFT
8490	213.61	9425.91
8489	211.84	9232.01
8488	209.96	9033.26
8487	208.10	8842.69
8486	206.19	8647.25
8485	204.31	8459.72
8484	202.27	8267.65
8483	200.20	8083.66
8482	198.04	7895.18
8481	195.89	7714.58
8480	193.65	7529.81
8479	191.55	7352.79
8478	189.46	7171.79
8477	187.48	6998.18
8476	185.44	6820.50
8475	183.44	6650.27
8474	181.43	6481.73
8473	179.30	6309.51
8472	177.19	6144.52
8471	174.95	5975.95
8470	172.58	5814.77
8469	169.44	5650.76
8468	165.22	5495.24
8467	126.35	5340.73
8466	41.98	5272.63
8465.2	33.51	5250.00

Henningson Dam Replacement

Location: NE¼ Sec 20, T20S, R4E, SLB&M; small existing reservoir in upper watershed of Muddy Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: 29 ft., Length: 287 ft., Crest El.: 10,014
Embankment with 21 ft. raise: Length: 960 ft., Add. Vol. 42,457 cu. yds., New crest El.: 10,035

Existing Reservoir: High Water El.: 10,009 ft., Existing capacity: 469 acre-ft.
Reservoir 21 ft. raise: High Water El.: 10,030 ft., New capacity: 834 acre-ft., Add. capacity: 365 acre-ft.

Rating Factor-20 raise (embankment volume/reservoir capacity): 116.3 cu.yds./ac.ft.

Geology: Setting is within the Muddy Creek watershed at high elevation less than a mile east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as surficial deposits derived from mass wasting of North Horn Formation and remnant glacial moraine (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of movement throughout the Wasatch Plateau. They are typically deeply weathered, unstable on over-steepened slopes, and may be subject to slow movement. More recent mapping by USG staff (personal communication, Greg McDonald, 2012), indicates that the existing dam and reservoir may lie on insitu North Horn sediments. While the North Horn formation is likely present at the dam it has not been mapped as being involved in landsliding. However, two faults have been identified forming a small graben that passes through and downstream of the dam embankment. The more prominent of the two was identified on Witkind's mapping (1987). Lineaments associated with both faults suggest they are geologically young.

Foundation Design Considerations: Local soil materials if derived from mass wasting of North Horn Formation will likely consist of sandy clay soils possibly with some gravel. These soils may be in slow movement, unstable if exposed on over-steepened slopes, and may exhibit shrink/swell characteristics. Recent mapping suggests that North Horn Formation may be exposed near surface in the vicinity of the dam so extending a cut-off for the dam into bedrock may be possible.

Other Considerations: Bedrock-derived landslide materials and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of soils adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Site access will need to be improved. A thorough investigation into the faults that pass through and downstream of the dam embankment needs to be completed before a decision to move forward is finalized. This may include a fault trench study to determine age of the fault. This dam has been breached in the past to stabilize it. Re-instatement of this dam will require the embankment to be

removed and the new dam built in its place. Laboratory testing will determine if old embankment materials can be reprocessed and used to build the new dam.

1098 Henningson T20S R4E Sec 20 (21 ft Raise)

Rolfson Reservoir Enlargement

Location: NW¼ Sec 33, T14S, R6E, SLB&M; small existing reservoir in upper watershed of Huntington Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: 36 ft., Length: 855 ft., Spillway Crest El.: 8,851.3 ft. Embankment with 11.7 ft. raise: Length: 1,500 ft., Add. Vol. 108,705 cu. yds., New crest El.: 8,868 ft.

Existing Reservoir: High Water El.: 8,851 ft., Existing capacity: 504 acre-ft.
Reservoir 11.7 ft. raise: High Water El.: 8,863 ft., New capacity: 1,267 acre-ft., Add. capacity: 763 acre-ft.

Rating Factor-11.7 raise (embankment volume/reservoir capacity): 142.5 cu.yds./ac.ft.

Geology: Setting is within Huntington Creek watershed at high elevation about 3 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as surficial deposits derived from mass wasting of North Horn Formation and remnant glacial moraine (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of mass-wasting throughout the Wasatch Plateau. They are typically deeply weathered, are unstable on over-steepened slopes and may be subject to slow movement. Site is located about 1.5 miles west of boundary faults of the Gooseberry graben. Some of these faults may exhibit evidence of late Quaternary activity and will deserve consideration in dam enlargement.

Foundation Design Considerations: Local soil materials are derived from mass wasting of North Horn Formation and will likely consist of sandy clay soils possibly with some gravel. While these soils will provide adequate source for construction materials, in their natural setting they may be in slow movement, will be unstable if exposed on over-steepened slopes and may exhibit shrink/swell characteristics. Extending a cut-off for the dam into bedrock will not likely be practical as undisturbed rock will probably lie at considerable depth beneath the existing dam.

Other Considerations: Bedrock-derived soils and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of materials adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic.

1096 Rolfson T14S R6E Sec 33 (11.7 ft Raise)

Elevaton FT	ACRES	Acre Feet
8863	70.92	1,267
8862	70.07	1,198
8861	69.16	1,127
8860	68.26	1,059
8859	67.31	990
8858	66.37	925
8857	65.36	858
8856	64.35	794
8855	63.24	729
8854	62.13	667
8853	61.00	605
8852	59.98	545
8851.3	59.25	504
8851	48.45	489
8850	45.99	442
8849	43.36	397
8848	40.99	355
8847	38.68	315
8846	36.35	278
8845	34.39	243
8844	32.55	209
8843	30.89	177
8842	29.33	147
8841	27.86	119
8840	26.14	92
8839	24.62	66
8838	23.19	42
8837	21.24	20
8836	19.00	0

Spinners Reservoir Enlargement

Location: SW¼ Sec 2, NW¼ Sec 11, T20S, R4E, SLB&M; small existing reservoir in upper watershed of Muddy Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: 57 ft., Length: 550 ft., Crest El.: 9,626.3
Dam Embankment with 23.7 ft. raise: Length: 1,615 ft., Add. Vol. 52,970 cu. yds., New crest El.: 9,650

Existing Reservoir: High Water El.: 9,621.3 ft., Existing capacity: 675 acre-ft.
Reservoir with raise: High Water El.: 9645 ft., New capacity: 1,041 acre-ft., Add. capacity: 366 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 144.7 cu.yds./ac.ft.

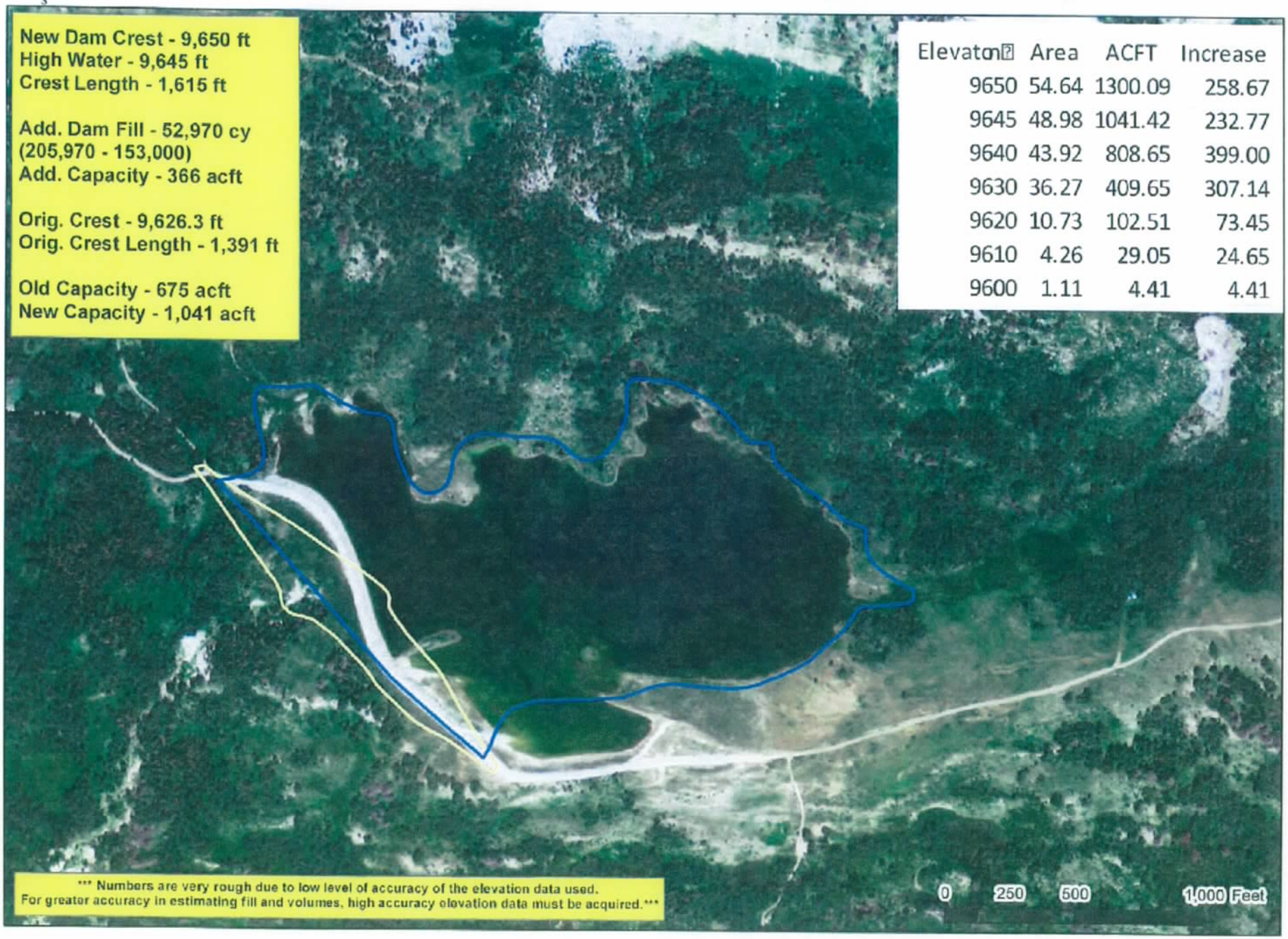
Geology: Setting is within the Muddy Creek watershed at high elevation about 3 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as surficial deposits derived from mass wasting of North Horn Formation and remnant glacial moraine (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate, and limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of movement throughout the Wasatch Plateau. More recent mapping by USG staff (personal communication, Greg McDonald, 2012) confirms that the existing dam and reservoir lie wholly within a landslide complex developed in North Horn sediments. These materials are deeply weathered, unstable on over-steepened slopes, and may be subject to slow movement.

Foundation Design Considerations: Local soil materials are derived from movement of North Horn Formation and will likely consist of sandy clay soils possibly with some gravel. While these soils will provide adequate source for construction materials, in their natural setting they may be in slow movement, unstable if exposed on over-steepened slopes, and may exhibit shrink/swell characteristics. Extending a cut-off for the dam into bedrock will not likely be practical as undisturbed rock will probably lie at considerable depth beneath the existing dam.

Other Considerations: Bedrock-derived landslide materials and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of soils adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Site access will need to be improved. Will raising the dam to increase storage also increase the amount of water that seeps into the ground? Water when added to an existing slide plain decreases the friction. Additional water in storage will also add load to the head of the slide and increase the driving force. A thorough investigation into the landslide underlying this dam and reservoir, including a slope stability analysis needs to be completed before a decision to move forward with enlargement is made. It was also concluded that the present drainage that feeds water into Spinners Reservoir is not enough to fill the reservoir. If the dam was increased in

size, water would have to be diverted to maximize the full potential of the reservoir basin. To fully utilize the storage capacity available at the site, a diversion structure will need to be built on Horse Creek and conveyance facilities constructed.

1079 Spinners T20S R4E Sec 11 (23.7 ft Raise)



Elevation	Area	ACFT	Increase
9650	54.64	1300.09	258.67
9645	48.98	1041.42	232.77
9640	43.92	808.65	399.00
9630	36.27	409.65	307.14
9620	10.73	102.51	73.45
9610	4.26	29.05	24.65
9600	1.11	4.41	4.41

Julius Flat Reservoir Enlargement

Location: Main Dam SE¼ Sec 22, T20S, R4E, SLB&M; Dike NE ¼ Sec. 27, T20S, R4E, SLB&M; small existing reservoir in upper watershed of Muddy Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam, dike, and reservoir all lie on Forest Service land.

Existing Dam Embankment: Height: 44 ft., Length: 895 ft., Crest El.: 8,872
Dam Embankment with 18 ft. raise: Length: 1,110 ft., Add. Vol. 51,260 cu. yds., New crest El.: 8,890

Existing Dike Embankment: Height: 3 ft., Length: ?, Crest Elev. 8,872
Dike Embankment with 18 ft. raise: Height: 21 ft, Length: 850 ft., Add. Vol. 12,835 cu. yds.

Existing Reservoir: High Water El.: 8,872 ft., Existing capacity: 725 acre-ft.
Reservoir 18 ft. raise: High Water El.: 8,885 ft., New capacity: 1,073 acre-ft., Add. capacity: 348 acre-ft.

Rating Factor-18 raise (embankment volume/reservoir capacity): 184.2 cu.yds./ac.ft.

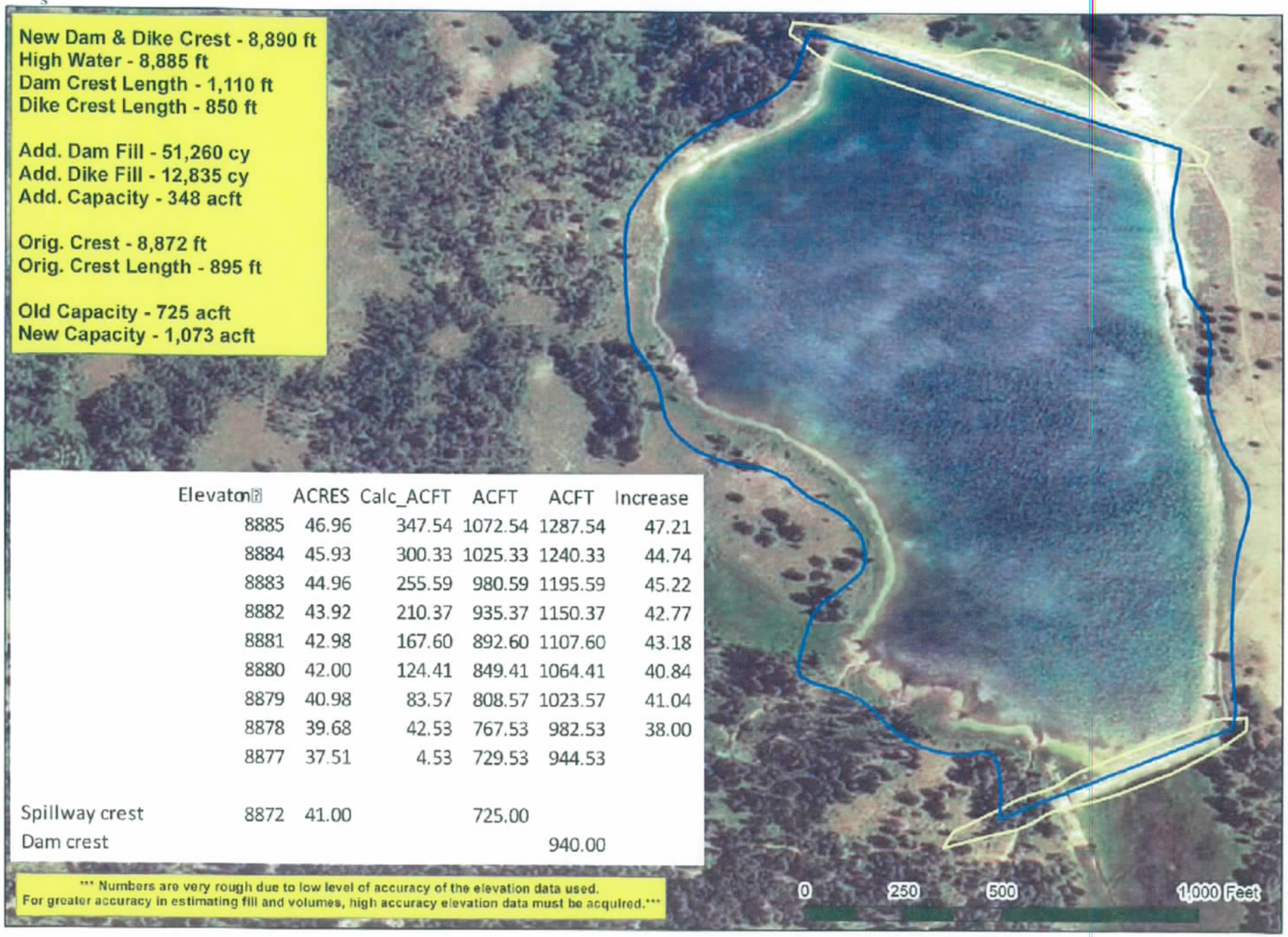
Geology: Setting is within the Muddy Creek watershed at high elevation about 3 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as North Horn Formation and remnant pediment although some mantling by remnant glacial moraine (Witkind, 1987) may also be present. North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of movement throughout the Wasatch Plateau. They are typically deeply weathered, unstable on over-steepened slopes, and may be subject to slow movement. More recent mapping by USG staff (personal communication, Greg McDonald, 2012) confirms that the existing dam and reservoir may lie on insitu North Horn sediments. However, a small fault with northward trend has been identified that passes through the right abutment of the dam embankment and the left abutment of the dike. Lineaments associated with this fault suggest it is geologically young. Most recent movement is difficult to estimate but likely pre-Holocene and may be synchronous with the end of the last glacial epoch.

Foundation Design Considerations: Local soil materials derived from North Horn Formation will likely consist of sandy clay soils possibly with some gravel. These soils may be in slow movement, will be unstable if exposed on over-steepened slopes and may exhibit shrink/swell characteristics. Recent mapping suggests that North Horn Formation may be exposed near surface in the vicinity of the dam so extending a cut-off for the dam into bedrock may be possible.

Other Considerations: Bedrock-derived soils and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of materials adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Site access will

need to be improved. A thorough investigation into the fault underlying the right abutment of the dam and left abutment of the dike needs to be completed before a decision to move forward is finalized. This may include a fault trench study to determine age of the fault.

1080 Julius T20S R4E Sec 22 (18 ft Raise)



New Dam & Dike Crest - 8,890 ft
High Water - 8,885 ft
Dam Crest Length - 1,110 ft
Dike Crest Length - 850 ft

Add. Dam Fill - 51,260 cy
Add. Dike Fill - 12,835 cy
Add. Capacity - 348 acft

Orig. Crest - 8,872 ft
Orig. Crest Length - 895 ft

Old Capacity - 725 acft
New Capacity - 1,073 acft

	Elevation	ACRES	Calc_ACFT	ACFT	ACFT	Increase
	8885	46.96	347.54	1072.54	1287.54	47.21
	8884	45.93	300.33	1025.33	1240.33	44.74
	8883	44.96	255.59	980.59	1195.59	45.22
	8882	43.92	210.37	935.37	1150.37	42.77
	8881	42.98	167.60	892.60	1107.60	43.18
	8880	42.00	124.41	849.41	1064.41	40.84
	8879	40.98	83.57	808.57	1023.57	41.04
	8878	39.68	42.53	767.53	982.53	38.00
	8877	37.51	4.53	729.53	944.53	
Spillway crest	8872	41.00		725.00		
Dam crest					940.00	

*** Numbers are very rough due to low level of accuracy of the elevation data used.
For greater accuracy in estimating fill and volumes, high accuracy elevation data must be acquired.***

Emery Reservoir Enlargement

Location: SE¼ Sec 4, T20S, R4E, SLB&M; small existing reservoir in upper watershed of Muddy Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: 25 ft., Length: 390 ft., Crest El.: 9,439 ft.
Embankment with 31 ft. raise: Length: 1,040 ft., Add. Vol. 85,143 cu. yds., New crest El.: 9,470 ft.

Existing Reservoir: High Water El.: 9,434 ft., Existing capacity: 145 acre-ft.
Reservoir 31 ft. raise: High Water El.: 9,465 ft., New capacity: 537 acre-ft., Add. capacity: 392 acre-ft.

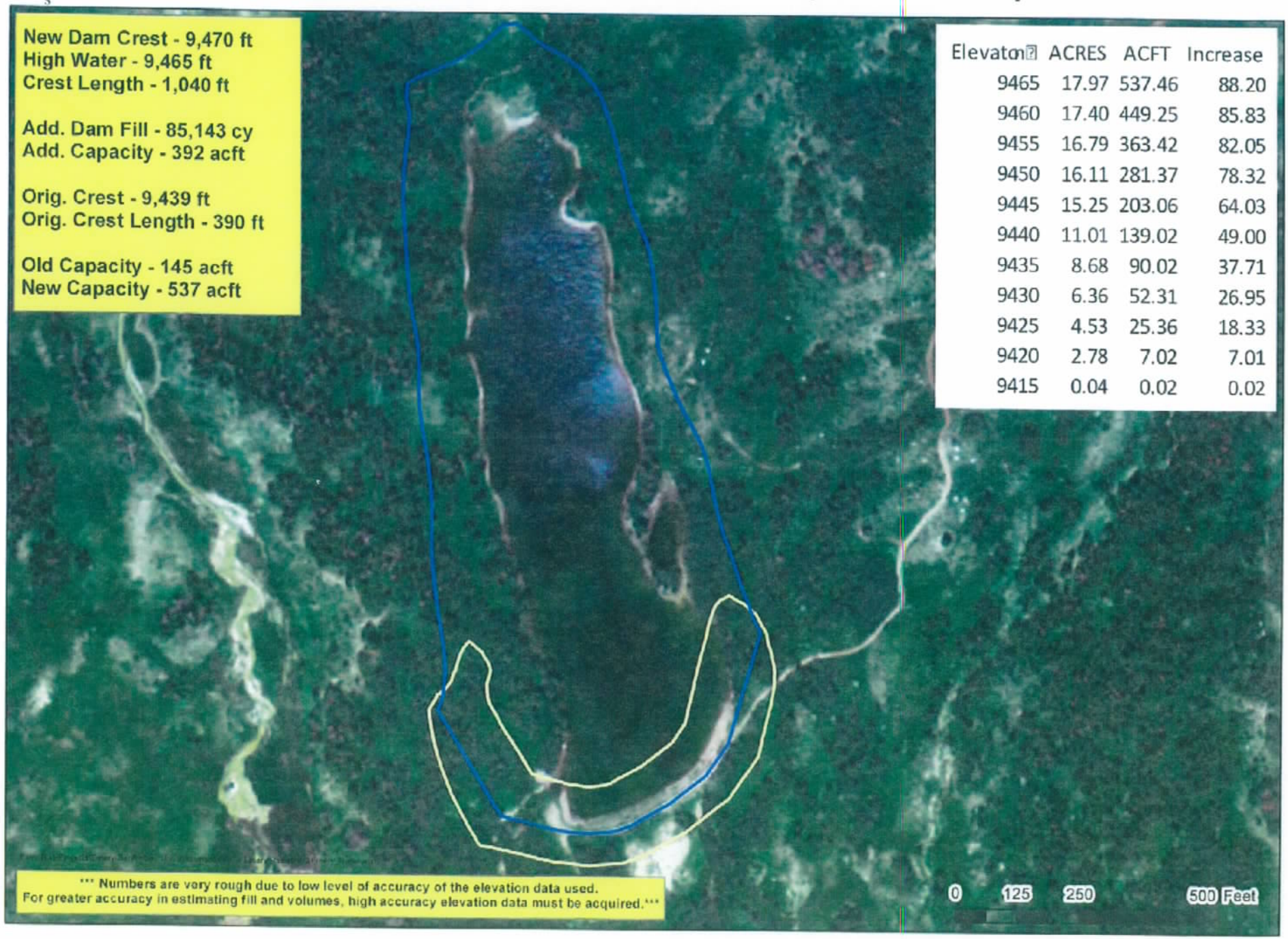
Rating Factor-31 raise (embankment volume/reservoir capacity): 217.2 cu.yds./ac.ft.

Geology: Setting is within the Muddy Creek watershed at high elevation about 1.5 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as surficial deposits derived from mass wasting of North Horn Formation and remnant glacial moraine (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of movement throughout the Wasatch Plateau. They are typically deeply weathered, unstable on over-steepened slopes, and may be subject to slow movement. More recent mapping by USG staff (personal communication, Greg McDonald, 2012) indicates that the existing dam and reservoir lies within the upper North Horn Formation. Landsliding has not been confirmed at the site but glacial deposits in the form of moraines are present on the west side of the reservoir.

Foundation Design Considerations: Local soil materials derived from North Horn Formation will likely consist of sandy clay soils and some gravel. These soils may be in slow movement, unstable if exposed on over-steepened slopes, and may exhibit shrink/swell characteristics. Recent mapping suggests that North Horn Formation may be exposed near surface in the vicinity of the dam so extending a cut-off for the dam into bedrock may be possible.

Other Considerations: Bedrock-derived soils and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of materials adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Site access also will need to be improved.

1078 Emery T20S R4E Sec 4 (31 ft Raise)



Elevation	ACRES	ACFT	Increase
9465	17.97	537.46	88.20
9460	17.40	449.25	85.83
9455	16.79	363.42	82.05
9450	16.11	281.37	78.32
9445	15.25	203.06	64.03
9440	11.01	139.02	49.00
9435	8.68	90.02	37.71
9430	6.36	52.31	26.95
9425	4.53	25.36	18.33
9420	2.78	7.02	7.01
9415	0.04	0.02	0.02

Little Madsen Reservoir Enlargement

Location: NW¼ Sec 33, T14S, R6E, SLB&M; small existing reservoir in upper watershed of Huntington Creek drainage near crest of Wasatch Plateau.

Land Ownership: Dam and reservoir both lie on Forest Service land.

Existing Dam Embankment: Height: ? ft., Length: ? ft., Crest El.: Approx 8,800 ft.
Embankment with 20 ft. raise: Length: ? ft., Add. Vol. cu. yds., New crest El.: 8,820 ft.

Existing Reservoir: High Water El.: 8,795 ft., Existing capacity: ? acre-ft.
Reservoir 20 ft. raise: High Water El.: ? ft., New capacity: ? acre-ft., Add. capacity: ? acre-ft

Rating Factor-20 raise (embankment volume/reservoir capacity): ?

Geology: Setting is within Huntington Creek watershed at high elevation about 3.5 miles east of the crest of the Wasatch Plateau. Existing dam and reservoir lie within terrain mapped as surficial deposits derived from mass wasting of North Horn Formation and remnant glacial moraine (Witkind, 1987). North Horn Formation is described as comprising various fluvial-derived deposits including mudstone, claystone, sandstone, conglomeratic sandstone, conglomerate and rarely, limestone. These rocks are notoriously unstable and show pervasive evidence of various forms of mass-wasting throughout the Wasatch Plateau. They are typically deeply weathered, are unstable on over-steepened slopes and may be subject to slow movement. Site is located about 1 mile west of boundary faults of the Gooseberry graben. Some of these faults may exhibit evidence of late Quaternary activity and will deserve consideration in dam enlargement.

Foundation Design Considerations: Local soil materials are derived from mass wasting of North Horn Formation and will likely consist of sandy clay soils possibly with some gravel. While these soils will provide adequate source for construction materials, in their natural setting they may be in slow movement, will be unstable if exposed on over-steepened slopes and may exhibit shrink/swell characteristics. Extending a cut-off for the dam into bedrock will not likely be practical as undisturbed rock will probably lie at considerable depth beneath the existing dam.

Other Considerations: Bedrock-derived soils and over-burden present within the vicinity of the existing dam and reservoir should provide ample source of materials adequate for use in the clay core as well as Zone I, II and III. Sources for rip-rap may be more problematic. Site access will need to be improved.

1108 Little Madsen T14S R6E Sec 33 (? ft Raise)

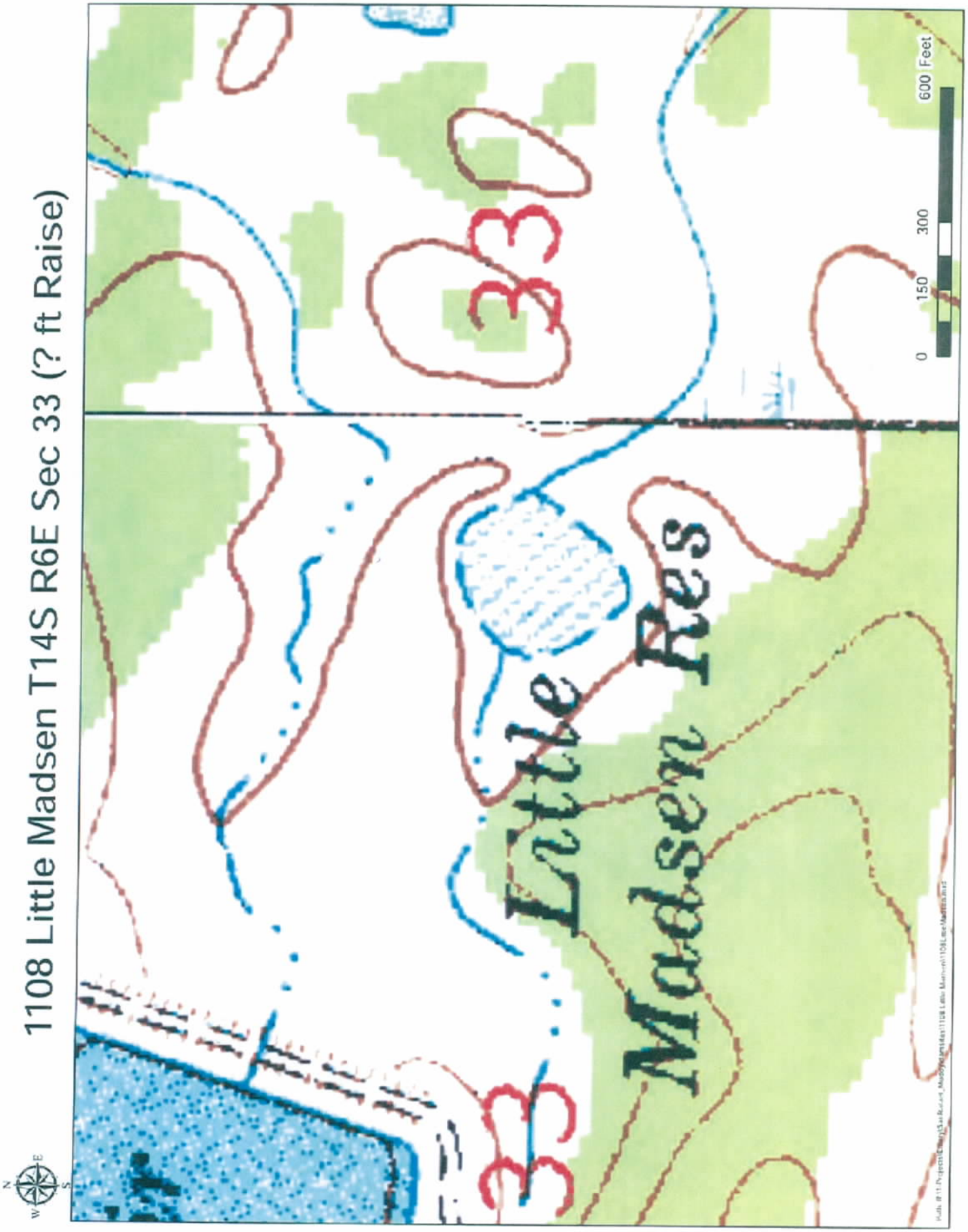


Table 3
San Rafael & Muddy Creek Potential Reservoir Study
26 Final Preferred Sites

Site Name	Dam/Dike Embankment Volume (cy)	Reservoir Storage (acft)	Height of Dam/Dike (ft)	Length of Dam/Dike (ft)	Emb. Volume (cy)/ Storage ratio (ac.ft.)
Fuller Bottom	81,184	8,771	55	395	9.2
Emery	158,603	11,084	90	380	14.3
Hadden Hills	95,614	6,465	45	775	14.8
The Box	154,385	9,738	69	1,210	15.8
Jorgensen	148,384	7,898	58	670	18.8
Hambrick Bottom	841,058	43,366	122	1,025	19.4
Rock Canyon Creek	284,492	13,741	80	855	20.7
The Breaks	431,780	14,452	125	775	29.9
Lower Ferron A	372,930	8,957	85	1,405	41.6
Lower Ferron L	273,798	6,378	90	615	42.9
Lower Molen Seep	77,017	1,587	56	420	48.5
Molen Seep B	102,668	1,322	68	440	77.6
Molen Seep C	132,827	1,268	65	660	104.8
Lower Ferron B	1,098,520	9,682	97	2,535	113.5
Peacock	1,769,190	14,518	140	1,675	121.9
Lower Ferron D	511,711	4,037	80	1,310	126.8
Lower Ferron C	464,747	3,615	68	1,375	128.6
Rock Canyon	43,581/1,536	319	48/7	365/220	141.4
Johnny Jensen Hollow	635,560	3,814	118	825	166.6
Quitchupah Creek	1,327,710	6,249	145	1,290	212.5
Henningson Dam - Replacement	Additional 42,457	Additional 365	50	960	116.3
Raise Rolfson Dam	Additional 108,705	Additional 763	47.7	1,500	142.5
Raise Emery Dam	Additional 85,143	Additional 392	56	1,040	81.1
Raise Spinners Dam	Additional 52,970	Additional 366	81	1,615	144.7
Raise Julius Flat Dam	Addit. 51,260/12,835	Additional 348	62/21.8	1,110/850	184.2
Enlarge Miller Flat Dam	Additional 242,680	Additional 4,176	98	2,070	58.1

Damsites in green – these sites were downsized to accommodate existing water supply (compare to Tables 2A-2D)

Section 4
Water Supply and Cursory Cost Estimation

Two important steps occur in this section. First, each site is evaluated for water supply. For on-stream sites, the amount of water in the stream at the location of the proposed dam is evaluated. By taking into account upstream diversions and return flow, an average annual yield for the drainage is determined. This amount, reported in acre-feet per year is then compared with the storage capacity in the proposed reservoir. If the storage capacity is greater than the available water supply, the dam and reservoir are downsized.

For off-stream sites, the average annual yield of water in the tributary is determined and compared to the storage capacity in the proposed reservoir. To fill the reservoir, additional water is always needed. The feasibility of diverting water from a nearby source and delivering it to the off-stream site is then evaluated. The relative locations and elevations of the potential storage reservoir and diversion structure become important in the evaluation of overall feasibility and affordability. Generally, the construction of a diversion structure and the installation of the canal or pipeline to convey water will add to the cost of utilizing an off-stream site. If the yield at the host site plus the amount of water available through diversion is less than the reservoir capacity then the proposed dam and reservoir are downsized to match the average annual water supply of both sources.

Applying this process to all twenty-six sites, we determined that only seven need to be downsized. These sites are listed in Table 4. The need to downsize the dam and reservoir at these sites, to accommodate the available water supply is also mentioned in the text for each re-sized dam in Section 2. Individual site maps and accompanying text of the seven dams and reservoirs, which require downsizing (identified with green labels) are found in Section 2 and shown in Tables 2A – 2D and Table 3. Revised site maps and text for these seven sites showing their new configuration in accordance with water availability are located in this section. Map configurations and text of the other nineteen sites did not change and thus are not repeated in this section, but are found in Section 2 and identified by the red color of the titles in their descriptive text.

The second important step in this phase of the screening process was to develop a cursory cost estimate for construction of a water impoundment structure at each of the twenty-six sites. To enhance comparability, we applied the same plan to each dam. Thus, the cursory cost estimate we developed is based on an assumed simplified dam configuration and design which is uniformly applied to the twenty-six sites. Table 5 shows the detailed breakdown of costs for each item we considered in the cost estimate. After obtaining a subtotal for each proposed, dam an additional amount of 30% for contingency and 15% for engineering was added to obtain the total cost for each site. Once the total cost was found a cost-per-acre-foot was calculated. For a discussion of the cost-per-acre-foot and final ranking refer to Section 5.

Table 4
Hydrology of
Downsized Reservoirs

Name of Damsite	Water Supply Name & Ac. Ft.	Reservoir Storage Ac. Ft.	Diversion Available Source & Ac. Ft.	Downsized Storage Ac. Ft.	Comments
The Box	Ferron Creek – 9,440	17,562	None	9,738	Reservoir downsized to accommodate supply in Ferron Creek.
Hambrick Bottom	San Rafael River – 42,480	47,428	None	43,366	Reservoir downsized to accommodate sole supply in S.R. River
Lower Molen Seep	Molen Seep – 1,540	22,343	None	1,587	Reservoir downsized to accommodate sole supply in Molen Seep
Molen Seep B	Molen Seep – 1,170	5,354	Too far to divert from Millsite Reservoir	1,322	Reservoir downsized to accommodate sole supply in Molen Seep
Molen Seep C	Molen Seep – 1, 190	5,546	Too far to divert from Millsite Reservoir	1,268	Reservoir downsized to accommodate sole supply in Molen Seep
Lower Ferron B	Unnamed Tributary to Ferron Creek – 90	17,040	Ferron Creek – 9,440	9,682	Reservoir downsized to accommodate diversion supply
Quitchupah Creek	Quitchupah Creek – 6,000	21,642	None	6,249	Reservoir downsized to accommodate sole supply in Quitchupah

The Box

Location: SW¼ Sec. 9, T20S, R8E, SLB&M. Located on Ferron Creek, approximately 5 miles east of Ferron, Utah.

Land Ownership: Both the dam site and the reservoir basin are located on a mixture of private and BLM land.

Dam Embankment: Height: 69 ft. Length: 1,210 ft. Volume: 154,385 cu. yds.
Crest Elev.: 5,692 ft. asl.

Reservoir: High Water Elev.: 5,687 ft. asl. Capacity: 9,738 ac. ft.

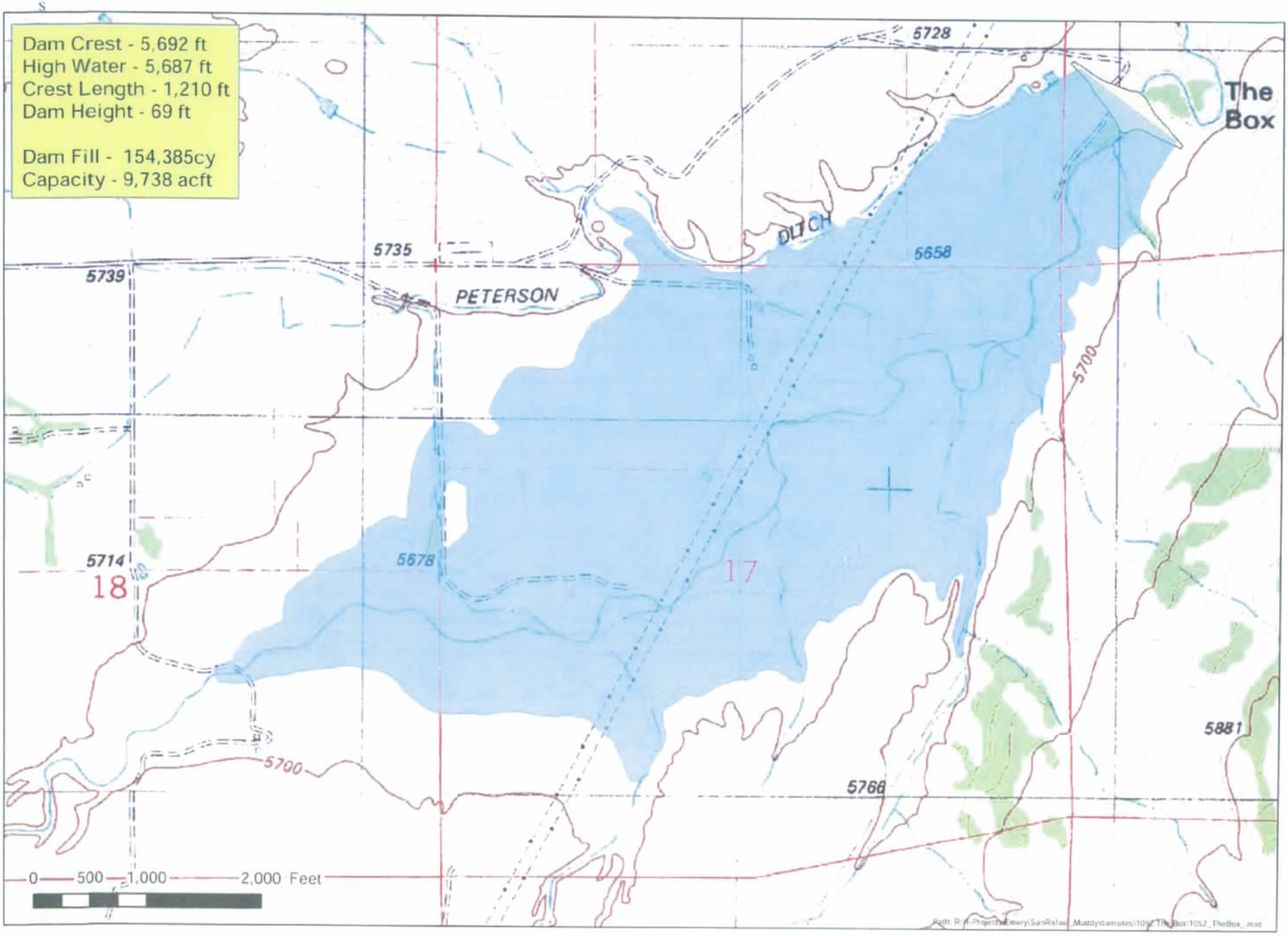
Rating Factor: (embankment volume/reservoir capacity) 15.8 cu.yds./ac.ft.

Geology: Setting is within Castle Valley with the Wasatch Plateau to the west and San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The dam abutments and center section will rest on or against interbedded sandstone and shale mapped as Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The reservoir basin will be underlain by shale and siltstone of the Blue Gate Member of the Mancos Shale Formation. Shale and siltstones of the Mancos Shale are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench or construction of concrete dam, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Site access needs to be improved. Power transmission lines will need to be relocated that presently occupy the proposed reservoir basin.

1052 The Box T20S R8E Sec 9



Hambrick Bottom

Location: NW¼ Sec 35, T19S, R9E, SLB&M; Main channel site on San Rafael River just below confluence Huntington, Cottonwood and Ferron Creeks approximately 12 miles southeast of Castle Dale, Utah.

Land Ownership: Dam will be on BLM land. Reservoir is located on mix of SITLA, UDWR, and BLM land.

Dam Embankment: Height: 122 ft.: Length: 1,025 ft.: Vol. 841,058 cu. yds.: Crest El.: 5,402

Reservoir: High Water El.: 5,397: Capacity: 43,366 acre-ft.

Rating Factor (embankment volume/reservoir capacity): 19.4

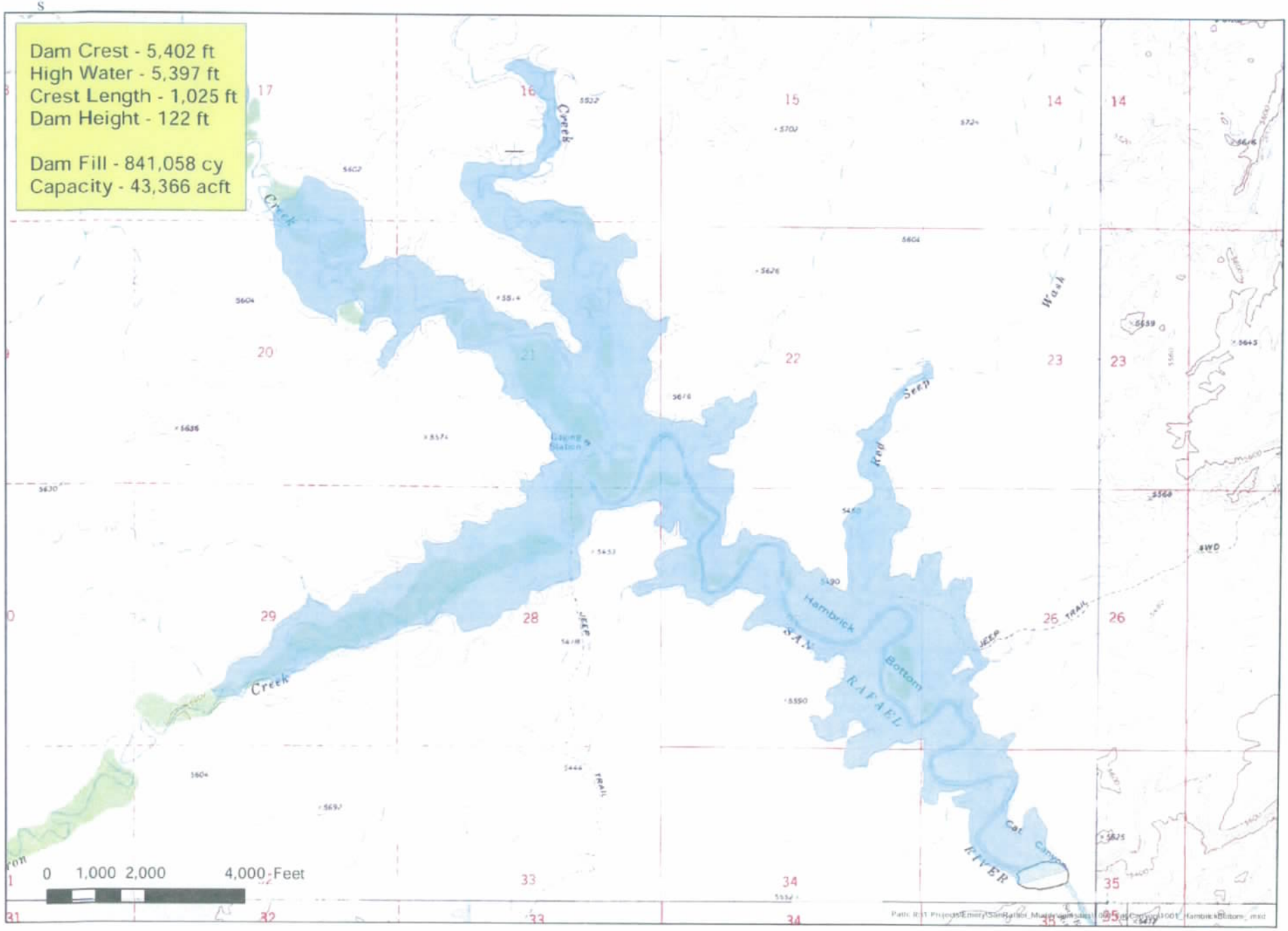
Geology: Setting is within incised reach of the San Rafael River about 2 miles downstream of the confluence of Huntington, Cottonwood, and Ferron Creeks about 12 southeast of Castle Dale, UT. Canyon walls cut progressively down-section through lower members of the Mancos Shale Formation (Ferron Sandstone and Tununk Shale) near the confluence, passing through Dakota Sandstone, both Brushy Basin and Salt Wash members of the Morrison Formation, Summerville Formation, Curtis Formation and finally Entrada Sandstone before the river emerges onto Fuller Bottom below the dam site. Dam foundation and abutments will lie upon rock mapped as Emery Sandstone with the upper abutments possibly placed against the lower portion of Curtis Formation. Entrada sandstone is described by Witkind et. al. (1987), as orange-brown, red-brown and light-brown eolian deposit dominantly fine grained sandstone locally with medium to coarse grained layers. Rock is variably weak and friable to relatively well-cemented and strong forming low rounded knobs with horizontal groves to over-steepened cliffs several tens of feet high. Generally medium to thick bedded with faint cross-bedding. Curtis Formation is likewise comprised predominantly of sandstone. It is described as firmly cemented with carbonate that lends to it forming cap rock and supporting low cliffs. It comprises of a light-grey, light-brown, or greenish-grey fine - to medium-grained, thin to thick-bedded, locally cross-bedded quartzose sandstone. Local beds of siltstone, conglomeratic sandstone, and conglomerate may also be present, and rarely interbeds of reddish shale. Reservoir basin will back up through the stratigraphic section mentioned above.

Foundation Design Considerations: Sandstone rock in both the Entrada Sandstone and Curtis Formation should provide adequate support for main dam foundation and abutments. However, permeability through primary porosity in the sandstone or secondary fracturing may lead to leaking foundation conditions and may require designed grout program within the abutments and possibly the main dam center section as well. Steep vertical walls of the canyon will have to be cut back at a 1.5:1 slope to allow construction equipment to dig cutoff trench. Deep alluvium along the centerline of the river is also possible and may require deep excavation to extend dam foundation, or at least a cut-off to rock across the entire alignment. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section, such as concrete dam structure. River diversion during construction will be an important consideration. Although rock in the vicinity of the dam alignment is

expected to be relatively stable, some of the formations around the reservoir basin upstream contain large amounts of clay-shale, siltstone, and other potentially unstable rock. Hence, slopes around the reservoir basin should be evaluated for potential landslides.

Other Considerations: Alluvium and some of the clay bearing formations within the reservoir basin should provide ample source of clay for core of dam. Sources of sand and gravel should be available through the formations within and around the dam foundation. Sources for rip-rap may be more problematic unless some of the sandstone layers are well-enough cemented to retain integrity for use as such. Angle exploration holes should be drilled to evaluate joint density, orientation, and permeability. Site access will need to be improved. Tunnel by-pass may be required at this site during construction. Fish passage may require special construction features. Due to the steep vertical walls, unknown thickness of the alluvium, and other physical properties found at the site, a concrete dam would need to be constructed.

1001 Hambrick Bottom T19S R09E Sec 35



Lower Molen Seep

Location: NW¼ Sec. 3, T21S, R8E, SLB&M. Located on Molen Seep Wash approximately 2 miles east of Molen Reef.

Land Ownership: Both the dam and reservoir basin are located on BLM land with the reservoir basin making a slight encroachment on SITLA land.

Dam Embankment: Height: 56 ft. Length: 420 ft. Volume: 77,017 cu. yds.
Crest Elev.: 5,816 ft. asl.

Reservoir: High Water Elev.: 5,811 ft. asl. Reservoir Capacity: 1,587 ac.ft.

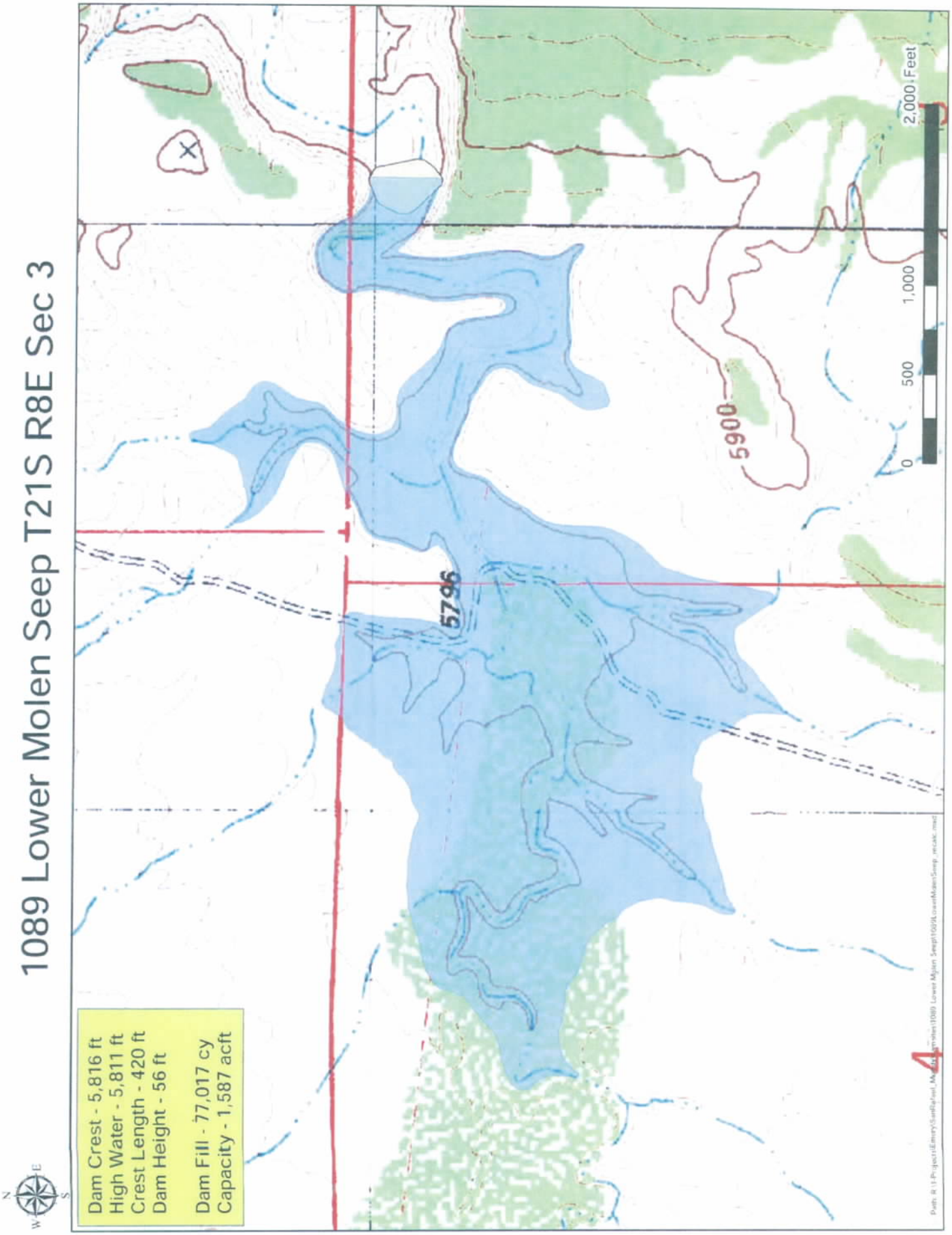
Rating Factor: (embankment volume/reservoir capacity) 48.5 cu.yds./ac.ft.

Geology: Setting is within Castle Valley with the Wasatch Plateau to the west and San Rafael Swell to the east. The abutments at this site are formed in the sandstone, mudstone, conglomerate, and conglomeratic sandstone of the lower Cretaceous Dakota Sandstone and Cedar Mountain Formations undivided. The Dakota comprises of sandstone that is tan to light brown, fine - to medium-grained, and cross-bedded. The Cedar Mountain consists of an upper unit of dominantly mudstone variegated in shades of purple, red, grey, and green; and a lower unit of grey, massive to thin-bedded, cross-bedded conglomerate and conglomeratic sandstone. This lower unit forms a resistant ledge. Underlying the center section of the dam and the reservoir basin is an unknown thickness of alluvium, which in turn overlies the variegated, bentonitic claystone and mudstone of the Brushy Basin Member of the Morrison Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Claystones and mudstones and their weathered equivalents may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within the Brushy Basin rocks in disseminated form or as fracture infillings.

Foundation Design Considerations: Clay rich bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Claystone bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately steep to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement or slumping. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap may be found in the Dakota Sandstone Formation.

1089 Lower Molen Seep T21S R8E Sec 3



Molen Seep B

Location: NW¼ Sec.6, T21S, R8E, SLB&M. Located on Molen Seep Wash as it cuts through Molen Reef.

Land Ownership: The damsite and most of the reservoir basin are located on BLM land. A small area of the reservoir encroaches on private land.

Dam Embankment: Height: 68 ft. Length: 440 ft. Volume: 102,668 cu.yds.
Crest Elev.: 5,960 ft. asl.

Reservoir: High Water Elev.: 5,955 ft. Capacity: 1,322 ac.ft.

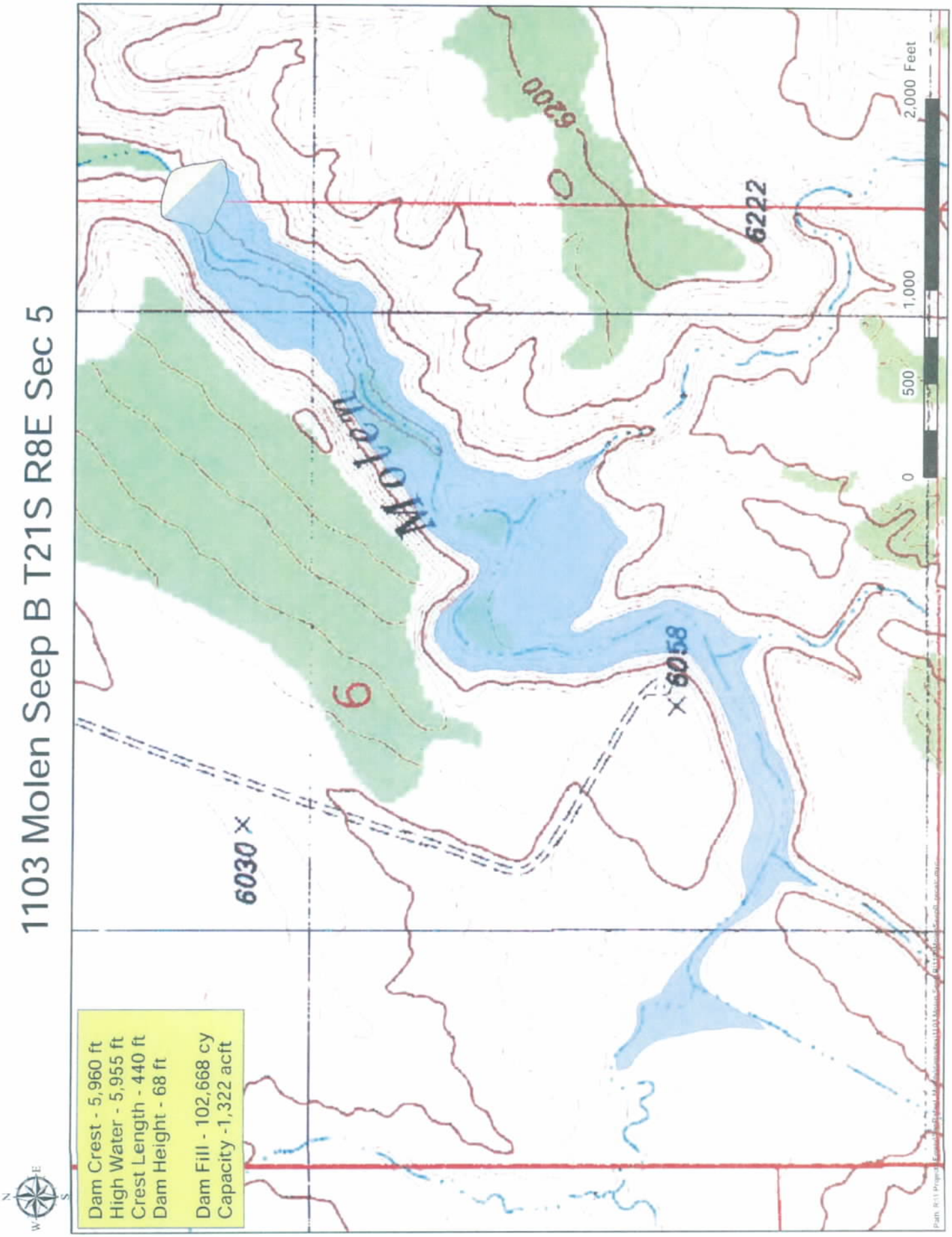
Rating Factor: (embankment volume/reservoir capacity) 77.6 cu.yds./ac.ft.

Geology: This site is located within Castle Valley about six miles southeast of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. At this site, the upper abutments are mapped as sandstone within the upper unit of the Ferron Sandstone Member of the Mancos Shale Formation (Witkind et. al., 1987). The remainder of the dam rests on mostly shale of the middle unit of the Ferron Sandstone Member. The sandstones are fine - to very fine-grained, medium to thick bedded, and locally massive or crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infillings. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location. Water will need to be diverted from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed. Site access will need to be improved.

1103 Molen Seep B T21S R8E Sec 5



Molen Seep C

Location: Dam NW¼ Sec. 5, Dike NE¼ Sec. 6, T21S, R8E, SLB&M. Located on Molen Seep Wash where it cuts through Molen Reef.

Land Ownership: The dam and most of the reservoir basin are located on BLM land. A small area of the reservoir encroaches on private land.

Dam Embankment: Height: 65 ft. Length: 660 ft. Volume: 132,827 cu.yds.
Crest Elev.: 5,942 ft. asl.

Reservoir: High Water Elev.: 5,937 ft. asl. Capacity: 1,268 ac.ft.

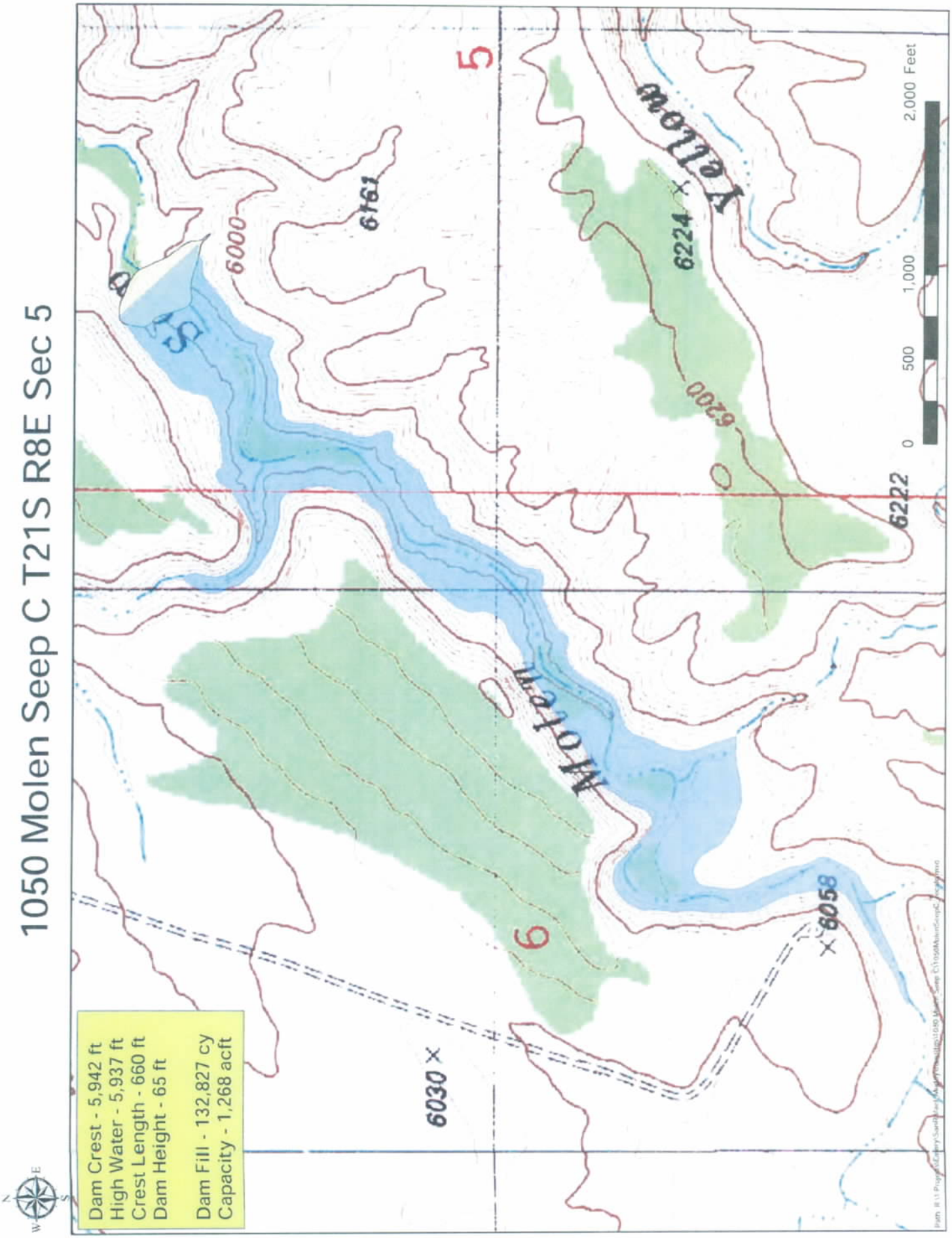
Rating Factor: (embankment volume/reservoir capacity) 104.8 cu.yds./ac.ft.

Geology: This site is located within Castle Valley about six miles southeast of the town of Ferron, between the Wasatch Plateau to the west and the San Rafael Swell to the east. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. At this site, the upper abutments are located in sandstone within the upper unit of the Ferron Sandstone Member of the Mancos Shale Formation. The remainder of the dam rests on mostly shale of the middle unit of the Ferron Sandstone Member. The sandstones are fine - to very fine-grained, medium to thick bedded, locally massive, and crossbedded. The shale is fissile, silty and carbonaceous, thin bedded, and interleaved with thin lenticular sandstone beds. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. An unknown depth of alluvium overlies bedrock in the stream channel.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum, which will require treatment and likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is subdued to moderately steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rate is not anticipated to be high at this location. Water may need to be diverted from Millsite Reservoir. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Diversion structure and transmission facilities will need to be constructed.

1050 Molen Seep C T21S R8E Sec 5



Lower Ferron B

Location: SW¼ Sec 4, SE¼ Sec. 5, NE¼ Sec 8, T20S, R8E, SLB&M; off channel site northeast of Ferron Creek about 6 miles east of Ferron, Utah.

Land Ownership: Dam and reservoir are located on mixture of private and BLM land.

Dam Embankment: Height: 97 ft.: Length: 2,535 ft.: Vol. 1,098,520 cu. yds.: Crest El.: 5,707

Reservoir: High Water El.: 5,702: Capacity: 9,682 acre-ft.

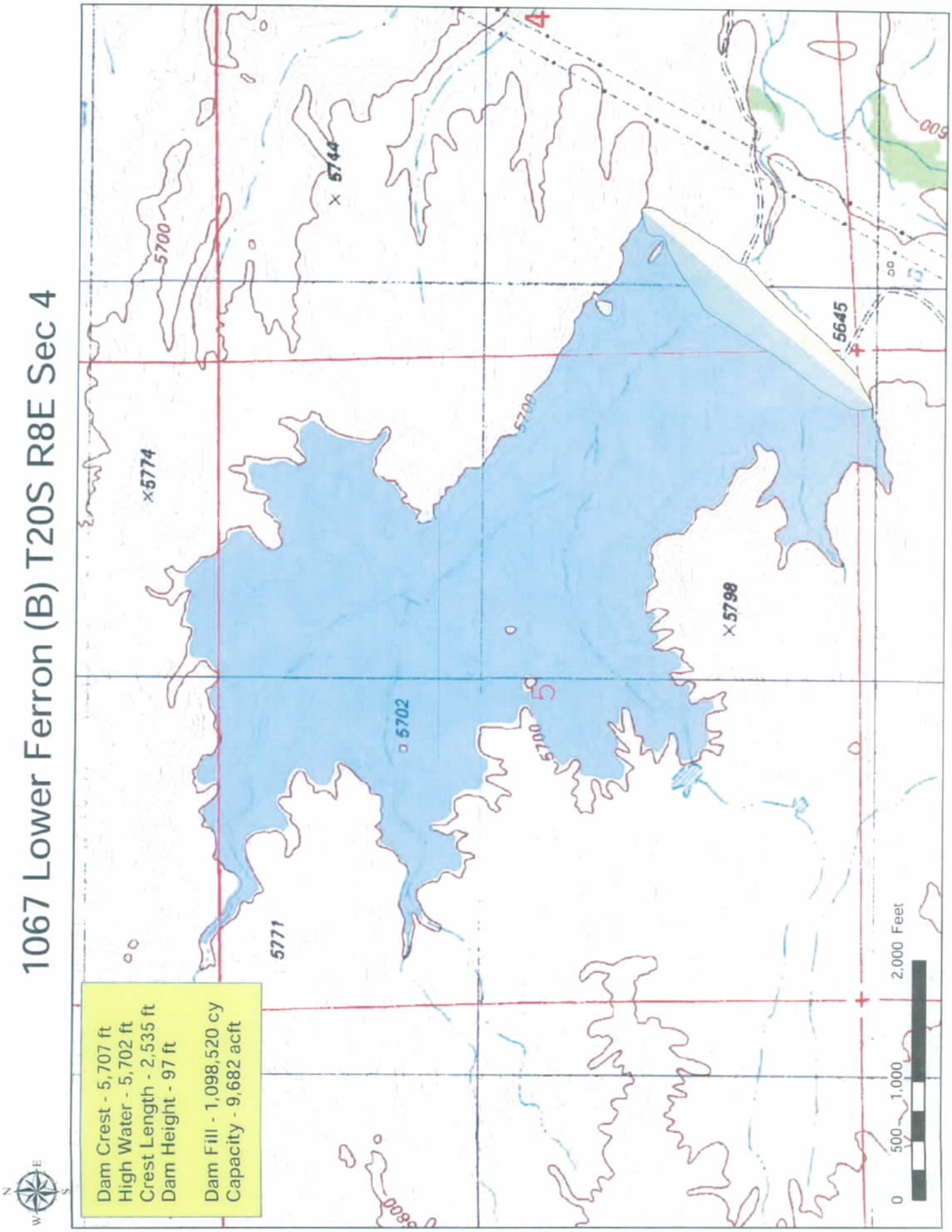
Rating Factor (embankment volume/reservoir capacity): 113.5

Geology: Setting is within the Castle Valley east of the town of Ferron, between the Wasatch Plateau to the west and San Rafael Swell to the east. Dam abutments and center section will rest on rock mapped as Blue Gate Member of the Mancos Shale Formation. Blue Gate Member is described as consisting of dark grey shale and thinly bedded siltstone with some thin interlayers of sandstone also present (Witkind, et. al., 1987). Shale and siltstone are typically fissile, deeply weathered, and moderately soft. On steep slopes, these materials may be susceptible to development of landslides or other forms of mass movement. At depth, rock is tight and moderately hard but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or in seams as fracture infilling. Deep soil profile with possible presence of alluvium is likely within center section of the dam—soils will likely be largely composed of clay and silt given that the parent material will most likely derive from the Blue Gate member. Ridgelines above abutments may be capped with late Tertiary/Quaternary pediment gravels. These will consist of crudely layered to massive fluvial deposits of mixed sand, gravel, cobbles and boulders with variable amounts of clay and silt fines.

Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and likely necessitate installation of grout curtain. Although rock is generally tight, on excavation it will slake; thus, special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock may also exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Although terrain in the vicinity of dam is subdued, slopes should be carefully observed for evidence of landslides or other forms of mass wasting. Deep weathering of bedrock within the center section will affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Reservoir location may be downstream of primary irrigable lands. This may not be an issue if water storage is for fisheries, recreation, or future power generating stations downstream. Alluvium and weathered bedrock should provide ample source of clay for core of dam. Sources of shell material and rip-rap may be more problematic. Terrace deposits may offer a source for the latter if present in sufficient quantity. Sedimentation rate could be high. Diversion and transmission facilities will need to be constructed on Ferron Creek or water routed to this site from Millsite Dam. Access to the site will need to be improved.

1067 Lower Ferron (B) T20S R8E Sec 4



Quitchipah Creek

Location: SW¼ Sec. 15, and SE¼ Sec. 16, T22S, R5E, SLB&M. Located on Quitchipah Creek approximately 500 feet downstream of its confluence with North Fork.

Land Ownership: The damsite is located on BLM and SITLA land. The reservoir basin occupies a mixture of SITLA, BLM, and private land.

Dam Embankment: Height: 145 ft. Length: 1,290 ft. Volume: 1,327,710 cu.yds.
Crest Elev.: 6,625 ft. asl.

Reservoir: High Water Elev.: 6,520 ft. asl. Capacity: 6,249 ac.ft.

Rating Factor: (embankment volume/reservoir capacity) 212.5 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flank of the Old Woman Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The abutments and foundation at this site are in the yellow-grey, fine - to medium-grained, cliff and ledge forming, and friable sandstone of the Emery Sandstone Member of the Mancos Shale Formation. Minor interbeds of grey sandy shale are also located within the Emery Sandstone Member. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. An unknown thickness of alluvium is located in the stream channel.

Foundation Design Considerations: The bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it might slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics, which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff trench. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site will need to be improved. Sedimentation rates could be high at this location. This site could host a storage facility that greatly exceeds the amount of water this drainage produces. Thus a smaller facility will be cited to match average annual water supply. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in. Spillway will likely have to be designed to go over the dam.

1042 Quitchupah Creek T22S R5E Sec 16

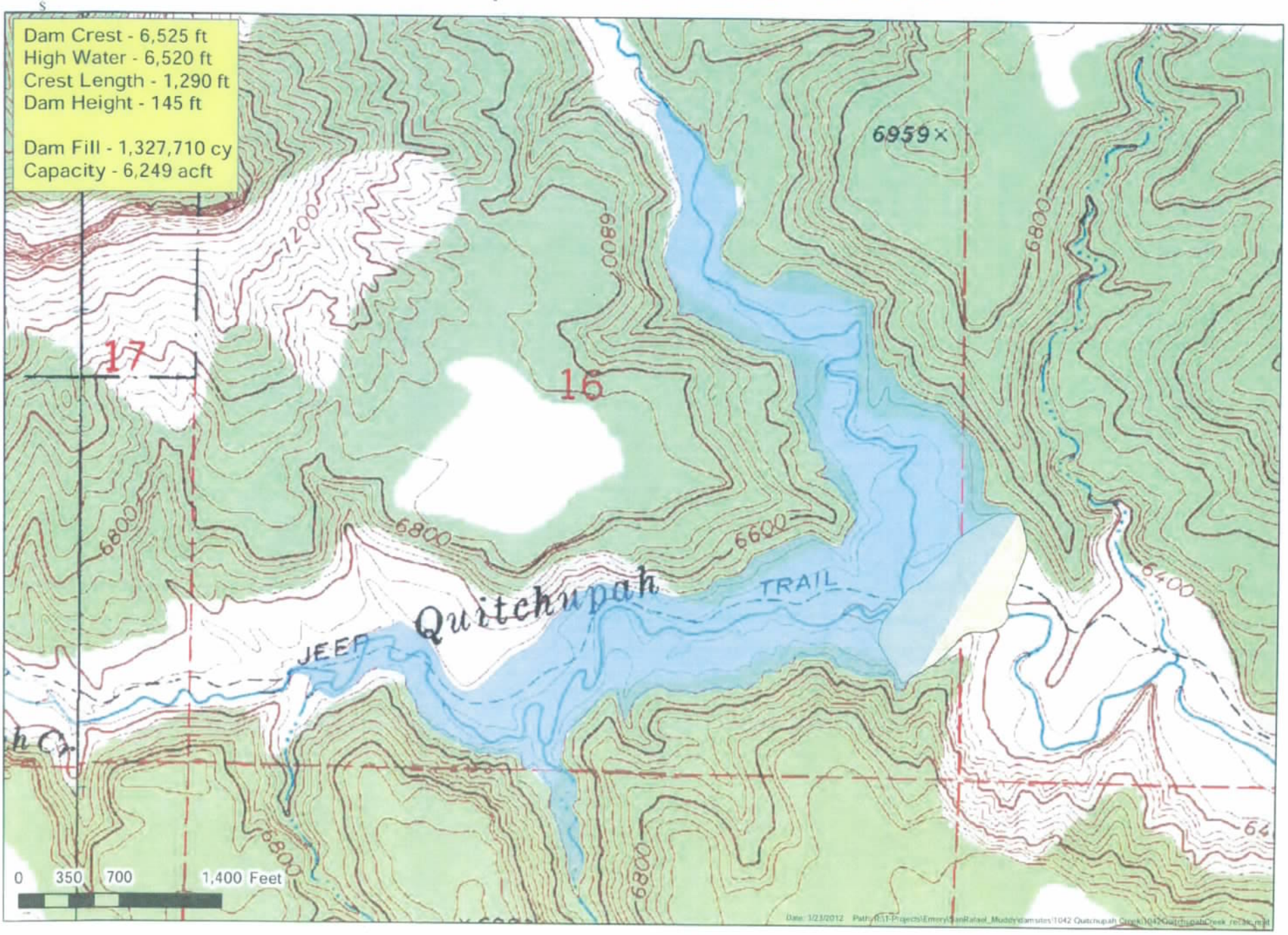


Table 5 - Emery County Damsites - Cursory Cost Estimates

				1. Fuller Bottom		2. Emery		3. Hadden Hills		4. The Box	
				Dam: 55' tall, 395' long Storage: 8,771 acft ***Concrete***		Dam: 90' tall, 380' long Storage: 11,084 acft Depth: 20' COT, 80' Slurry Trench Length of COT = 300'		Dam: 45' tall, 775' long Storage: 6,465 acft COT depth 50' Length of COT = 450'		Dam: 69' tall, 1210' long Storage: 9,738 acft Depth: 50' COT, 20' Grt Crtn Length of COT = 1000'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS			1	285,000	1	290,000	1	458,000
2	Access		LS			1	150,000	1	500,000	1	500,000
3	Clearing & Grub		LS	**Site is presently in a deep**		1	80,000	1	80,000	1	80,000
4	COT Excavation	8	CY	**slot canyon on the**		12,200	97,600	83,300	666,400	185,200	1,481,600
5	Foundation Treat	11	SF	**San Rafael River.**				19,375	213,125	30,250	332,750
6	Grout Curtain**	90	SF								
	Slurry Trench	10	SF	**Site characteristics require**		24,000	240,000				
7	Embankment*		CY	**concrete dam to be**		158,603		95,614		154,385	
8	Emb + COT***	12	CY	**built at the site.**		170,803	2,049,636	178,914	2,146,968	339,585	4,075,020
	Dewatering			**(Outside the realm of**			500,000		500,000		500,000
	Care & Div Stream			**the cost estimate)**			1,000,000		1,000,000		1,000,000
9	Spillway		LS			1	1,000,000	1	500,000	1	800,000
10	Outlet		LS			1	600,000	1	200,000	1	400,000
11	Diversion Structure		LS								
12	Diversion Canal	150,000	mi								
	Powerline Relocation	200,000	pole							25	5,000,000
13	Road Realignment		LS								
	Subtotal						6,002,236		6,096,493		9,627,370
	Contingency (30%)						1,800,671		1,828,948		2,888,211
	Engineering (15%)						900,335		914,474		1,444,106
	TOTAL COST						**8,703,242**		**8,839,915**		**13,959,687**
	COST per ACRE FT						**785**		**1,367**		**1,433**

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25' Wide w/ 1.5:1 Excavated Slopes

High voltage transmission lines will have to be relocated to allow construction of the dam and reservoir basin.

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				5. Lower Molen Seep		6. Hambrick Bottom		7. Jorgensen		8. Rock Canyon Creek	
				Dam: 56' tall, 420' long Storage: 1,587 acft Depth: 40' COT, 20' Grt Crtn Length of COT = 225'		Dam: 122' tall, 1025' long Storage: 43,366 acft ***Concrete***		Dam: 58' tall, 670' long Storage: 7,898 acft Depth: 20' COT, 80' Slurry Trench Length of COT = 500'		Dam: 80 tall, 855 long Storage: 13,741 acft Depth: 40' COT, 40' Grt Crtn Length of COT = 425'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	282,000			1	295,000	1	468,500
2	Access		LS	1	1,000,000			1	500,000	1	500,000
3	Clearing & Grub		LS	1	80,000	**Site is presently in a deep**		1	80,000	1	80,000
4	COT Exc	8	CY	28,300	226,400	**slot canyon on the San**		20,400	163,200	53,500	428,000
5	Foundation Treat	11	SF	10,500	115,500	**Rafael River**				21,400	235,400
6	Grout Curtain**	90	SF	8,400	756,000					17,000	1,530,000
	Slurry Trench	10	SF			**Site characteristics require**		40,000	400,000		
7	Embankment*		CY	77,017		**concrete dam to be**		148,384		284,492	
8	Emb + COT***	12	CY	105,317	1,263,804	**built at the site.**		168,784	2,025,408	337,992	4,055,904
	Dewatering				300,000	**(Outside the realm of**			500,000		100,000
	Care & Div Stream				500,000	**the cost estimate)**			1,000,000		200,000
9	Spillway		LS	1	800,000			1	800,000	1	800,000
10	Outlet		LS	1	400,000			1	400,000	1	400,000
11	Diversion		LS							1	1,000,000
12	Diversion Canal	40,000	mi							1	40,000
	Powerline Relocation										
13	Road Realignment		LS		200,000						
	Subtotal				5,923,704				6,163,608		9,837,804
	Contingency (30%)				1,777,111				1,849,082		2,951,341
	Engineering (15%)				888,556				924,541		1,475,671
	TOTAL COST				**8,589,371**				**8,937,232**		**14,264,816**
	COST per ACRE FT				**5,412**				**1,131**		**1,038**

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25' Wide w/ 1.5:1 Excavated Slopes

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				9. The Breaks		10. Lower Ferron A		11. Lower Ferron L		12. Molen Seep B	
				Dam: 125' tall, 775' long Storage: 14,452 acft Depth: 20' COT, 80' Slurry Trench Length of COT = 550'		Dam: 85' tall, 1405' long Storage: 8,957 acft Depth: 50' COT, 40' Grt Crtn Length of COT = 675'		Dam: 90' tall, 615' long Storage: 6,378 acft Depth: 50' COT, 40' Grt Crtn Length of COT = 350'		68' tall, 440' long Storage: 1,322 acft Depth: 40' COT, 30' Grt Crtn Length of COT = 260'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	540,000	1	916,000	1	553,500	1	432,500
2	Access		LS	1	1,000,000	1	100,000	1	1,000,000	1	1,000,000
3	Clearing & Grub		LS	1	80,000	1	100,000	1	80,000	1	80,000
4	COT Exc	8	CY	22,400	179,200	125,000	1,000,000	64,800	518,400	32,700	261,600
5	Foundation Treat	11	SF			35,000	385,000	15,400	169,400	11,000	121,000
6	Grout Curtain**	90	SF			56,000	5,040,000	24,600	2,214,000	39,600	3,564,000
	Slurry Trench	10	SF	44,000	440,000						
7	Embankment*		CY	431,780		372,930		273,798		102,668	
8	Emb + COT***	12	CY	454,180	5,450,160	497,930	5,975,160	338,598	4,063,176	135,368	1,624,416
	Dewatering				500,000		100,000		100,000		300,000
	Care Diversion Strm				1,000,000		200,000		200,000		500,000
9	Spillway		LS	1	1,000,000	1	800,000		800,000	1	800,000
10	Outlet		LS	1	600,000	1	400,000		400,000	1	400,000
11	Diversion		LS			1	200,000	1	1,000,000		
12	Diversion Canal	150,000	mi			4	525,000	4	525,000		
	Powerline Relocation	200,000	pole			15	3,000,000				
13	Road Realignment		LS	1	500,000	1	500,000				
	Subtotal				11,289,360		19,241,160		11,623,476		9,083,516
	Contingency (30%)				3,386,808		5,772,348		3,487,043		2,725,055
	Engineering (15%)				1,693,404		2,886,174		1,743,521		1,362,527
	TOTAL COST				16,369,572		27,899,682		16,854,040		13,171,098
	COST per ACRE FT				1,133		3,115		2,643		9,963

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25' Wide w/ 1.5:1 Excavated Slopes

High voltage transmission lines will have to be relocated to allow construction of the dam and reservoir basin.
Roads will have to realigned to allow construction of dam and reservoir basin.

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				13. Molen Seep C		14. Lower Ferron B		15. Peacock		16. Lower Ferron D	
				Dam: 65' tall, 660' long Storage: 1,268 acft Depth: 40' COT, 30' GrtCrtn Length of COT = 375'		Dam: 97' tall, 2535' long Storage: 9,682 acft Depth: 40' COT, 70' Grt Crtn Length of COT = 1500'		Dam: 140' tall, 1675' long Storage: 14,518 acft Depth: 40' COT, 60' Grt Crtn Length of COT = 1100'		Dam: 80' tall, 1310' long Storage: 4,037 acft Depth: 40' COT, 40' Grt Crtn Length of COT = 775'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	379,000	1	1,898,300	1	2,034,600	1	768,400
2	Access		LS	1	1,000,000	1	800,000	1	100,000	1	100,000
3	Clearing & Grub		LS	1	80,000	1	80,000	1	100,000	1	100,000
4	COT Exc	8	CY	47,200	377,600	189,000	1,512,000	138,500	1,108,000	97,600	780,800
5	Foundation Treat	11	SF	16,500	181,500	63,400	697,400	41,400	455,400	32,750	360,250
6	Grout Curtain**	90	SF	19,800	1,782,000	185,850	16,726,500	99,300	8,937,000	52,400	4,716,000
	Slurry Trench	10	SF								
7	Embankment*		CY	132,827		1,098,520		1,769,190		511,711	
8	Emb + COT***	12	CY	180,027	2,160,324	1,287,520	15,450,240	1,907,690	22,892,280	609,311	7,311,732
	Dewatering				300,000		100,000		500,000		100,000
	Care Diversion Strm				500,000		200,000		1,000,000		200,000
9	Spillway		LS	1	800,000	1	1,000,000	1	1,000,000	1	800,000
10	Outlet		LS	1	400,000	1	600,000	1	600,000	1	400,000
11	Diversion Structure		LS			1	200,000			1	200,000
12	Diversion Canal	150,000	mi			4	600,000			2	300,000
	Powerline Relocation										
13	Road Realignment		LS					1	4,000,000		200,000
	Subtotal				7,960,424		39,864,440		42,727,280		16,137,182
	Contingency (30%)				2,388,127		11,959,332		12,818,184		4,841,155
	Engineering (15%)				1,194,064		5,979,666		6,409,092		2,420,577
	TOTAL COST				11,542,615		57,803,438		61,954,556		23,398,914
	COST per ACRE FT				9,103		5,970		4,267		5,726

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25 Wide w/ 1.5:1 Excavated Slopes

State Highway 29 will have to realigned to allow construction of dam and reservoir basin.

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				17. Lower Ferron C		18. Rock Canyon		19. Johnny Jensen Hollow		20. Ouitchupah Creek	
				Dam: 68' tall, 1375' long Storage: 3,615 acft Depth: 40' COT, 30' GrtCrtn Length of COT = 850'		Dam: 48' tall, 365' long Storage: 319 acft Depth: 20' COT, 30' Grt Crtn Dike: 7' tall, 220' long Length of COT of dam = 320'		Dam: 118' tall, 825' long Storage: 3,814 acft Depth: 30' COT, 70' Grt Crtn Length of COT = 500'		Dam: 145' tall, 1290' long Storage: 6,249 acft Depth: 40' COT, 60' Grt Crtn Length of COT = 750'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	700,400	1	226,600	1	860,000	1	1,406,400
2	Access		LS	1	100,000	1	500,000	1	100,000	1	500,000
3	Clearing & Grub		LS	1	100,000	1	80,000	1	80,000	1	80,000
4	COT Exc	8	CY	107,000	856,000	16,200	129,600	38,900	311,200	94,400	755,200
5	Foundation Treat	11	SF	34,400	378,400	14,600	160,600	20,600	226,600	32,250	354,750
6	Grout Curtain**	90	SF	41,250	3,712,500	10,950	985,500	57,750	5,197,500	77,400	6,966,000
	Slurry Trench	10	SF								
7	Embankment*		CY	464,747		43,581		635,560		1,327,710	
8	Emb + Dike/Berms	12	CY	571,747	6,860,964	45,117	541,404	674,460	8,093,520	1,422,110	17,065,320
	Dewatering				100,000		300,000		100,000		300,000
	Care Diversion Stm				200,000		500,000		200,000		500,000
9	Emb+Dike/Berms+COT	12	CY			61,317	735,804				
10	Spillway		LS	1	800,000	1	300,000	1	1,000,000	1	1,000,000
11	Outlet		LS	1	400,000	1	200,000	1	600,000	1	600,000
12	Diversion Structure		LS	1	200,000			1	1,000,000		
13	Diversion Canal	150,000	mi	2	300,000			2	300,000		
	Powerline Relocation										
14	Road Realignment		LS			1	100,000				
	Subtotal				14,708,264		4,759,508		18,068,820		29,527,670
	Contingency (30%)				4,412,479		1,427,852		5,420,646		8,858,301
	Engineering (15%)				2,206,240		713,926		2,710,323		4,429,151
	TOTAL COST				21,326,983		6,901,287		26,199,789		42,815,122
	COST per ACRE FT				5,900		21,634		6,864		6,852

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25 Wide w/ 1.5:1 Excavated Slopes

Unimproved road will have to realigned to allow construction of dam and reservoir basin.

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				21. Henningson Dam Replacement		22. Raise Rolfson Dam		23. Raise Emery Dam		24. Raise Spinners Dam	
				Dam: 50' tall (incl. 21' raise), 960' long New Storage: Approx. 834 acft Depth: 20 COT, 30' GrtCrtn ****Length of COT = 580'		Dam: 50' tall (incl. 11.7' raise), 1500' long New Storage: Approx. 1,267 acft Depth: 20' COT ****Length of COT = 900'		Dam: 56' tall (incl. 31' raise), 1040' long New Storage: Approx. 537 acft Depth: 20' COT ****Length of COT = 620'		Dam: 81' tall (incl. 24' raise), 1615' long New Storage: Approx. 1,041 acft Depth: 20' COT ****Length of COT = 970	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	318,260	1	138,000	1	121,400	1	141,300
2	Access		LS	1	1,000,000	1	100,000	1	200,000	1	200,000
3	Clearing & Grub		LS	1	80,000	1	50,000	1	50,000	1	50,000
4	COT Exc	8	CY	23,600	188,800	36,600	292,800	25,400	203,200	39,519	316,152
5	Foundation Treat	11	SF	19,200	211,200						
6	Grout Curtain**	90	SF	28,800	2,592,000						
	Slurry Trench	10	SF		0						
7	Embankment*		CY	42,500		108,700		85,100		52,970	
8	Emb + COT***	12	CY	66,100	793,200	138,700	1,664,400	110,400	1,324,800	92,500	1,110,000
	Dewatering				300,000		100,000		100,000		100,000
	Care Diversion Strm				500,000						
9	Spillway		LS	1	500,000	1	500,000	1	500,000	1	500,000
10	Outlet		LS	1	200,000	1	50,000	1	50,000	1	50,000
11	Diversion Structure		LS							1	200,000
12	Diversion Canal	150,000	mi							2	300,000
	Powerline Relocation										
13	Road Realignment		LS								
	Subtotal				6,683,460		2,895,200		2,549,400		2,967,452
	Contingency (30%)				2,005,038		868,560		764,820		890,236
	Engineering (15%)				1,002,519		434,280		382,410		445,118
	TOTAL COST				**9,691,017**		**4,198,040**		**3,696,630**		**4,302,805**
	COST per ACRE FT				**10,148**		**3,313**		**6,884**		**4,133**

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25 Wide w/ 1.5:1 Excavated Slopes
**** COT Length 60% of Crest Length of dam

Diversion structure and canal will have to be constructed to divert water from Horse Creek. It was determined that present drainage does not fill up Spinners Reservoir and water must be diverted to maximize reservoir capacity.

Table 5 - Emery County Damsites - Cursory Cost Estimates (Continued)

				25. Raise Julius Flat Dam		26. Little Madsen rebuild	27. Enlarge Miller Flat Dam	
				Dam: 62' tall (incl. 18' raise), 1110' long New Storage: Approx. 1,070 Dike: 21.8' (incl. 18' raise), 850' long dike Depth: 20' COT ****Length of COT of dam = 670' Length of COT for dike = 510'		20' raise Storage acft is unknown Present height is unknown Total length of crest of dam is unknown, therefore length of COT cannot be calculated	Dam: 98' tall (incl. 25' raise), 2,070' long New Storage: Approximately 9,426 acft Depth: 15' COT at US toe 80' GrtCrtn ****Length of COT = 1240'	
Item	Description	Unit Price	Unit	Quantity	Total		Quantity	Total
1	Mobilization (5%)		LS	1	119,400		1	683,000
2	Access		LS	1	200,000	**Insuffcient information is**	1	100,000
3	Clearing & Grub		LS	1	50,000	**available to quantify a**	1	20,000
4	COT Exc (dam & Dike)	8	CY	35,000	280,000	**evaluation at this time.**	34,400	275,200
5	Foundation Treat	11	SF				22,000	242,000
6	Grout Curtain**	90	SF			**No record of this structure**	88,000	7,920,000
	Slurry Trench	10	SF			**is available on the Water**		
7	Embankment*		CY	51,300		**Rights Dam Safety website**	242,700	
	Dike Embankment			12,800				
8	Emb + COT*** (& Dike)	12	CY	88,100	1,057,200		271,200	3,254,400
	Dewatering				100,000			300,000
	Diversion Care Strm							
9	Spillway		LS	1	500,000		1	1,000,000
10	Outlet		LS	1	200,000		1	200,000
11	Diversion Structure		LS				1	200,000
12	Diversion Canal	150,000	mi				1	150,000
	Powerline Relocaton							
13	Road Realignment		LS					
	Subtotal				2,387,200			14,344,600
	Contingency (30%)				716,160			4,303,380
	Engineering (15%)				358,080			2,151,690
	TOTAL COST				**3,461,440**			**20,799,670**
	COST Per ACRE FT				**2,663**			**2,207**

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope
** 3 Row Grout Curtain
*** COT, 25 Wide w/ 1.5:1 Excavated Slopes
**** COT Length 60% of Crest Length of dam

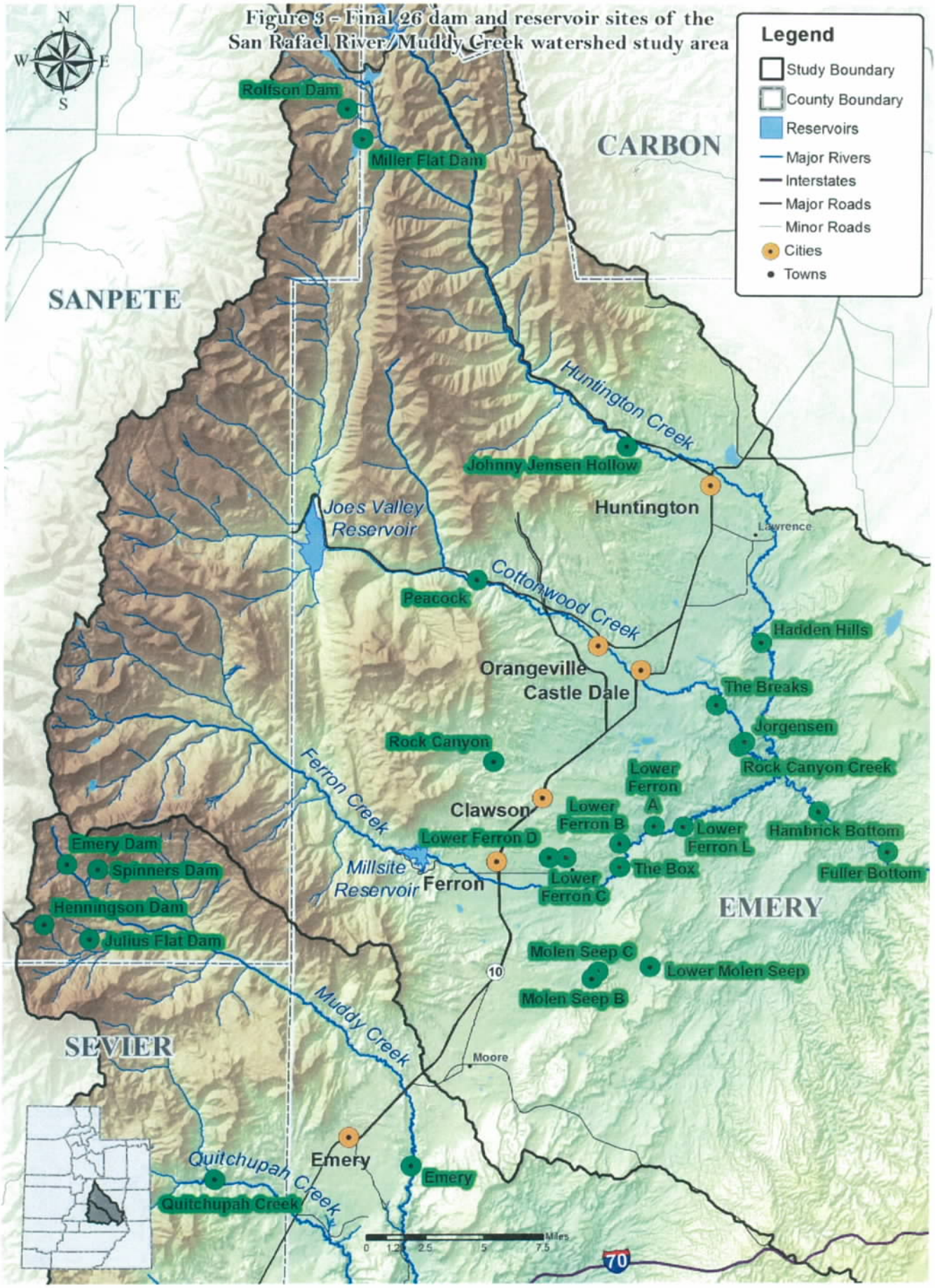


Figure 3 - Final 26 dam and reservoir sites of the San Rafael River/Muddy Creek watershed study area

Section 5
Cost Per Acre Foot
And
Final Site Ranking

It is important to note that proposed state-funded dam construction projects must demonstrate an acceptable cost-benefit ratio. Due to the reconnaissance nature of this study coupled with the potential for changes in the future use of water (conversion from agriculture to more M&I applications), a reasonable cost-benefit ratio cannot be obtained at this level of investigation. Instead, we examined the costs of previously completed agricultural and M&I projects including several Water Resource funded dams. These costs were then updated to arrive at a current representative value. Summing the cost per-acre-foot of these several dams and figuring an average, we arrive at a cost ratio of $1,600 per acre-foot. From this perspective, the highest ranking dams in this study, numbers 1 – 6 (see Table 6) meet this criterion and demonstrate an average cost per-acre-foot of $1,133. The remaining proposed dam sites (see table 6), beginning with number 7 and proceeding sequentially to number 24, exhibit an increasing deviation from the average from $2,200 to $21,700 per acre-foot. Thus, without substantial federal grants, and/or a large component of M& I water available to be marketed from storage at each site, these projects demonstrate less feasibility at this time.

Table 6 - Dams Ranked based on Cost per Acft

Ranking No.	Name	Dam		Dike		Storage	Embankment Volume		Emb(cy)/ Storage(acft)	Off Stream Diversion	Cost	Cost/Acft
		Height (ft)	Length (ft)	Height (ft)	Length (ft)	(acft)	Dam (cy)	Dike (cy)			($M)	($K/acft)
1	Emery	90'	380'			11,084	158,603		14.3	No	8.7	0.8
2	Rock Canyon Creek	80'	855'			13,741	284,492		20.7	Yes	14.2	1.0
3	Jorgensen	58'	670'			7,898	148,384		18.8	No	8.9	1.1
4	The Breaks	125'	775'			14,452	431,780		29.9	No	16.3	1.1
5	Hadden Hills	45'	775'			6,465	95,614		14.8	No	8.8	1.4
6	The Box	69'	1210'			9,738	154,385		15.8	No	14.0	1.4
7	Miller Flat 25' raise	98'	2070'			9,426	242,680		58.1	Yes	20.8	2.2
8	Lower Ferron L	90'	615'			6,378	273,798		42.9	Yes	16.9	2.6
9	Julius Flat Dam 18' raise	62'	1110'	21.8'	850	1,073	51,260	12,835	184.2	No	3.5	2.7
10	Lower Ferron A	85'	1405'			8,957	372,930		41.6	Yes	27.9	3.1
11	Rolfson Dam 12' raise	56'	1500'			1,860	108,705		142.5	No	4.1	3.3
12	Spinners Dam 24' raise	81'	1615'			1,041	52,970		144.7	Yes	4.3	4.1
13	Peacock	140'	1675'			14,518	1,769,190		121.9	No	62.0	4.3
14	Lower Molen Seep	56'	420'			1,587	77,017		48.5	No	8.6	5.4
15	Lower Ferron D	80'	1,310'			4,037	511,711		126.8	Yes	23.4	5.7
16	Lower Ferron C	68'	1375'			3,615	464,747		128.6	Yes	21.3	5.9
17	Lower Ferron B	97'	2535'			9,682	1,098,520		113.5	Yes	57.8	6.0
18	Quitchupah Creek	145'	1,290			6,249	1,327,710		212.5	No	42.8	6.9
19	Johnny Jensen Hollow	118'	825'			3,814	635,560		166.6	Yes	26.2	6.9
20	Emery Dam 31' raise	56'	1040'			537	85,143		217.2	No	3.6	6.9
21	Molen Seep C	65'	660'			1,268	132,827		104.8	No	11.5	9.1
22	Molen Seep B	68'	440'			1,322	102,668		77.6	No	13.2	10.0
23	Henningson Dam 21' raise	49'	960'			834	42,457		116.3	No	9.7	10.1
24	Rock Canyon	48'	365'	7'	220'	319	43,581	1,536	141.4	No	6.9	21.7
Not Ranked	Fuller Bottom	55'	395'			8,771	Concrete		9.2	No		
Not Ranked	Hambrick Bottom	122'	1025'			43,366	Concrete		19.4	No		
	Comparison - M & S Dam	85'	1450'	25'	1350'	2,600	1,244,550		478.7	Yes	11	4.2
	Comparison - Jackson Flat	45'	4450'			4,228	831,290		197.9	Yes	6.7	1.6

Current dams have been raised to increase reservoir capacity. Numbers are very rough due to low level of accuracy of the elevation used. For greater level of accuracy in estimating volumes, high accuracy elevation data must be acquired.

The original dam at this location was breached to stablize it. Embankment fill value is calculated for a 21' raise.

Locations that require construction of concrete dam based on being situated in a slot canyon.

ADDENDUM

As studies for this section neared completion, the request was received to look for potential reservoir storage sites for the Town of Emery. Unusually low flows in Muddy Creek have prompted Emery town to look at the benefits of a small surface storage facility. They would like to find an on- or off-stream site located upstream of their culinary diversion, capable of storing approximately 800 to 1,500 acre-feet of water. A storage reservoir would help offset widely fluctuating flows in Muddy Creek and provide a more uniform flow to their culinary system. It would serve as a hedge against the very low flows which occur during drought conditions.

Thirteen potential sites were identified as part of this effort. The sites were screened and two were found to be the most feasible. Muddy Creek 4b and Muddy Creek 4c are the preferred sites (see Figure 1). Each is an on-stream site, capable of storing just over 1,000 acre-feet of water.

For each site there is a written description of the location, land ownership, size of embankment and reservoir, geology, geologic hazards, foundation design, and other considerations. Two maps showing location of the embankment and reservoir and land ownership are also included for each site. The accompanying table contains the cursory cost estimate for each site.

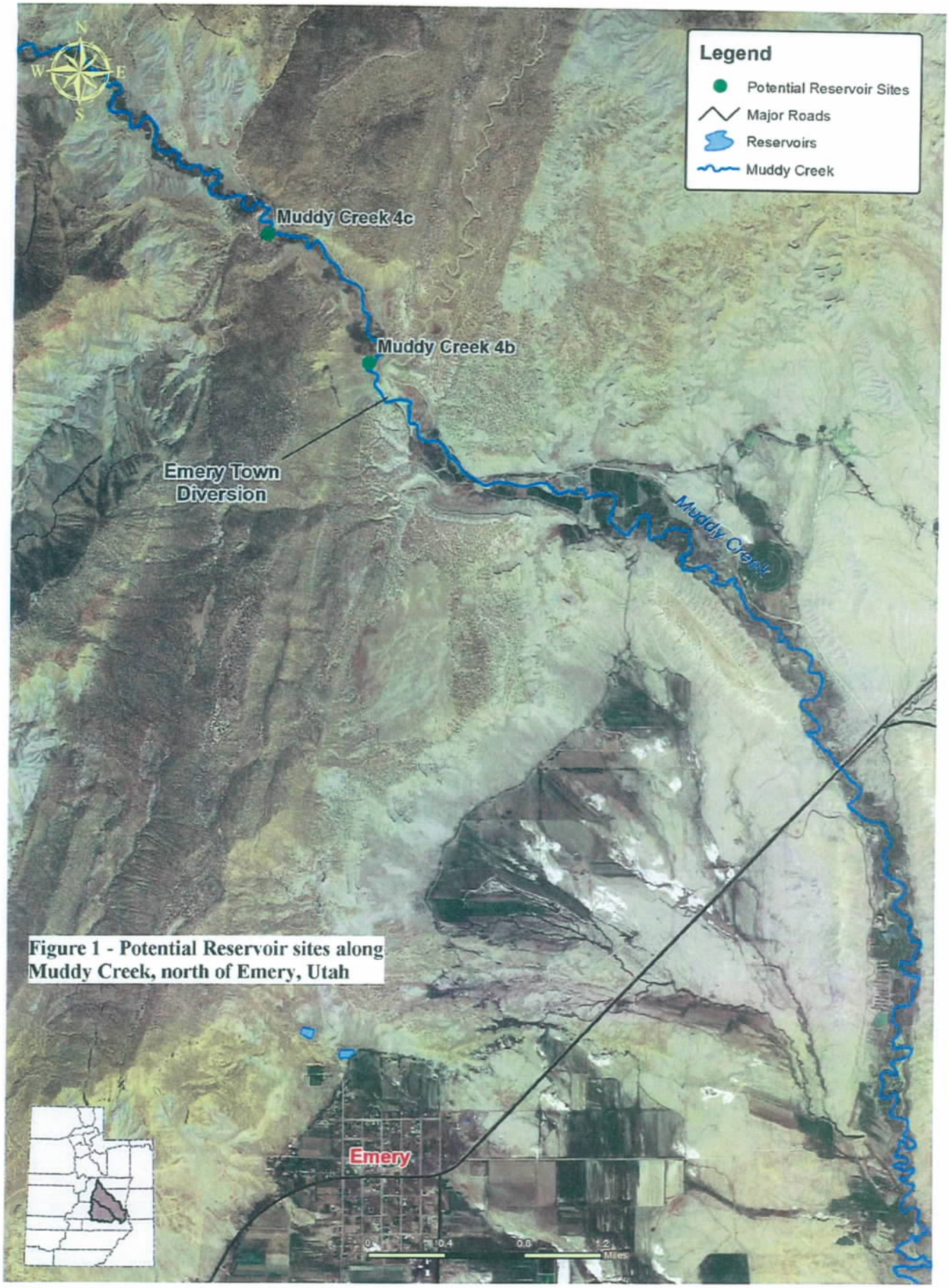


Figure 1 - Potential Reservoir sites along Muddy Creek, north of Emery, Utah

Muddy Creek 4b

Location: NE¼ Sec. 21 and SE¼ Sec. 16, T21S, R6E, SLB&M. Damsite is located on Muddy Creek, approximately 4.0 miles north of Emery.

Land Ownership: The damsite and reservoir basin occupy mostly private land with a little USFS land.

Dam Embankment: Height: 80 ft. Length: 930 ft. Volume: 291,385 cu.yds.
Crest Elev.: 6,500 ft. asl.

Reservoir: High Water Elev.: 6,495 ft. asl. Capacity: 1,265 ac.ft.

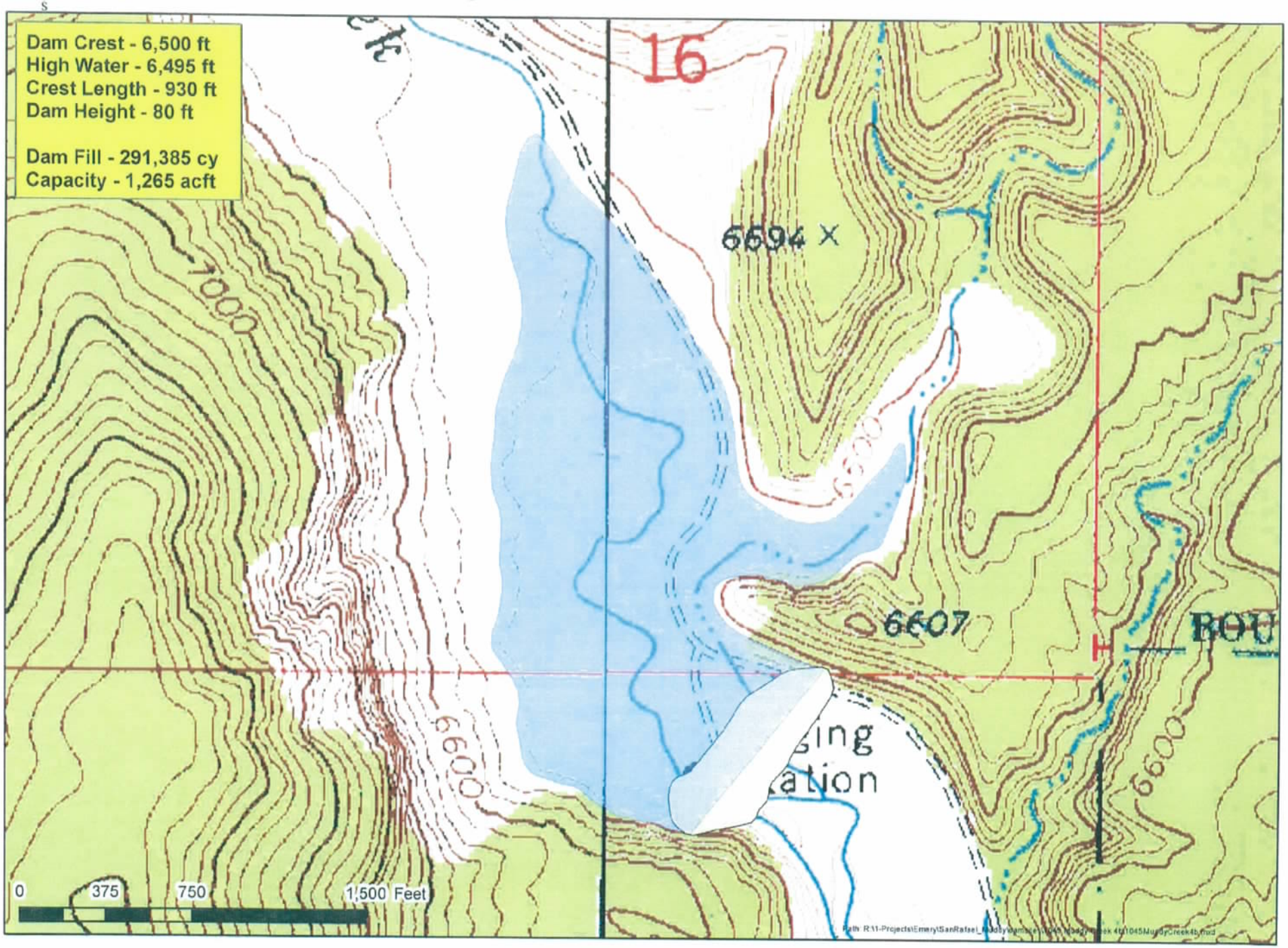
Rating Factor: (embankment volume/reservoir capacity) 230 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flanks of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The damsite and reservoir basin are located in the pale blue-grey shale and nodular, irregular bedded mudstone and siltstone of the Blue Gate Member and overlying yellow-grey, friable, fine - to medium-grained sandstone of the Emery Sandstone Member both of the Mancos Shale Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. Nearby north trending normal faults may increase the fracture density at the site. An unknown depth of alluvium overlies bedrock in the stream channel.

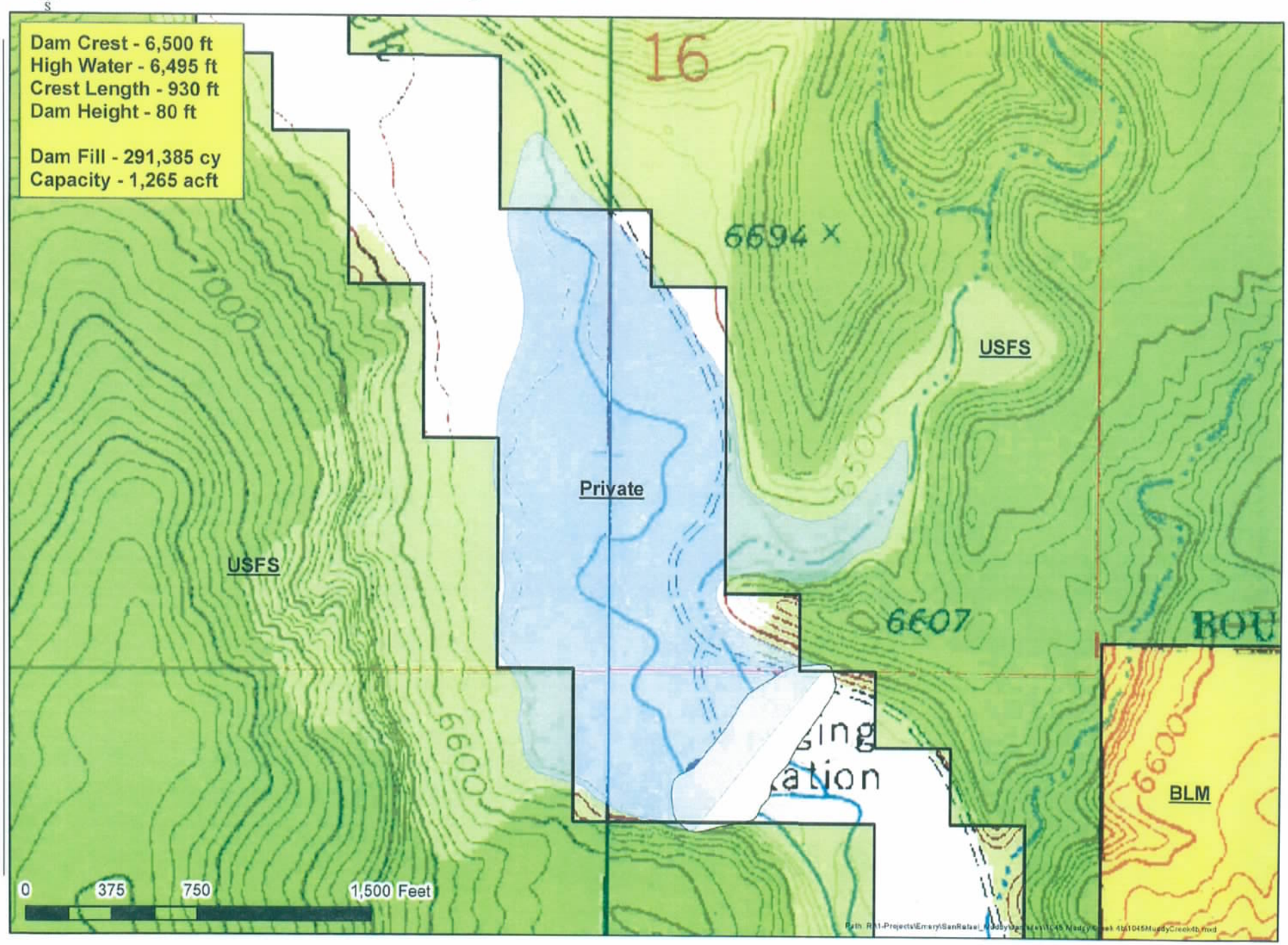
Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site may need to be improved. Sedimentation rates could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1045 Muddy Creek 4b T21S R6E Sec 21



1045 Muddy Creek 4b T21S R6E Sec 21



Muddy Creek 4c

Location: NW¼ Sec. 16 and SE¼ Sec. 8, T21S, R6E, SLB&M. Damsite is located on Muddy Creek, approximately 4.8 miles north of Emery.

Land Ownership: The damsite and reservoir basin occupy USFS land.

Dam Embankment: Height: 67 ft. Length: 520 ft. Volume: 132,740 cu.yds.
Crest Elev.: 6,630 ft. asl.

Reservoir: High Water Elev.: 6,625 ft. asl. Capacity: 1,043 ac.ft.

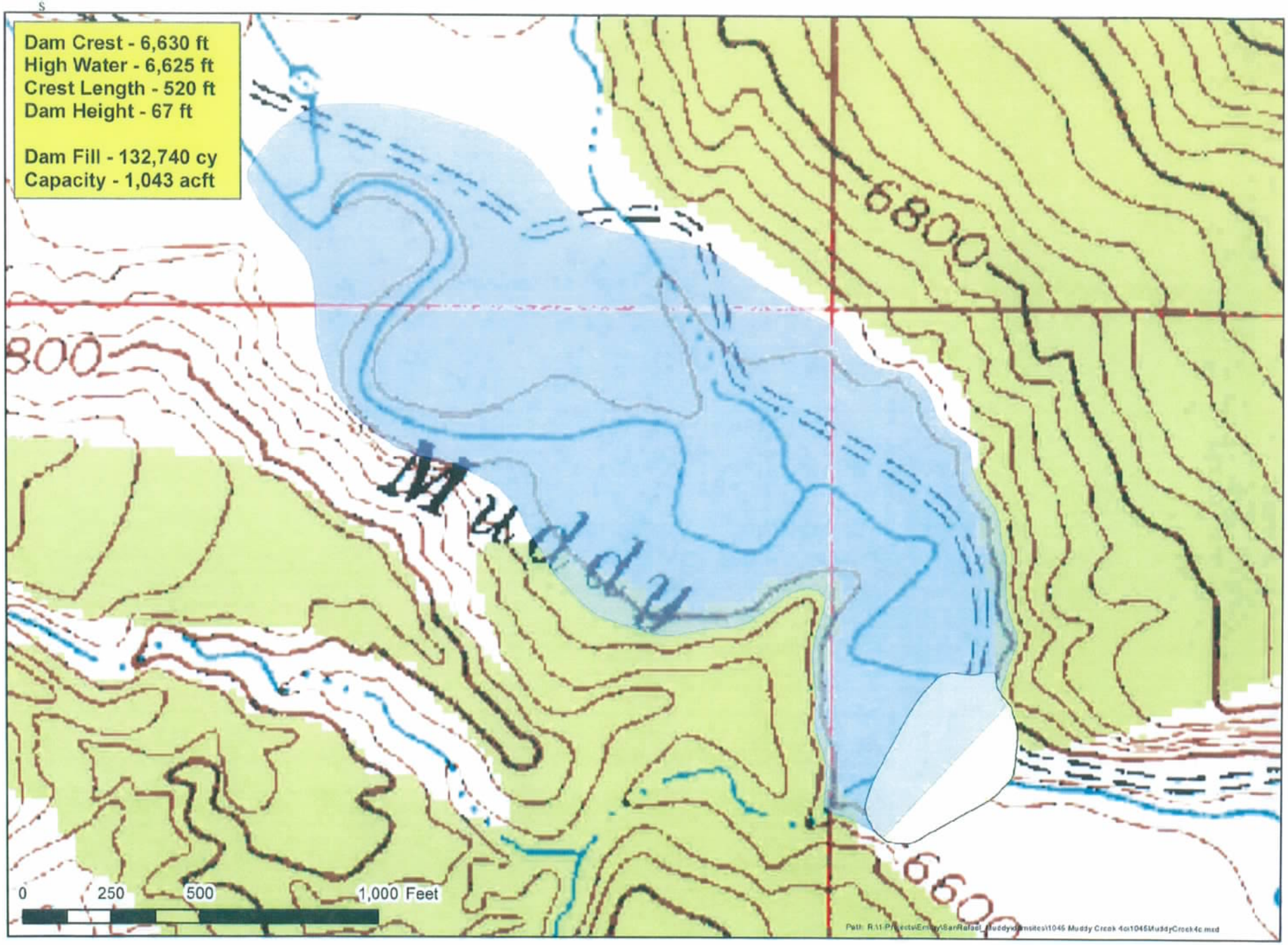
Rating Factor: (embankment volume/reservoir capacity) 127.3 cu.yds./ac.ft.

Geology: This damsite is located on the eastern flanks of the Wasatch Plateau. Bedrock in this vicinity is nearly flat lying with a gentle northwesterly dip. The damsite and reservoir basin are located in the pale blue-grey shale and nodular, irregular bedded mudstone and siltstone of the Blue Gate Member and overlying yellow-grey, friable, fine - to medium-grained sandstone of the Emery Sandstone Member both of the Mancos Shale Formation. On steep slopes, these materials may be susceptible to development of landslides or other forms of movement. Shales and their weathered section may also contain expansive elements (bentonite). At depth, the rock is tight and moderately hard, but subject to slaking on exposure to air. Soluble salts and gypsum may be present within shale bedrock in disseminated form or as fracture infilling. Nearby north trending normal faults may increase the fracture density at the site. An unknown depth of alluvium overlies bedrock in the stream channel.

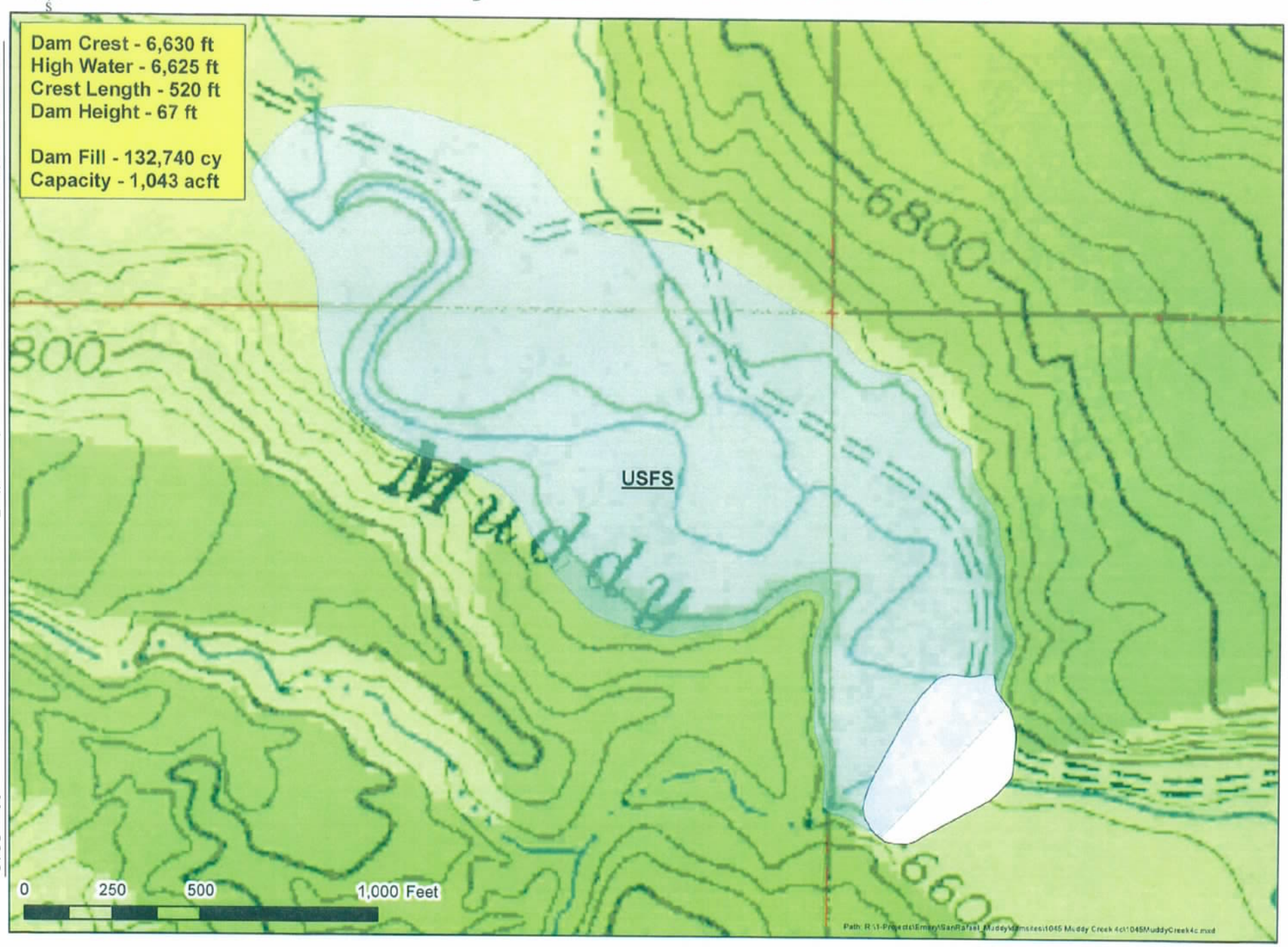
Foundation Design Considerations: Shale bedrock may contain soluble salts and/or gypsum which will require treatment and jointing in the sandstone will likely necessitate installation of a grout curtain. Although rock is generally tight, on excavation it will slake; thus special provisions will be needed to avoid prolonged air exposure of excavated surfaces during construction. Shale bedrock and its weathered components may exhibit shrink/swell characteristics which will need to be evaluated and addressed if present. Terrain in the vicinity of the proposed dam is moderately to very steep. Slopes should be carefully observed for evidence of landsliding or other forms of mass movement. Potentially deep weathering of bedrock within the center section may affect depth of cutoff. If weathered rock and alluvium is beyond reasonable depth of excavation, other foundation treatment may be needed through the center section such as slurry trench, RCC, etc.

Other Considerations: Access to the site may need to be improved. Sedimentation rates could be high at this location. Angle drill holes should be considered to investigate joints and fractures. Alluvium and weathered bedrock could provide an ample source of clay and shell material. Material suitable for use as rip-rap will likely have to be hauled in.

1045 Muddy Creek 4c T21S R6E Sec 16



1045 Muddy Creek 4c T21S R6E Sec 16



Emery County New Muddy Creek sites Cursory Cost Estimates				Muddy Creek 4b Dam: 80' tall, 930' long Storage: 1,265 acft Depth: 20' COT, 80' Slurry Trench Length of COT = 740'		Muddy Creek 4b Dam: 67' tall, 520' long Storage: 1,043 acft Depth: 20' COT, 80' Slurry Trench Length of COT = 420'	
Item	Description	Unit Price	Unit	Quantity	Total	Quantity	Total
1	Mobilization (5%)		LS	1	383,000	1	248,000
2	Access		LS	1	500,000	1	500,000
3	Clearing & Grub		LS	1	80,000	1	80,000
4	COT Exc	8	CY	30,150	241,200	17,100	136,800
5	Foundation Treat	11	SF	18,600	204,600	10,400	114,400
6	Grout Curtain**	90	SF				
	Slurry Trench	10	SF	59,200	592,000	33,600	336,000
7	Embankment*		CY	291,385		132,740	
8	Emb + COT***	12	CY	321,535	3,858,420	132,748	1,592,976
	Dewatering				300,000		300,000
	Care & Div Stream				500,000		500,000
9	Spillway		LS	1	800,000	1	800,000
10	Outlet		LS	1	400,000	1	400,000
11	Diversion		LS				
12	Diversion Canal		mi				
	Powerline Relocation						
13	Road Realignment		LS		200,000		200,000
	Subtotal				8,059,220		5,208,176
	Contingency (30%)				2,417,766		1,562,453
	Engineering (15%)				1,208,883		781,226
	TOTAL COST				11,685,869		7,551,855
	COST per ACRE FT				9,237		7,240

* Emb Dam, 25' Crest Width, 3:1 US Slope, 2:1 DS Slope

** 3 Row Grout Curtain

*** COT, 25' Wide w/ 1.5:1 Excavated Slopes

PRICE RIVER, SAN RAFAEL RIVER, AND MUDDY CREEK TMDLS FOR TOTAL DISSOLVED SOLIDS WEST COLORADO WATERSHED MANAGEMENT UNIT, UTAH

EPA APPROVAL DATE: AUGUST 4, 2004

Prepared for:

UTAH DIVISION OF WATER QUALITY

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TABLE OF CONTENTS

1.0 Introduction 1
1.1 Watershed Characterization 2
1.1.1 Land Use and Administration 5
1.1.2 Geology 6
1.1.2.1 Physiography and Topography 6
1.1.2.1 Stratigraphy and Structure 10
1.1.2.2 Mancos Shale and Blackhawk Formation 12
1.1.3 Soils 16
1.1.4 Vegetation 17
1.1.5 Climate 17
2.0 Water Quality Standards and TMDL Target Sites/Endpoints 21
2.1 Water Quality Standards 21
2.1.1 Use Designations 21
2.1.2 Numeric Criteria 23
2.1.3 Narrative Standards 23
2.1.4 Antidegradation Policy 23
2.1.5 Colorado River Salinity Standards 23
2.2 TMDL Endpoint and Target Sites 24
3.0 Water Quality Assessments and Impairment Analysis 26
3.1 Non-TDS Impairments 26
3.2 TDS Impairments- DEQ and EWCD Water Quality and Flow Data 28
3.3 Flow Data 32
3.4 Data Use and Limitations 32
3.5 Water Quality Assessment 33
3.5.1 Price River Watershed 33
3.5.1.1 Critical Seasonal Variations in TDS Concentrations 35
3.5.1.2 Critical Flow verses TDS Concentrations 36
3.5.2 San Rafael River Watershed 36
3.5.2.1 Water Chemistry 37
3.5.2.2 Critical Seasonal Variations in TDS Concentrations 41
3.5.3 Muddy Creek Watershed 48
3.5.3.1 Critical Seasonal Variations in TDS Concentrations 50
3.5.3.2 Critical Flow verses TDS Concentrations 50
3.5.4 Summary 53
4.0 Source Assessment 54
4.1 Municipal and Industrial Sources 54
4.2 Non-point Sources 57
5.0 Loading Calculations 60
5.1 Price River Watershed 61

5.2 San Rafael Watershed 64
5.3 Muddy Creek 69
6.0 TMDL and Load Allocation 72
6.1 Description of TMDL Allocation 72
6.2 Margin of Safety 72
6.3 TMDL Allocations 72
6.3.1 Existing Conditions 75
6.3.2 Summary of TDS Load Allocation 84
7.0 Public Participation 85
8.0 References 87

LIST OF TABLES

Table 1-1 Impaired Stream Segments in the Price River, San Rafael, and Muddy Creek Watersheds due to TDS loadings 2
Table 1-2 Land Use Distributions in the WCRW 5
Table 1-4 Price Temperature and Precipitation Data (1968-2000) 18
Table 1-5 Ferron Temperature and Precipitation Data (1948-2000) 19
Table 1-6 Emery Temperature and Precipitation Data (1901-1978) 20
Table 2-1 Utah Water Quality Classifications/Beneficial Uses 22
Table 2-2 Use Classifications Assigned to Stream Segments in the WCRW 22
Table 3-1 Segments Listed for Iron and Dissolved Oxygen 27
Table 3-2 DEQ and EWCD Monitoring Station Descriptions (shown on Maps 10, 11, and 12) 31
Table 3-3 USGS Flow Gages in the Price River Watershed 32
Table 3-4 USGS Flow Gages in the San Rafael Watershed 32
Table 3-5 USGS Flow Gages in the Muddy Creek Watershed 32
Table 3-6 Water Quality Data for the Price River Watershed 35
Table 3-7 Water Quality Data for the Huntington Creek Sub-watershed 38
Table 3-8 Water Quality Data for the Cottonwood Creek Sub-watershed 38
Table 3-9 Water Quality Data for the Rock Canyon Creek Sub-watershed 38
Table 3-10 Water Quality Data for the Ferron Creek Sub-watershed 39
Table 3-11 Water Quality Data for the Lower San Rafael River Sub-watershed 39
Table 3-12 Water Quality Data for the Muddy Creek Watershed 48
Table 4-1 NPDES Permit Holders, Permit Numbers, and Locations in the WCRW 55
Table 4-2 NPDES Permit Numbers, Flow, and TDS Data in the WCRW 56
Table 5-1 Loading Statistics for Station 493239, Price River Watershed 62
Table 5-2 Loading Statistics for Station 493165, Price River Watershed 62
Table 5-3 Loading Statistics for Station EWCD-03, Huntington Creek Watershed 64
Table 5-4 Loading Statistics for Station EWCD-07, Cottonwood Creek Watershed 65
Table 5-5 Loading Statistics for Station EWCD-09, Rock Canyon Creek Watershed 65
Table 5-6 Loading Statistics for Station EWCD-11, Ferron Creek Watershed 66
Table 5-7 Loading Statistics for Station 493029, Lower San Rafael River Watershed 66
Table 5-8 Loading Statistics for Station EWCD-14 Muddy Creek Watershed 70
Table 5-9 Loading Statistics for Station 495500, Muddy Creek Watershed 70
Figure 5-9 Existing TDS Loading by Flow for Station 495500 71
Table 6-1 Proposed New Permit Limits for TDS for the Existing Point Sources in WCRW. 74
Table 6-2a Summary of Average Annual TDS Load and TMDL Load Allocation for the Price River Watershed from Coal Creek to Carbon Canal Diversion 76
Table 6-2b Summary of Average TDS Load and TMDL Load Allocation for critical conditions in the Price River Watershed from Coal Creek to Carbon Canal Diversion 77
Table 6-3 Summary of Average Annual TDS Load and TMDL Load Allocation for the Price River Watershed from Confluence of Green River to Soldier Creek Confluence 78
Table 6-4 Summary of Average Annual TDS Load and TMDL Load Allocation for the Huntington Creek Watershed from Confluence with Cottonwood Creek Upstream to USFS Boundary 79
Table 6-5 Summary of Average Annual TDS Load and TMDL Load Allocation for the Cottonwood Creek Watershed from the Confluence of Huntington Creek to Highway 57 80
Table 6-6 Summary of Average Annual TDS Load and TMDL Load Allocation for the Rock Canyon Creek Watershed from Confluence with Cottonwood Creek to Headwaters 81
Table 6-7 Summary of Average Annual TDS Load and TMDL Load Allocation for the Ferron Creek Watershed from Confluence with the San Rafael River to Headwaters 81

Table 6-8 Summary of Average Annual TDS Load and TMDL Load Allocation for the Lower San Rafael River Watershed from Confluence with the Green Ricer to Confluence with Huntington Creek 82
Table 6-9 Summary of Average Annual TDS Load and TMDL Load Allocation for the Upper Muddy Creek Watershed from Confluence with Ivie Creek to Highway 10 83
Table 6-10 Summary of Average Annual TDS Load and TMDL Load Allocation for the Lower Muddy Creek Watershed from Confluence with the Fremont River to Ivie Creek Confluence 84

LIST OF FIGURES

Figure 1-1 Mean monthly precipitation at Price, Utah, 1968-2000 18
Figure 1-2 Mean Monthly Precipitation at Ferron, Utah, 1948-2000 19
Figure 1-3 Mean monthly precipitation at Emery, Utah, 1901-1978. 20
Figure 3-1 Average Monthly Flow and TDS at STORET 493281 (Price River above Price River Coal) 29
Figure 3-2 Average Monthly Flow and TDS at STORET 493239 (Price River above Price WWTP at Wellington Bridge). 29
Figure 3-3 Average Monthly Flow and TDS at STORET 493165 (Price River near Woodside at US 6 crossing) 30
Figure 3-8 Average Monthly Flow and TDS for 493029 (San Rafael River at US 24 Crossing) 44
Figure 3.9 Flow verses TDS Regression Plot for EWCD-03 (Lower Huntington Creek). 45
Figure 3-10 Flow verses TDS Regression Plot for EWCD-07 (Lower Cottonwood Creek) 46
Figure 3-11 Flow verses TDS Regression Plot for EWCD-09 (Lower Rock Canyon Creek). 46
Figure 3-12 Flow verses TDS Regression Plot for EWCD-11 (Lower Ferron Creek) 47
Figure 3-13 Flow verses TDS Regression Plot for 493029 (San Rafael River at US 24 Crossing) 47
Figure 3-14 Average Monthly Flow and TDS for 495500 (Muddy Creek at Old US 24 Crossing) 51
Figure 3-15 Average Monthly Flow and TDS for EWCD-14 (Lower Muddy Creek). 51
Figure 3-16 Flow verses TDS Regression Plot for 495500 (Muddy Creek at Old US 52
Figure 3-17 Flow verses TDS Regression Plot for EWCD-14 (Lower Muddy Creek). 52
Figure 5-1 Existing TDS Loading by Flow for Station 493239 (Price River above Price WWTP at Wellington Bridge). 63
Figure 5-2 Existing TDS Loading by Flow for Station 493165 (Price River near Woodside at US 6 Crossing) 63
Figure 5-3 Existing TDS Loading by Flow for Station EWCD-03 (Lower Huntington Creek). 67
Figure 5-4 Existing TDS Loading by Flow for Station EWCD-07 (Lower Cottonwood Creek). 67
Figure 5-5 Existing TDS Loading by Flow for Station EWCD-09 (Lower Rock Canyon Creek). 68
Figure 5-6 Existing TDS Loading by Flow for Station EWCD-11 (Lower Ferron Creek). 68
Figure 5-7 Existing TDS Loading by Flow for Station 493029 (Lower San Rafael River). 69
Figure 5-8 Existing TDS Loading by Flow for Station EWCD-14 (Lower Muddy Creek). 71
Figure 5-9 Existing TDS Loading by Flow for Station 495500 (Lower Muddy Creek). 71

LIST OF MAPS

Map 1 West Colorado River Watershed WCRW 3
Map 2 West Colorado River Watershed 4
Map 3 Price River Watershed Administrative Ownership 7
Map 4 San Rafael Watershed Administrative Ownership 8
Map 5 Muddy Creek Watershed Administrative Ownership 9
Map 6 West Colorado River Watershed Geologic Formations 11
Map 7 Price River Watershed Geologic Formations 13
Map 8 San Rafael River Watershed Geologic Formations 14
Map 9 Muddy Creek Watershed Geologic Formations 15
Map 10 Price River Watershed Sampling Locations 34
Map 11 San Rafael River Watershed Sampling Locations 40
Map 12 Muddy Creek Watershed Sampling Locations 49

APPENDICES

Appendix A Project Implementation Plan
Appendix B Water Quality Data Used for Load Calculations
Appendix C Comments on Draft Report and Response to Comments

LIST OF ACRONYMS

BLM	Bureau of Land Management
BMP	Best Management Practice
BOR	Bureau of Reclamation
CBM	coal-bed methane
cfs	cubic feet per second
DEQ	Utah Department of Environmental Quality
DO	Dissolved Oxygen
EWCD	Emery Water Conservancy District
Fe	Iron
gpm	gallons per minute
L	liter
LA	load allocation
M&I	municipal and industrial
mg	milligrams
MOS	margin of safety
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PIP	Project Implementation Plan
POC	Parameter of Concern
SCS	Soil Conservation Service
SLA	sum of individual load allocations
SWLA	sum of individual wasteload allocations
TDS	total dissolved solids
TMDL	total maximum daily load
UAC	Utah Administrative Code
USFS	United States Forest Service
USGS	United States Geological Survey
WCRW	West Colorado River Watershed
WLA	wasteload allocation

1.0 INTRODUCTION

This TMDL study has been prepared for the Price River, San Rafael River, and Muddy Creek watersheds. These three watersheds encompass a large portion of the West Colorado Watershed Management Unit located in east-central Utah. Water quality assessments completed by the Utah Department of Environmental Quality, Division of Water Quality (DEQ) in 1997 resulted in several stream segments in these watersheds being listed on the Utah's 303 (d) list for impaired waters in 2000. The DEQ determined that primarily due to high concentrations of total dissolved solids (TDS) several portions and/or tributaries of the Price River its headwaters and the Green River are non-supporting or partially supporting of their agricultural use classifications. Additionally, for certain smaller river sections, pH, dissolved oxygen (DO), and dissolved iron (Fe) are also cited as causing impairment. The water quality assessment performed by the DEQ, which was also supported by water quality sampling performed by the Emery County Water Conservancy District (EWCD), also revealed that agricultural use classifications are not being supported in several stream segments in the San Rafael and Muddy Creek watersheds as a result of high concentrations of TDS in these waters. The impaired stream segments in the watershed are listed in Table 1-1.

Section 303 (d) of the Clean Water Act requires states to identify waterbodies not currently meeting water quality standards after technology-based controls are in place. Consequently, states are required to have TMDLs established in order to attain water quality standards for impaired waters. The TMDL establishes allowable loadings for pollutants for a given waterbody. Although pH, dissolved oxygen (DO), and iron (Fe) have also been cited as causing water quality impairments in the Price River and one tributary (see Table 1-1), the focus of this TMDL study is TDS. As described in Section 3.1 of this report, analyses of available data indicate that there are no impairments attributable to DO and pH (Toole 2003).

This section of the report describes the purposes of this TMDL study, the watersheds studied, and the associated water quality impairments. Section 2 of this report describes the applicable water quality standards and the establishment of target sites and a TMDL endpoint. Section 3 discusses the assessment of the current water quality in the watersheds and impairment analysis. Section 4 addresses the sources of TDS loading in the watersheds. Section 5 describes the methods that were used to establish TDS loading capacity, and Section 6 describes the TMDL allocations required to meet established TMDL endpoints.

Table 1-1 Impaired Stream Segments in the Price River, San Rafael, and Muddy Creek Watersheds due to TDS loadings[1]

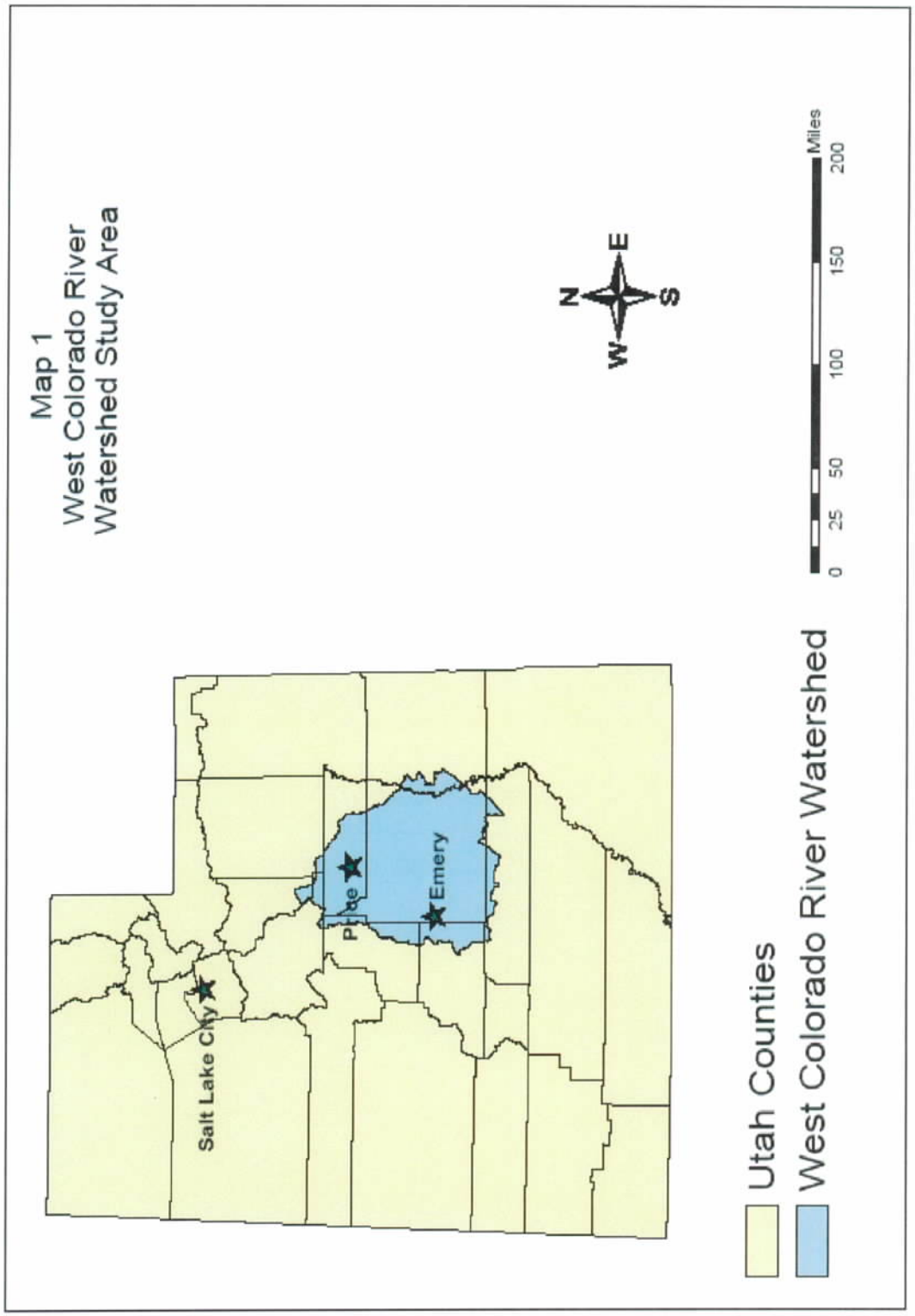
Price River Watershed	San Rafael River Watershed	Muddy Creek Watershed
Non-supporting segments[2]:	***Non-supporting segments:***	***Non-supporting segments:***
Gordon Creek and tributaries from confluence with Price River to headwaters[6]	Huntington Creek tributaries from the confluence with Cottonwood Creek to Utah highway 10	Muddy Creek and its tributaries from Quitchupah Creek confluence to the Utah Highway 10 bridge
Pinnacle Creek from confluence with Price River to headwaters[8]	Huntington Creek and tributaries from Highway 10 crossing to USFS boundary[7]	Quitchupah Creek from confluence with Ivie Creek to the Utah Highway 10 bridge
Price River and tributaries from confluence with Green River to near Woodside[3]	Cottonwood Creek from the confluence with Huntington Creek to Highway 57	Ivie Creek and its tributaries from the confluence with Muddy Creek to Utah Highway 10
Price River and tributaries from near Woodside to Soldier Creek confluence	Rock Canyon Creek from confluence with Cottonwood Creek to headwaters[5]	Muddy Creek from the confluence with Fremont River to Quitchupah Creek confluence
Upper Grassy Trail Creek from Grassy Trail Creek Reservoir to headwaters[4]	San Rafael River from Buckhorn Crossing to the confluence with Huntington Creek and Cottonwood Creek	
Partially-supporting segments[2]:	San Rafael River from the confluence with the Green River to Buckhorn Crossing	
Price River and its tributaries from Coal Creek to Carbon Canal Diversion		

Source: DEQ (2000)

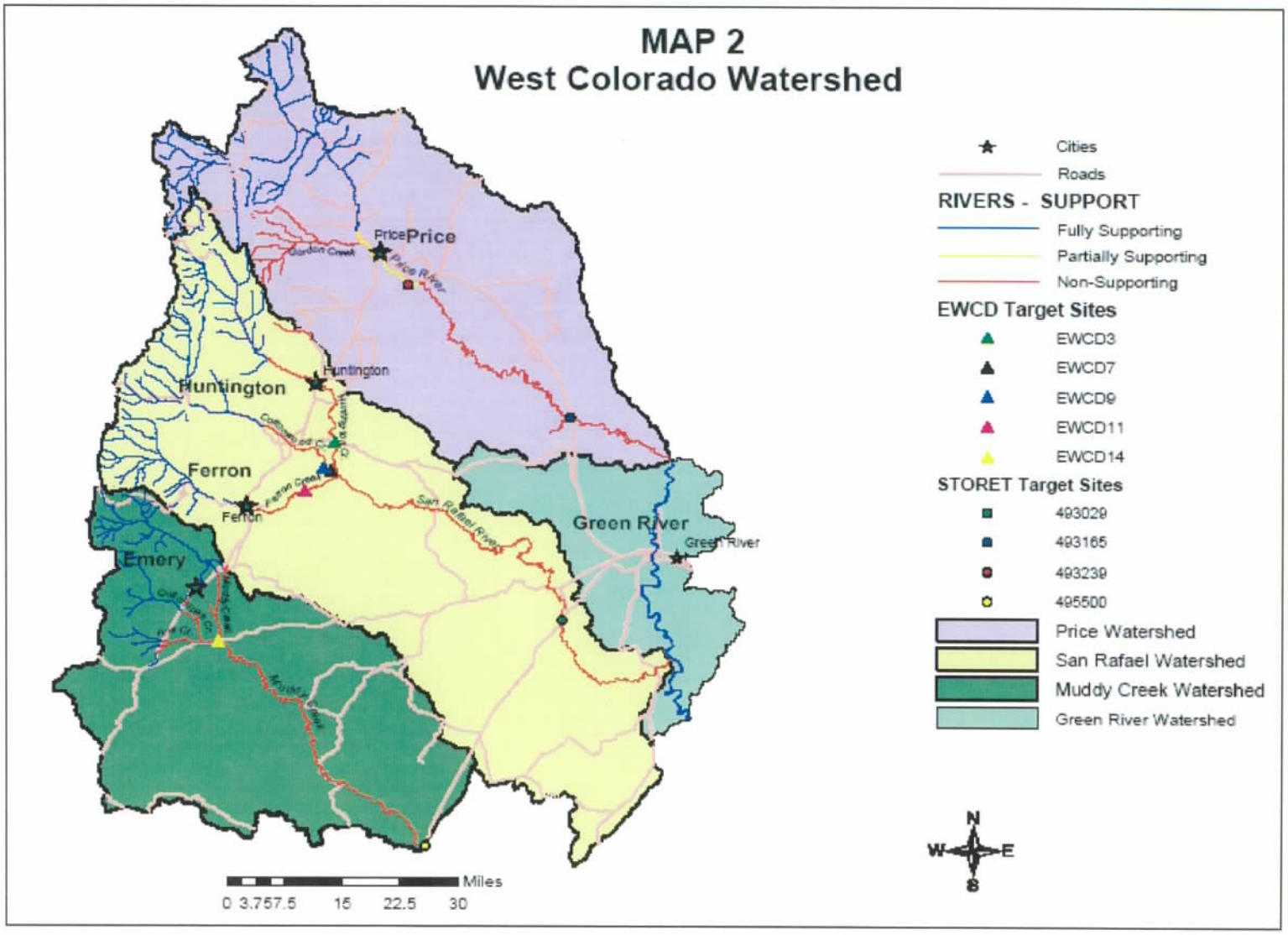
1. All impairments are due to measured TDS concentrations and also dissolved oxygen and iron concentrations as noted.
2. Non-support is defined as TDS criteria that were exceeded at least two times and the criterion was exceeded in more than 25% of the samples. Partial support for TDS is defined as criterion that was exceeded at least two times and the criterion was exceeded in more than 10% but less than 25% of the samples.
3. Includes impairment for DO and Fe
4. This reach is listed in DEQ (2000) as impaired due to pH. More recent information indicates that it is not impaired and DEQ has petitioned for delisting in the draft Utah 2004 303 (d) list of waters.
5. Rock Canyon Creek is not listed as impaired in DEQ (2000) but the available data indicate that there is impairment from TDS.
6. Gordon Creek is not listed in DEQ (2000) but recent information indicates that there is impairment from TDS.
7. This reach is not listed in DEQ (2000), but is included in the draft Utah 2004 303(d) list of waters.
8. Pinnacle Creek was originally listed as Gordon Creek

1.1 Watershed Characterization

The Price River, San Rafael River, and Muddy Creek watersheds, which collectively make up the West Colorado River Watershed (WCRW) TMDL, are located in east-central Utah, approximately 100 miles southeast of Salt Lake City (Map 1). The WCRW is generally encompassed within Carbon and Emery counties and is approximately 100 miles in length north to south and 65 miles in length east to west (Map 2). Elevations within the WCRW range from approximately 3,700 feet to 11,000 feet.


Map 1
West Colorado River
Watershed Study Area
Salt Lake City
Price
Emery
N
E
S
W
0 25 50 100 150 200
Miles
Utah Counties
West Colorado River Watershed

3


MAP 2
West Colorado Watershed
Price
Price
Price River
Huntington
Huntington
Ferron
Ferron
Ferron Creek
San Rafael River
Green River
Green River
Emery
Muddy Creek
Cities
Roads
RIVERS - SUPPORT
Fully Supporting
Partially Supporting
Non-Supporting
EWCD Target Sites
EWCD3
EWCD7
EWCD9
EWCD11
EWCD14
STORET Target Sites
493029
493165
493239
495500
Price Watershed
San Rafael Watershed
Muddy Creek Watershed
Green River Watershed
N
W
E
S
Miles
0 3.757.5 15 22.5 30

The Price River is the northernmost river in the WCRW. It is approximately 50 miles long and discharges into the Green River above Green River, Utah. The San Rafael River, located further south, is approximately 55 miles long and empties into the Green River below Green River, Utah. Muddy Creek, the southernmost river in the WCRW, is approximately 40 miles long and empties into the Dirty Devil River. The Green and Dirty Devil Rivers ultimately empty into the Colorado River. Smaller hierarchy streams in the WCRW include Gordon Creek in the Price River watershed; Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek in the San Rafael River watershed; and Quitchupah Creek and Ivie Creek in the Muddy Creek watershed. The WCRW contains approximately 2,550 perennial stream miles. Of this total, approximately 1,986 stream miles were assessed for beneficial use by the DEQ (DEQ 2000).

1.1.1 Land Use and Administration

Current land uses in the WCRW are agriculture (crop production and rangeland), mixed use public lands, and gas and coal production. There is a small amount of forest production in the higher elevations of the WCRW.

Based on data from the USGS (2000), existing land uses in the WCRW were grouped into seven general land use categories. Current land use distributions for the three watersheds in the WCRW are given in Table 1-2.

Table 1-2 Land Use Distributions in the WCRW

Land Use	Price River watershed		San Rafael River watershed		Muddy Creek watershed	
	Area (acres)	% of total area	Area (acres)	% of total area	Area (acres)	% of total area
Barren	91,737	7.0%	328,767	12%	225,932	13%
Residential	3,812	<1%	2,877	<1%	1,105	<1%
Agriculture	16,341	<1%	20,202	1%	4,618	<1%
Rangeland	792,271	66%	1,022,531	73%	662,453	75%
Forest	300,125	24%	179,300	13%	97,309	11%
Water	1,954	<1%	1,982	<1%	173	<1%
Wetland	228	<1%	304	<1%	192	<1%
TOTAL	1,206,468	100.0%	1,555,963	100%	991,782	100%

Source: USGS 2000

Approximately 73 percent of the land in the WCRW is administered by three federal agencies: the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the National Park Service (NPS). The State of Utah administers about 11 percent of the WCRW, while 16 percent is privately owned land. Land administration types and acreages for the three watersheds are listed in Table 1-3. Maps 3, 4, and 5 show the land administrative ownership for the three sub-watersheds in the WCRW.

Table 1-3 WCRW Land Ownership/Administration

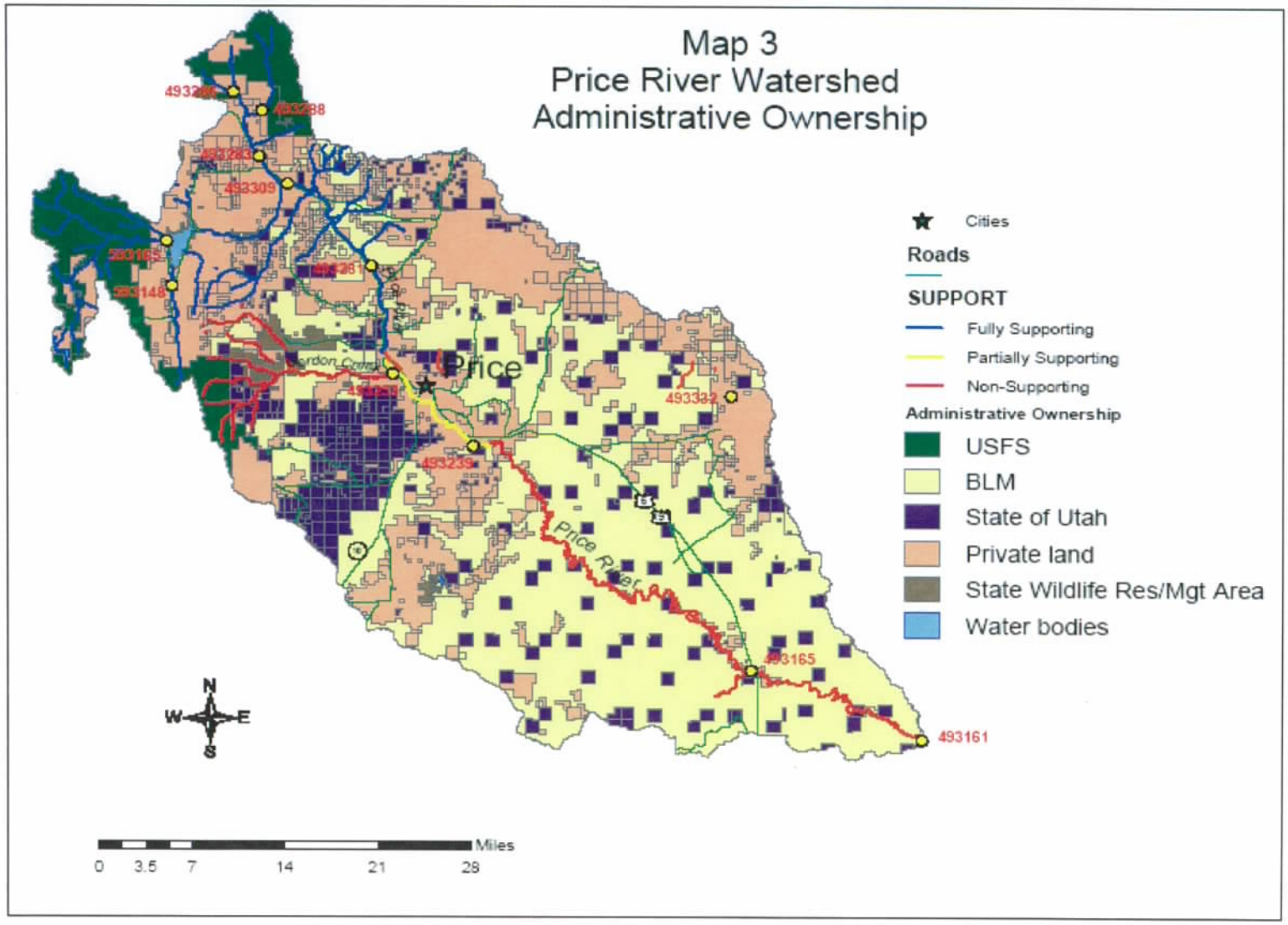
Land Ownership/ Administrator	Price watershed		San Rafael watershed		Muddy Creek watershed	
	Area (acres)	% of area	Area (acres)	% of area	Area (acres)	% of area
USFS	86,656	7%	335,920	21%	196,980	20%
BLM	532,559	44%	915,885	59%	644,929	65%
State of Utah	143,131	12%	160,256	10%	85,399	8%
Private	424,861	35%	138,847	9%	46,313	5%
Nat Parks/Mon.	0	0%	45	<1%	17,571	2%
State Parks/Rec. Areas	0	0%	393	<1%	0	0%
State Wildlife Areas	15,604	1%	1,171	<1%	0	0%
Water	3,133	<1%	2,778	<1%	91	<1%
TOTAL	1,205,944	100%	1,555,295	100%	991,283	100%

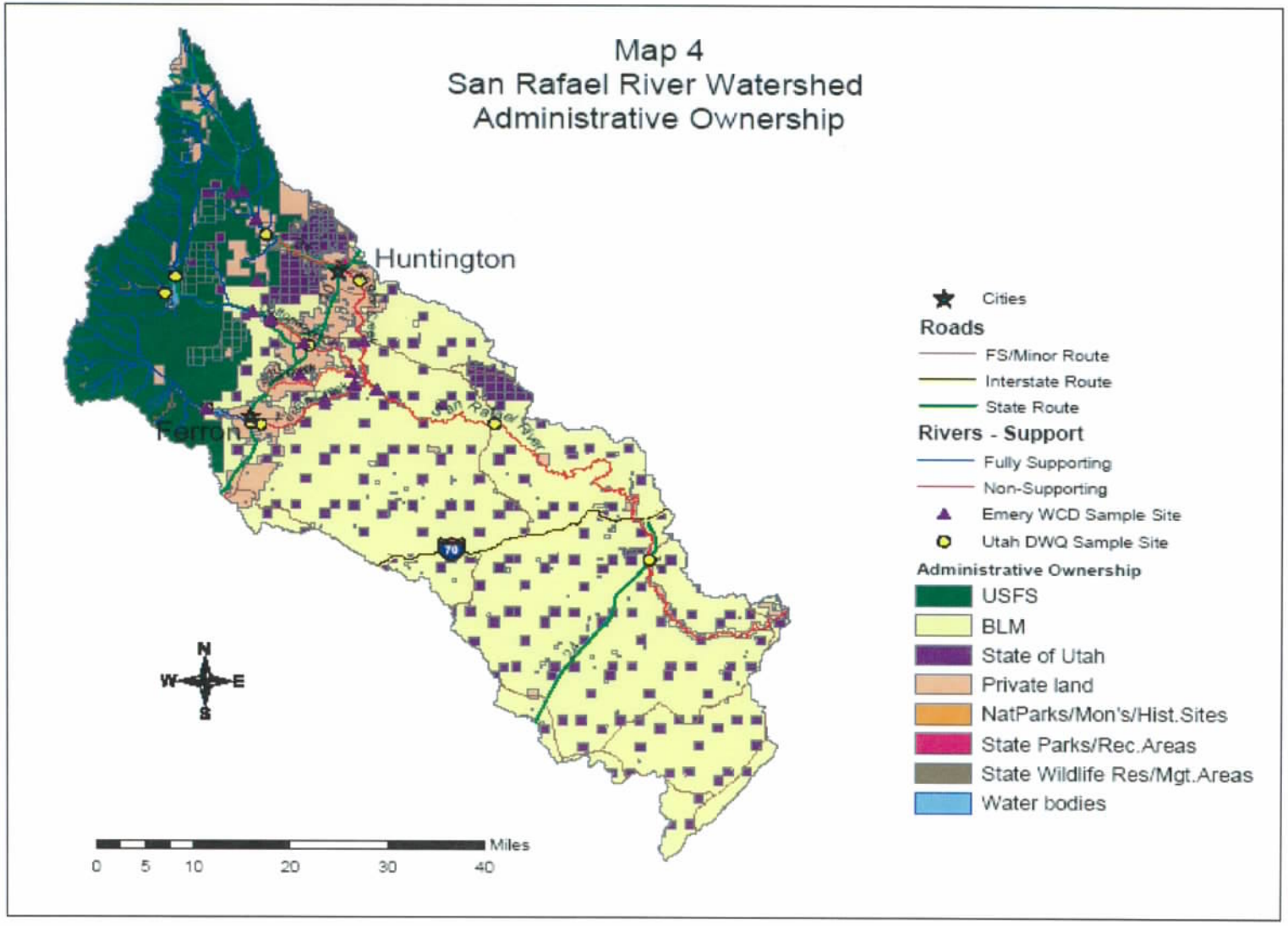
Source: DEQ 2000

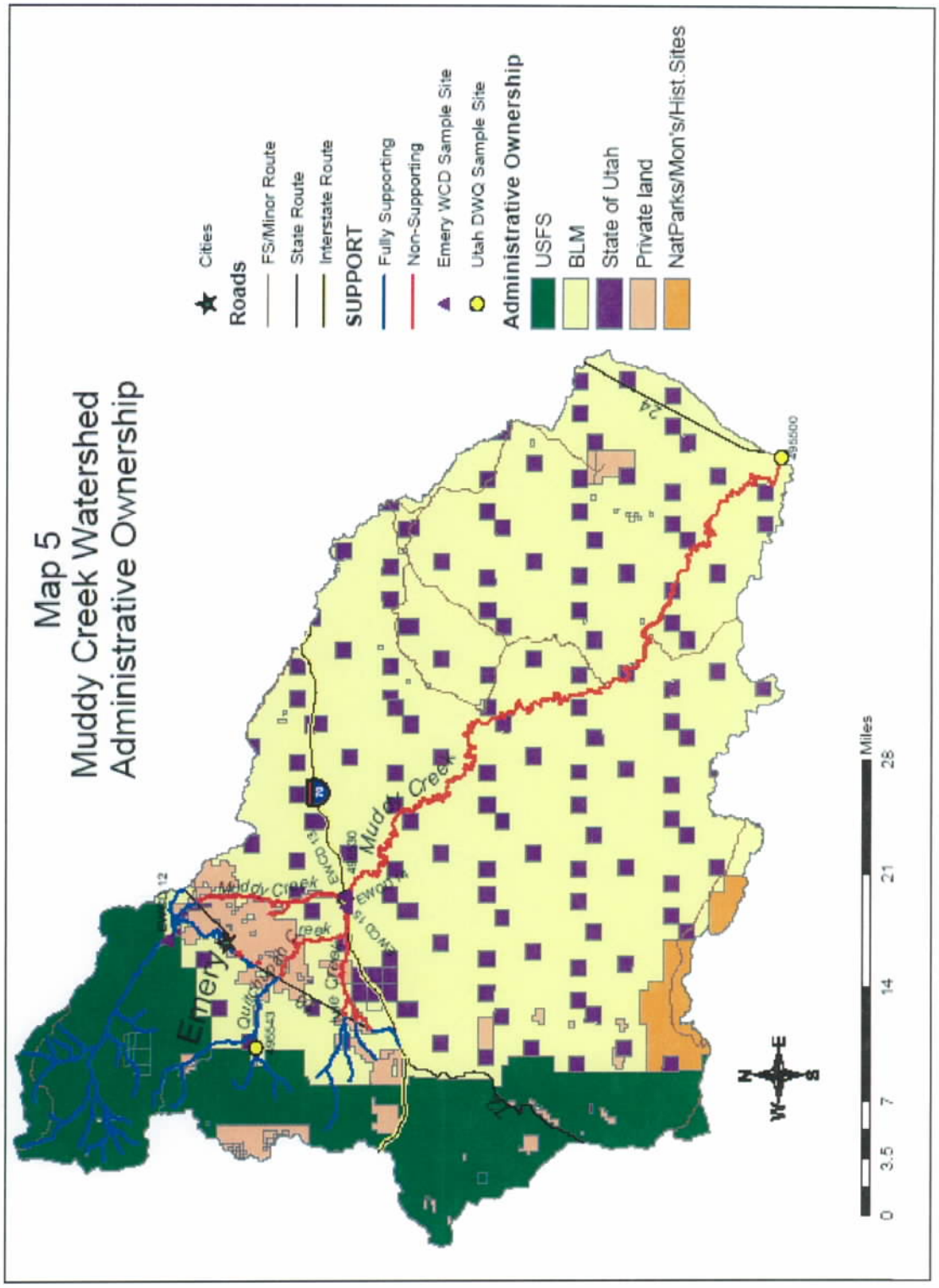
1.1.2 Geology

1.1.2.1 Physiography and Topography

The WCRW is located in the northwestern portion of the Colorado Plateau physiographic province, within the Mancos Shale Lowlands (Stokes 1986). The Mancos Shale Lowlands is characterized by sloping, gravel-covered pediments, rugged badlands and narrow, flat-bottomed alluvial valleys (Stokes 1986). The Mancos Shale Lowlands is bounded by the Book Cliffs-Roan Plateau to the north, the San Rafael Swell to the southeast, and the Wasatch Plateau to the west. The Book Cliffs-Roan Plateau is a series of erosional cliffs, including the Book Cliffs, Roan Cliffs and Badland Cliffs that separate the Mancos Shale Lowlands from the Uinta Basin to the northeast. The San Rafael Swell, an anticline structure of uplifted and exposed Paleozoic and Cretaceous rocks (Stokes 1986), is approximately 80 miles long and 30 miles wide. The Wasatch Plateau is primarily sedimentary rock that contains zones of normal faulting, which forms long, narrow horst and graben structures. The Joes Valley Fault system is found along the eastern edge of the Wasatch Plateau and separates it from the Mancos Shale Lowlands.

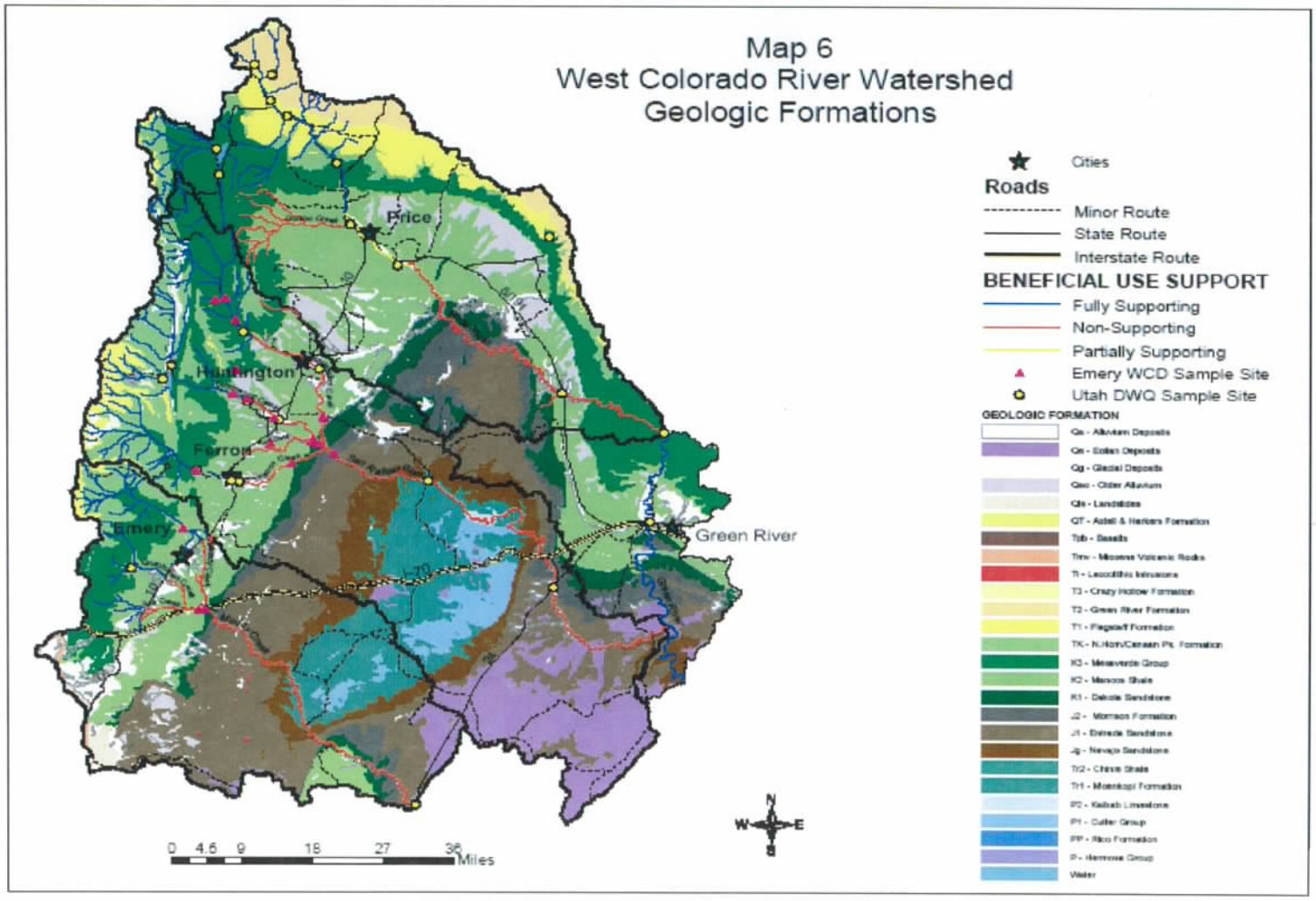

Map 3
Price River Watershed
Administrative Ownership
Cities
Roads
SUPPORT
Fully Supporting
Partially Supporting
Non-Supporting
Administrative Ownership
USFS
BLM
State of Utah
Private land
State Wildlife Res/Mgt Area
Water bodies
Price
Price River
493309
493332
493239
493165
493161
N
W
E
S
Miles
0 3.5 7 14 21 28


Map 4
San Rafael River Watershed
Administrative Ownership
Huntington
Ferron
San Rafael River
70
N
W
E
S
Miles
0 5 10 20 30 40
Cities
Roads
FS/Minor Route
Interstate Route
State Route
Rivers - Support
Fully Supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
Administrative Ownership
USFS
BLM
State of Utah
Private land
NatParks/Mon's/Hist.Sites
State Parks/Rec.Areas
State Wildlife Res/Mgt.Areas
Water bodies


Map 5
Muddy Creek Watershed
Administrative Ownership
Cities
Roads
FS/Minor Route
State Route
Interstate Route
SUPPORT
Fully Supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
Administrative Ownership
USFS
BLM
State of Utah
Private land
NatParks/Mon's/Hist.Sites
Emery
Muddy Creek
Miles
0
3.5
7
14
21
28
N
W
E
S

1.1.2.1 Stratigraphy and Structure

Stratigraphic units in the WCRW include exposed igneous and sedimentary units that range from Triassic to Tertiary in age (Map 6). The exposed rocks include limestone, sandstone, shale, conglomerate, coal, and various types of igneous rocks. Units of the Mesaverde Group form the distinct cliffs along the northern and western edge of the WCRW. Within the Mesaverde Group is the coal-bearing Blackhawk Formation. The Mancos Shale Formation is exposed in the middle reaches of the WCRW. Within the Mancos Shale, the Ferron Sandstone Member is a source of coal and groundwater. Surrounding the San Rafael Swell are the Dakota Sandstone, Morrison Formation, Entrada Sandstone, Navajo Sandstone, and Chinle Shale units.

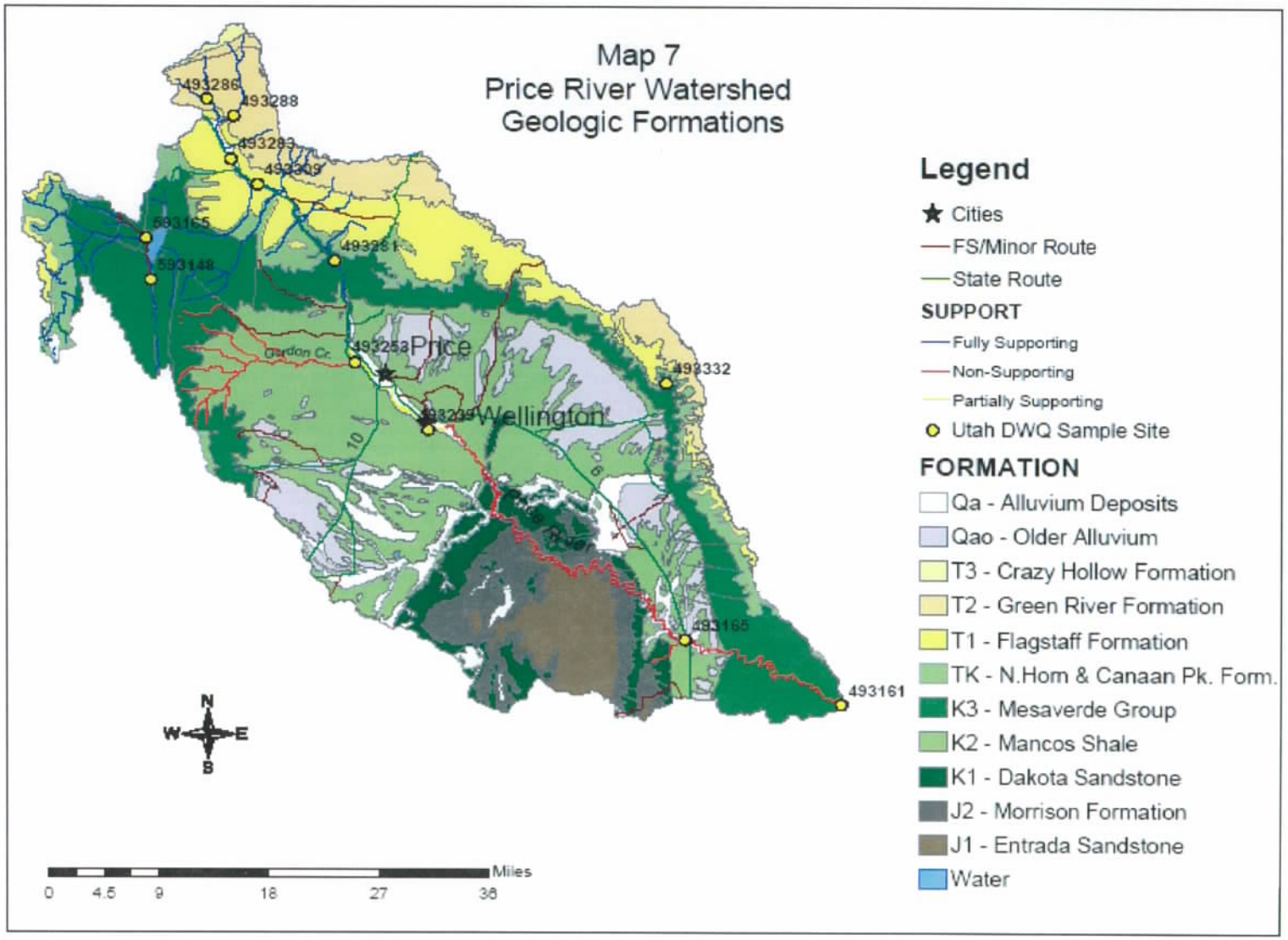

Map 6
West Colorado River Watershed
Geologic Formations
Cities
Roads
Minor Route
State Route
Interstate Route
BENEFICIAL USE SUPPORT
Fully Supporting
Non-Supporting
Partially Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
GEOLOGIC FORMATION
Qa - Alluvium Deposits
Qe - Eolian Deposits
Qg - Glacial Deposits
Qao - Older Alluvium
Qls - Landslides
QT - Astell & Harlem Formation
Tob - Basalts
Tmv - Miocene Volcanic Rocks
Ti - Laccolithic Intrusions
T3 - Crazy Hollow Formation
T2 - Green River Formation
T1 - Flagstaff Formation
TK - N.Horn/Canaan Pk. Formation
K3 - Mesaverde Group
K2 - Mancos Shale
K1 - Dakota Sandstone
J2 - Morrison Formation
J1 - Entrada Sandstone
Jg - Navajo Sandstone
Tr2 - Chinle Shale
Tr1 - Moenkopi Formation
P2 - Kaibab Limestone
P1 - Cutler Group
PP - Rico Formation
P - Hermosa Group
Water
Price
Huntington
Ferron
Emery
Green River
0 4.5 9 18 27 36 Miles
N
W
E
S

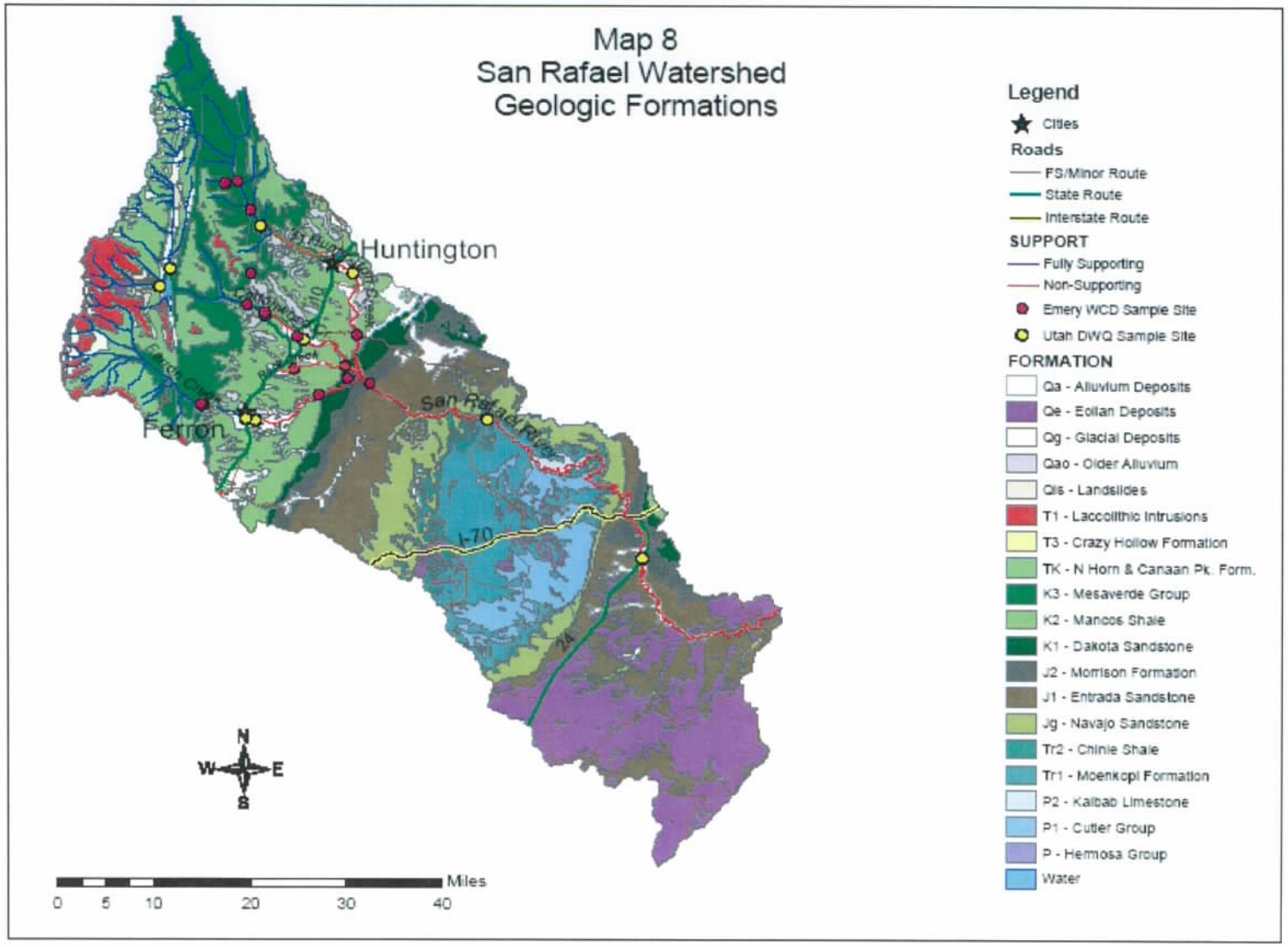
1.1.2.2 Mancos Shale and Blackhawk Formation

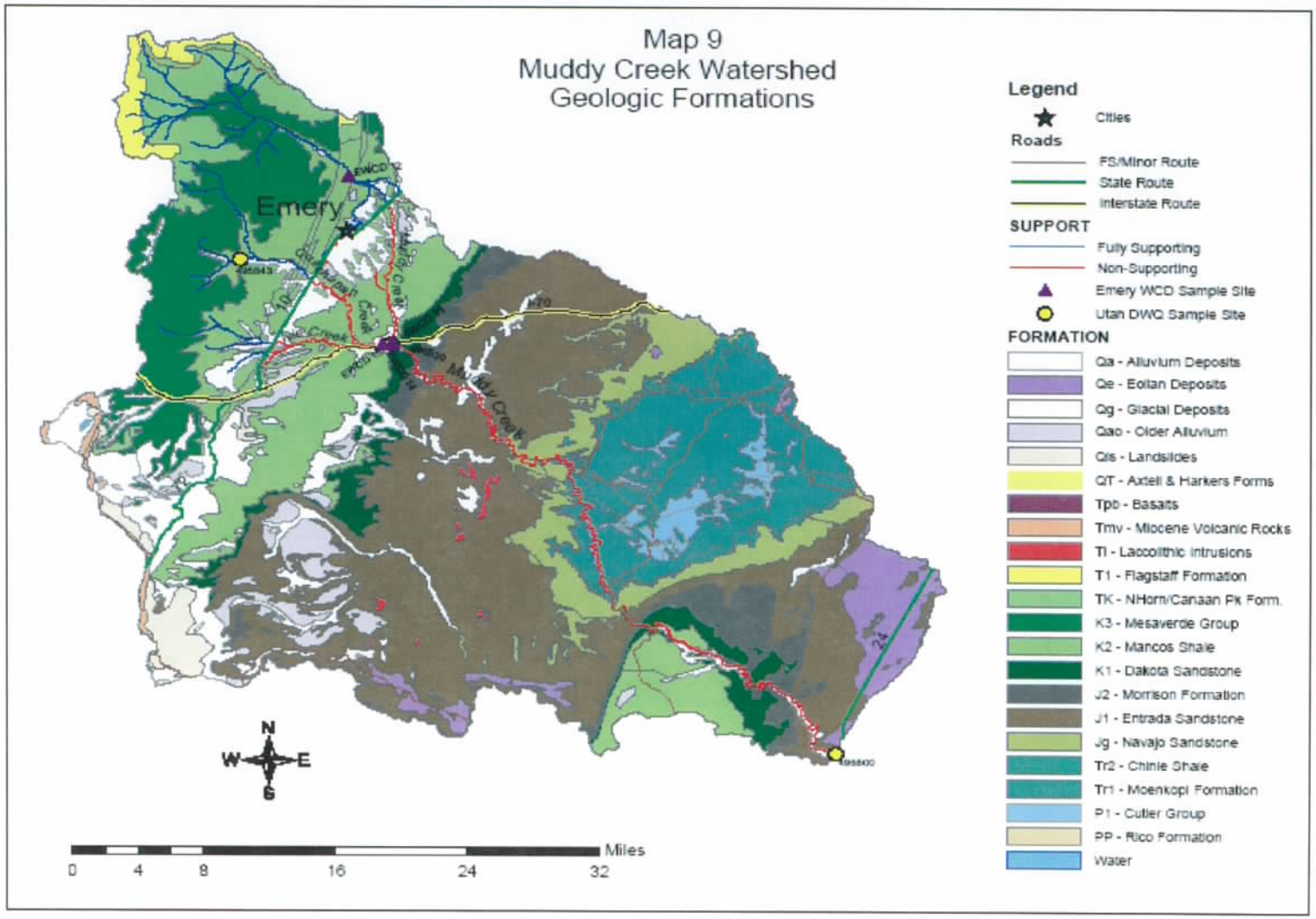
Due to their geochemical composition, range of exposure in the WCRW, and erodability from physical contact with water, the Mancos Shale and Blackhawk Formations present natural sources of soluble salts. Both are similar in composition in that they contain coal-bearing beds, formed in coastal-marine environments, and are predominately shale units. Through mineral dissolution and cation/anion exchange, shale and coal beds are a known contributor of increased TDS in surface water and groundwater (Freeze and Cherry 1979).

The Mancos Shale Formation is a known source of soluble sodium-sulfate minerals such as mirabilite ($Na_2SO_4 \cdot 10H_2O$) and thenardite (Na_2SO_4) (Waddell et al. 1979). Thickness of the Mancos Shale ranges from 2,300 to 6,100 feet. It consists of six members, the Upper Blue Gate, Emery Sandstone, Blue Gate, Garley Canyon Sandstone, Ferron Sandstone, and Tununk Shale, that were deposited from the transgression and regression of coastal marine environments (BLM 2000, Frazier and Schwimmer 1987). The Upper Blue Gate Member is a light to dark-gray shale and shaley siltstone with minor thin sandstone beds. The Emery Sandstone consists of two fine-grained, light brown quartzose sandstones with an average thickness of 285 feet. A gray, thin-bedded shale averaging 35 to 50 feet thick separates the two sandstones units. The Blue Gate Member consists of light bluish gray thin-bedded shale and shaley siltstones that range in thickness from 1,600 to more than 3,500 feet (BLM 1999). The Garley Canyon Sandstone consists of two thin, cliff forming sandstone beds, separated by shale, which ranges in thickness from 70 to 220 feet (BLM 1999). The Ferron Sandstone consists of alternating fluvial-deltaic sandstones and thick coals, which range in thickness from 250 to 490 feet (BLM 2000). Deposition of the Ferron Sandstone occurred by a repeating series of wave and river dominated shorelines, delta plains, and bog swamp facies (BLM 1994). The Tununk Shale consists of light- to dark-gray, thin-bedded shale and shaley siltstones that range in thickness from 400 to 650 feet (BLM 2000).

The Blackhawk Formation of the Mesaverde Group is an important large coal-bearing formation. It consists of bedded quartzose sandstones with shaley siltstone, shale, carbonaceous shale, and coal beds that intertongue with and pinch-out into the Mancos Shale (BLM 1997, Hettinger and Kirschbaum 2002). Thickness of the Blackhawk Formation ranges from 700 feet to approximately 1,250 feet (BLM 1999, Hettinger and Kirschbaum 2002). Maps 7, 8, and 9 show the geologic formations for the three watersheds in the WCRW.


Map 7
Price River Watershed
Geologic Formations
Legend
Cities
FS/Minor Route
State Route
SUPPORT
Fully Supporting
Non-Supporting
Partially Supporting
Utah DWQ Sample Site
FORMATION
Qa - Alluvium Deposits
Qao - Older Alluvium
T3 - Crazy Hollow Formation
T2 - Green River Formation
T1 - Flagstaff Formation
TK - N.Horn & Canaan Pk. Form.
K3 - Mesaverde Group
K2 - Mancos Shale
K1 - Dakota Sandstone
J2 - Morrison Formation
J1 - Entrada Sandstone
Water
Price
Wellington
493286
493288
493283
493309
593165
593148
493281
493253
493332
493165
493161
N
W
E
S
Miles
0
4.5
9
18
27
36


Map 8
San Rafael Watershed
Geologic Formations
Huntington
Ferron
San Rafael River
I-70
24
Legend
Cities
Roads
FS/Minor Route
State Route
Interstate Route
SUPPORT
Fully Supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
FORMATION
Qa - Alluvium Deposits
Qe - Eolian Deposits
Qg - Glacial Deposits
Qao - Older Alluvium
Qls - Landslides
T1 - Laccolithic Intrusions
T3 - Crazy Hollow Formation
TK - N Horn & Canaan Pk. Form.
K3 - Mesaverde Group
K2 - Mancos Shale
K1 - Dakota Sandstone
J2 - Morrison Formation
J1 - Entrada Sandstone
Jg - Navajo Sandstone
Tr2 - Chinle Shale
Tr1 - Moenkopi Formation
P2 - Kaibab Limestone
P1 - Cutler Group
P - Hermosa Group
Water
N
W
E
S
Miles
0 5 10 20 30 40


Map 9
Muddy Creek Watershed
Geologic Formations
Emery
Muddy Creek
Legend
Cities
Roads
FS/Minor Route
State Route
Interstate Route
SUPPORT
Fully Supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
FORMATION
Qa - Alluvium Deposits
Qe - Eolian Deposits
Qg - Glacial Deposits
Qao - Older Alluvium
Qls - Landslides
QT - Axtell & Harkers Forms
Tpb - Basalts
Tmv - Miocene Volcanic Rocks
Tl - Laccolithic Intrusions
T1 - Flagstaff Formation
TK - NHorn/Canaan Pk Form.
K3 - Mesaverde Group
K2 - Mancos Shale
K1 - Dakota Sandstone
J2 - Morrison Formation
J1 - Entrada Sandstone
Jg - Navajo Sandstone
Tr2 - Chinle Shale
Tr1 - Moenkopi Formation
P1 - Cutler Group
PP - Rico Formation
Water
N
W
E
S
Miles
0
4
8
16
24
32

Soils

Information regarding soils data was taken from the Natural Resource Conservation Service (NRCS 2003). Soil series that dominate the WCRW are Casmos, Hanksville, Moenkopie, Nakai, Sheppard, and Strych. These soils can be characterized by the parent material and the climatic zones in which they were formed.

Higher elevations in the WCRW (8,000 to 11,000 feet), where the average annual precipitation ranges from 22-40 inches per year, have developed deeper soil profiles than lower elevation areas, where the average annual precipitation ranges from 6-8 inches per year. The loamy soils in the higher elevations are generally well drained, exhibit moderately rapid permeability, and relatively high organic matter content. Although slopes range from 20 to 70 percent in the upper regions of the WCRW, the high percentage of vegetative cover in these areas holds the soil in place. High elevation soils were derived mainly from igneous material and are thus low in soluble salts. Therefore, these soils provide little TDS loading into stream segments in the WCRW. Land use in the higher elevations of the WCRW is centered on forestry and livestock grazing. These soils are predominantly represented by Bundo, Castino, Midfork, Skylick, and Trag soil series.

The middle portions of the WCRW are dominated by soils that were derived predominately from marine shale deposits. Slopes in the area range from 0 to 10 percent, and the mean annual precipitation is approximately 7 inches. The shale derived soils, along with the underlying shale deposits in these areas, are a significant source of TDS loading in WCRW streams. Water moving within the soil profile can dissolve salts and convey them to the streams in surface runoff and via groundwater. Groundwater in contact with the underlying shale formations provides an additional source of TDS loading in WCRW streams.

Soils in the middle portion of the WCRW, where most of the irrigated agricultural land is located, are dominated by two distinctly different soil textural types: silty clay loams and sandy clay loams. The silty clay loam soils are represented by the Billings, Chipeta, Penoyer, Ravola, Saltair and Killpack soil series. These soils are fine textured, exhibit slow permeability and moderate to rapid runoff, and are thus susceptible to erosion caused by irrigation and intense thunderstorms. The soluble salt content of these soils ranges from 0.08 to 2.1 percent and is due to the shaly parent material from which they were derived. The sandy clay loams are represented by the Sanpete and Sanpete-Minchey soil series. These soils contain a significant amount of sand, exhibit moderate to rapid permeability and slow runoff, and have soluble salt contents ranging from 0.02 to 0.7 percent.

Lower portions of the WCRW are dominated by soils that are derived primarily from sedimentary and igneous rocks. The soils derived from sedimentary material are generally calcareous in nature and are therefore also a potential source of TDS loading in the lower portions of the WCRW. Slopes in the lower region range from 0 to 60 percent. Permeability and runoff from these soils is moderate. Land use in this portion of the WCRW is associated with livestock grazing.

1.1.3 Vegetation

The amount of precipitation, along with slope aspect, generally determines the type of vegetation found in the WCRW. Vegetation cover ranges from spruce, fir, and aspen at higher elevations, where precipitation averages nearly 30 inches per year, to cheatgrass, ricegrass, blackbrush, greasewood, and atriplex at lower elevations, where the average annual precipitation is about 7 inches per year. Mid-elevation areas, where the annual precipitation averages from 10-15 inches per year, are dominated by juniper, sagebrush, rabbitbrush, and ricegrass.

The distribution and occurrence of some of the lower elevation species, notably greasewood and atriplex, is somewhat controlled by the concentration of salt in the soil. These species can withstand salt concentrations in excess of 10,000 parts per million (Skougard and Brotherson 1979), well above the threshold for non-salt tolerant species.

1.1.4 Climate

The average annual precipitation at lower elevations in the WCRW ranges from over 9 inches at Price to less than 8 inches at Emery. Lower elevations of the WCRW receive most of the yearly total precipitation in the spring and summer months. Summer precipitation is generally from localized, intense thunderstorms that may cause erosion due to increased runoff. Higher elevations in the Wasatch Plateau receive in excess of 30 inches per year, 70 percent of which falls in the October-April time period (USGS 1986a). Winter precipitation in the WCRW usually is in the form of snow. The accumulation of snow, especially in the higher elevations, provides support for plant communities at the base of the mountains as well as along river courses. Runoff from snowmelt is used for irrigation purposes, municipal use, and by industry.

Average daily temperatures in the WCRW range from approximately 8 to 90 degrees Fahrenheit (Western Regional Climate Center 2003). Temperature and precipitation data for Price, Ferron, and Emery are summarized in Tables 1-4, 1-5, and 1-6 and Figures 1-1, 1-2, and 1-2, respectively.

Table 1-4 Price Temperature and Precipitation Data (1968-2000)

Month	Maximum ^{0}F	Minimum ^{0}F	Mean ^{0}F	Maximum (in./month)	Minimum (in./month)	Mean (in./month)
January	36.9	13.4	25.1	2.57	0	0.8
February	42.8	19.7	31.2	3.81	0	0.76
March	52.5	27.6	40.1	2.38	0	0.74
April	63.2	34.6	48.9	2.01	0	0.53
May	72.5	42.9	57.7	2.34	0	0.73
June	83.8	52.1	68.1	2.41	0	0.61
July	90	58.3	74.2	3.14	0.01	0.9
August	88.4	57	72.7	4.21	0.02	1.07
September	79.5	48.1	63.9	3.12	0	1.1
October	64.8	37.5	51	4.34	0	1.32
November	49.5	25.7	37.3	3.47	0	0.6
December	40.1	16.7	28.4	1.51	0	0.48
ANNUAL	63.7	36.1	49.9	17.46	5.83	9.65

(Data source: Western Regional Climate Center` 2003.)

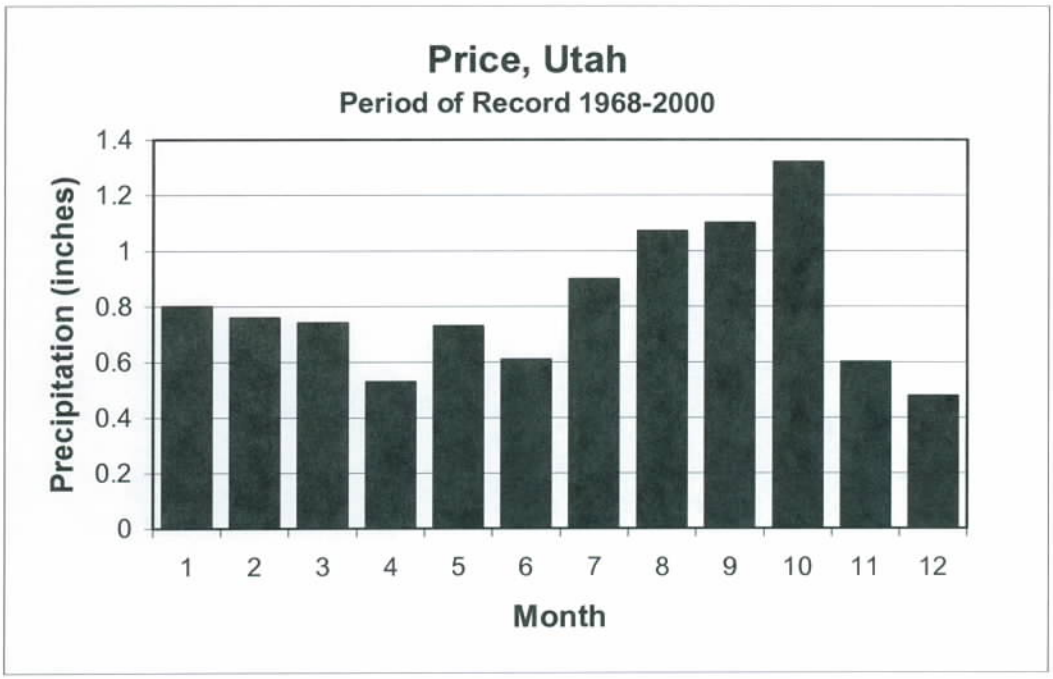


Figure 1-1 Mean monthly precipitation at Price, Utah, 1968-2000

Table 1-5 Ferron Temperature and Precipitation Data (1948-2000)

Month	Maximum ^{0}F	Minimum ^{0}F	Mean ^{0}F	Maximum (in./mo)	Minimum (in./mo)	Mean (in./mo)
January	35.8	11.1	23.5	2.65	0	0.67
February	41.7	17.2	29.4	2.41	0	0.59
March	51	25.3	38.2	1.88	0	0.61
April	60.7	33.3	47	2.3	0	0.5
May	70.6	42.4	56.5	2.24	0.03	0.74
June	80.7	51.1	65.9	1.95	0	0.5
July	87.3	57.8	72.5	3.47	0.01	0.89
August	84.9	55.4	70.2	3.14	0.01	1.12
September	77.3	46.7	62	4.36	0	0.96
October	65.6	35.3	50.4	2.64	0	0.84
November	49.6	22.9	36.3	2.73	0	0.55
December	38.4	14	26.2	1.71	0	0.5
ANNUAL	62	34.4	48.2	13.82	5.03	8.47

(Data source: Western Regional Climate Center 2003.)

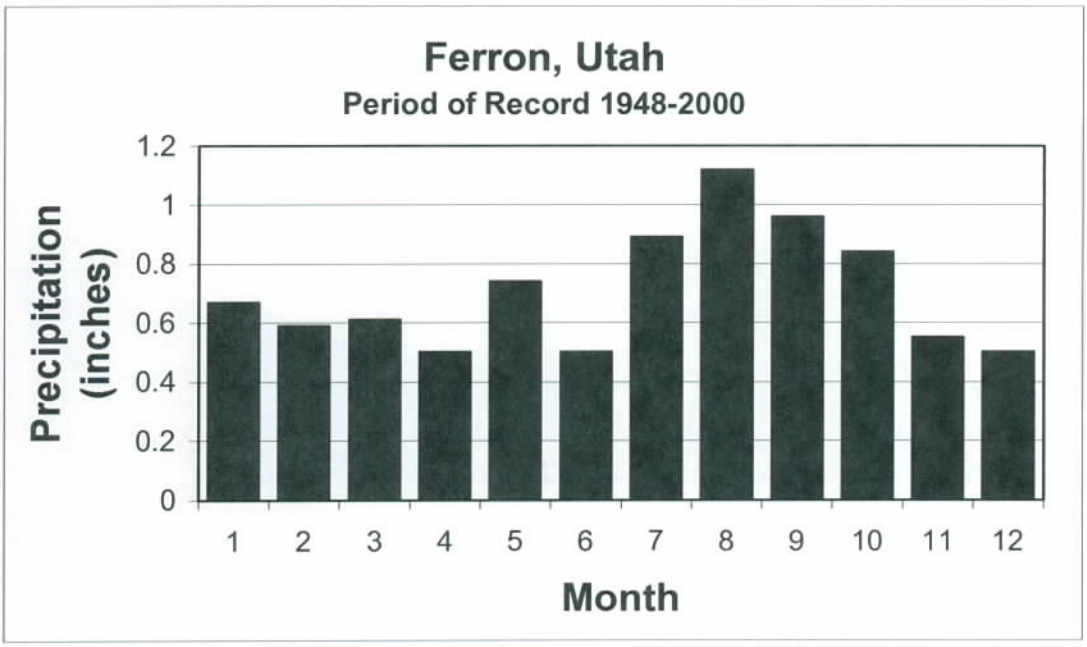


Figure 1-2 Mean Monthly Precipitation at Ferron, Utah, 1948-2000

Table 1-6 Emery Temperature and Precipitation Data (1901-1978)

Month	Maximum ^{0}F	Minimum ^{0}F	Mean ^{0}F	Maximum (in./month)	Minimum (in./month)	Mean (in./month)
January	36.7	10.9	23.9	2.5	0	0.47
February	42	16.1	29.1	3.01	0	0.5
March	49.7	22.8	36.2	1.97	0	0.43
April	59.3	30	44.6	2.6	0	0.39
May	68.8	37.8	53.3	4	0	0.6
June	77.6	45.4	61.5	3.34	0	0.51
July	83.2	52.2	67.7	4.26	0	0.83
August	81.3	50.7	66	5.47	0	1.12
September	74.4	42	58.2	3.48	0	0.9
October	63.3	32.3	47.8	3.87	0	0.81
November	49.7	21.6	35.7	2	0	0.33
December	39.3	13.5	26.4	1.7	0	0.44
ANNUAL	60.4	31.3	45.9	16.84	0.94	7.33

(Data source: Western Regional Climate Center 2003.)

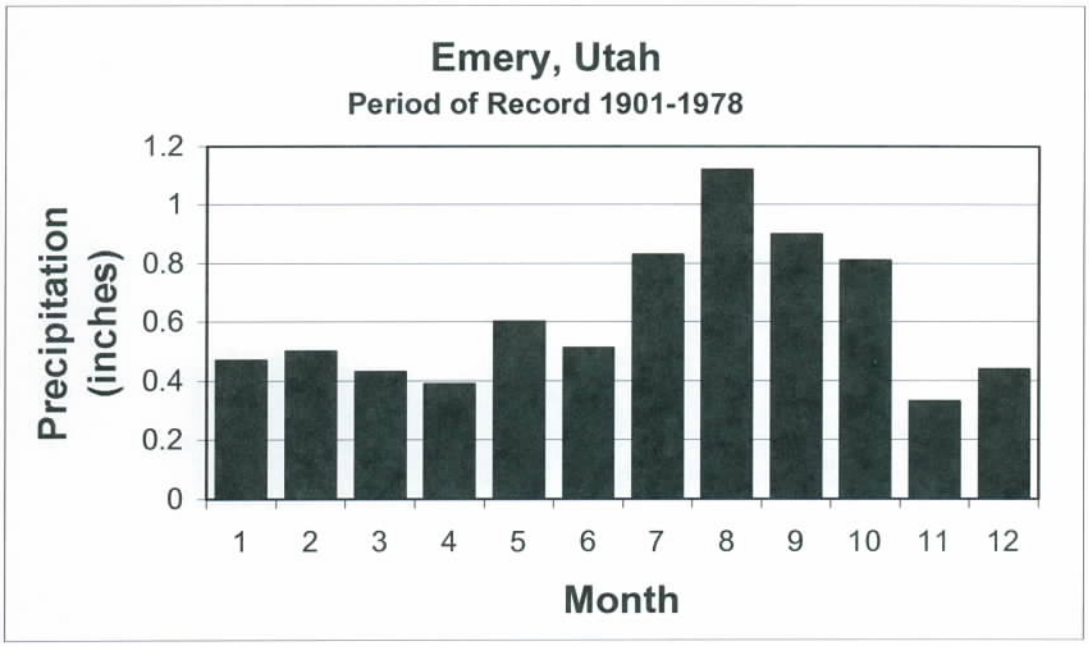


Figure 1-3 Mean monthly precipitation at Emery, Utah, 1901-1978

2.0 UTAH WATER QUALITY STANDARDS AND TMDL TARGET SITES/ENDPOINTS

The purpose of a TMDL is to attain and maintain applicable water quality standards. The TMDL specifies the maximum amount of a pollutant that a body of water can receive in order to meet these goals.

In order to evaluate the attainment of acceptable water quality, measurable in-stream endpoints must be established. These endpoints may be narrative or numeric criteria, and represent the water quality goals that are to be met by load reductions specified in the TMDL. The criteria for this TMDL are based on Utah state water quality standards (UAC 2003). Target sites represent those locations along the streams in the WCRW where constituent loads are calculated and allocated to upgradient sources contributing load to the target site. In this TMDL, target sites were selected downgradient of the three distinguishable land uses in each of the watersheds: 1) upper forest lands, 2) middle agricultural and urban uses, and 3) BLM rangeland. The target sites were selected at locations where there was sufficient chemical and flow data to allow for the calculation of constituent loads.

2.1 Water Quality Standards

Water quality standards applicable to streams within the WCRW are comprised of designated uses and numerical criteria. Narrative standards, as well as the State of Utah's antidegradation policy, also apply. Additionally, streams in the WCRW are protected by requirements of *Proposed Water Quality Standards for Salinity including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System* (June 1975) and subsequent supplements and revisions.

2.1.1 Use Designations

The DEQ has classified the waters in the State of Utah so as to protect the beneficial uses designated within each stream reach. These classifications and associated beneficial uses are presented in Table 2.1. The beneficial use classification assigned to the Price River, San Rafael River, Muddy Creek, and their tributaries are presented in Table 2-2.

Table 2-1 Utah Water Quality Classifications/Beneficial Uses

Class 1	Protected for uses as a raw water source for domestic water systems Class 1A: Reserved Class 1B: Reserved Class 1C: Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water
Class 2	Recreational and aesthetic use Class 2A: Protected for primary contact recreation such as swimming Class 2B: Protected for secondary contact recreation such as boating, wading or similar uses
Class 3	Protected for use by aquatic wildlife Class 3A: Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain Class 3B: Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain Class 3C: Protected for non-game fish and other aquatic life, including necessary aquatic organisms in their food chain Class 3D: Protected for waterfowl, shore birds, and other water-oriented wildlife not included in Classes 3A, 3B or 3C, including the necessary aquatic organisms in their food chain Class 3E: Severely habitat-limited waters
Class 4	Protected for agricultural uses including irrigation of crops and stock watering
Class 5	The Great Salt Lake. Protected for primary and secondary contact recreation, aquatic wildlife, and mineral extraction

Source: Utah Administrative Code (UAC) R317-2-6

Table 2-2 Use Classifications Assigned to Stream Segments in the WCRW

Stream Segment	Use Classifications
Gordon Creek and tributaries from confluence with Price River to headwaters	1C, 2B, 3A, 4
Pinnacle Creek from confluence with Price River to headwaters	1C, 2B, 3A, 4
Grassy Trail Creek and tributaries from Grassy Trail Creek reservoir to headwaters	1C, 2B, 3A, 4
Price River and tributaries from confluence with Green River to near Woodside	2B, 3C, 4
Price River and tributaries from near Woodside to Soldier Creek confluence	1C, 2B, 3A, 4
Price River and tributaries from Coal Creek to Carbon Canal Diversion	1C, 2B, 3A, 4
Portion of Lower Grassy Trail Creek	2B, 3C, 4
Huntington Creek and tributaries from Utah Highway 10 to headwaters	1C, 2B, 3A, 4
Huntington Creek and tributaries from the confluence with Cottonwood Creek to Utah highway 10	2B, 3C, 4
Cottonwood Creek from the confluence with Huntington Creek to highway 57	2B, 3C, 4
San Rafael River from Buckhorn Crossing to the confluence with Huntington Creek and Cottonwood Creek	2B, 3C, 4
San Rafael River from the confluence with the Green River to Buckhorn Crossing	2B, 3C, 4
Muddy Creek and its tributaries from Quitchupah Creek confluence to the Utah highway 10 bridge	2B, 3C, 4
Muddy Creek from the confluence with Fremont River to Quitchupah Creek confluence	2B, 3C, 4
Quitchupah Creek from confluence with Ivie Creek to the Utah highway 10 bridge	2B, 3C, 4
Ivie Creek and its tributaries from the confluence with Muddy Creek to Utah highway 10	2B, 3C, 4

Source: Utah Administrative Code (UAC) R317-2-13.1

2.1.2 Numeric Criteria

Numeric criteria, set forth in Utah Administrative Code (UAC) R317-2-14, have been promulgated for each of the beneficial use classes assigned to waters in the State. Of the use classifications assigned to the streams in the WCRW, numeric criteria for TDS only apply for agricultural use (beneficial use class 4). The numeric criterion for TDS in the WCRW streams is 1,200 mg/L. Although this numeric criterion has been established, Section R317-2-14 of the UAC provides that TDS limits may be adjusted if the adjustment does not impair the beneficial use of the receiving water.

2.1.3 Narrative Standards

In addition to numeric criteria, narrative standards set forth at UAC R317-2-7.2 also apply to the WCRW streams. These narrative standards generally address the discharge or placement of wastes or other substances in a waterbody that are offensive, that will cause conditions that produce undesirable aquatic life or tastes in edible aquatic organisms, that result in undesirable physiological responses in aquatic life, or that produce undesirable human health effects.

2.1.4 Antidegradation Policy

The State's antidegradation policy is set forth at UAC R317-2-3. If a water body has a better water quality than necessary to support its designated uses, the antidegradation policy requirements dictate that the existing water quality shall be maintained and protected, unless the State finds that a lowering of water quality is necessary to accommodate important economic or social development in the area in which the water is located. The antidegradation policy applies to three categories of high quality waters designated by the State.

Waters in the State designated as High Quality Waters – Category 1 are listed at UAC R317-2-12.1. As set forth in UAC R317-2-12.1.1, these include all surface waters geographically located within the outer boundaries of the U.S. National Forests, whether on public or private lands, with limited exceptions. Portions of Gordon Creek, Huntington Creek, Cottonwood Creek, Muddy Creek, and Quitchupah Creek are located within the outer boundary of the Manti-La Sal National Forest and are, therefore, designated Category 1, High Quality Waters.

2.1.5 Colorado River Salinity Standards

Due to the concern of the adverse impacts of high salinity concentrations on water use, the Colorado River Basin states established the Colorado River Basin Salinity Control Forum in 1973 to address the

issue of salinity in the Colorado River System. The Forum submitted to the EPA in June 1975 a report entitled *Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control-Colorado River System*. A supplement was issued on August 26, 1975, entitled *Supplement, Including Modifications to Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System, June 1975*. These standards require the development of a plan that would maintain the flow-weighted average annual salinity at or below 1972 levels. As set forth at UAC R317-2-4, waters of the Colorado River and its tributaries shall also be protected by these requirements.

2.2 TMDL Endpoint and Target Sites

This TMDL establishes an endpoint and target sites where loading capacities for TDS are calculated and allocated to upgradient sources contributing TDS load to a target site. The initial endpoint selected for this TMDL for TDS is the water quality criterion of 1,200 mg/L. This endpoint may be modified at selected target sites to reflect an adjustment in the TDS criterion based on specific site conditions as allowed for under the Utah water quality standards. The basis for selection of site-specific criteria for TDS is discussed in the Project Implementation Plan, which is Appendix A of this report.

The Price River, San Rafael River, and Muddy Creek watersheds can be divided into upper, middle, and lower reaches, based generally on land uses within the watersheds. As discussed in Section 3 of this report, water quality in the upper reaches of the watersheds meets TDS water quality standards. Land in this portion of the watershed is primarily forest lands managed by the BLM or USFS. TDS loading sources (e.g., Mancos Shale) and activities contributing TDS loading to streams in the watersheds (e.g., irrigation) predominantly occur in the middle sections of the watersheds, and it is within and below these areas where impairment in water quality is first noted. Much of the land in this section of the watershed is privately owned, and is where the majority of the irrigated land and urban areas are located. Impairment of water quality is also present in the lower reaches of the watershed. This portion of the watershed is primarily BLM administered land. Target sites in each watershed were located based on these watershed characteristics, as well as other considerations. These other considerations included bracketing sources within defined sub-watersheds and the amount and availability of water quality and flow data taken at and around the target site locations that allowed for the adequate assessment of water quality in the stream reaches above the target sites.

Two target sites were selected for establishing a TMDL in the Price River watershed, five target sites were selected in the San Rafael River watershed, and two target sites were selected for the Muddy Creek watershed. The selected target sites are shown on Map 2.

3.0 WATER QUALITY ASSESSMENTS AND IMPAIRMENT ANALYSIS

Surface water quality and flow data for all three watersheds within the WCRW were available from a number of sources, including the U.S. Environmental Protection Agency (USEPA) STORET data retrieval system (including data collected by the DEQ), the U.S. Geological Survey (USGS), and the Emery Water Conservancy District (EWCD). Together with other available information, such as watershed characteristics, and permitted discharge monitoring reports, these available data were compiled and reviewed to evaluate water quality impairment and to identify and characterize the significant causes and sources of TDS loading to surface waters in the WCRW.

3.1 Non-TDS Impairments

While the majority of impaired sections within the WCRW are listed due to TDS, there are also reported impairments due to pH, iron, and dissolved oxygen (DEQ 2000). Only one stream segment, Lower Grassy Creek Trail (Table 1-1) is listed as impaired due to pH. This segment is only 1.74 miles in length (DEQ 2000). The review of the STORET data for this segment over the period of 1997 to 2002 indicated that there are no exceedances (N=11) of the pH criterion (range of 6.5-9.0) for lab-analyzed pH samples. There is a single exceedance (pH=10; June 1998) for a field-measured pH value, although the corresponding lab analyzed pH for that date of 8.53 is within the standard range. Based on the data evaluation, this segment of Grassy Creek should not be listed as pH impaired. DEQ is petitioning for delisting in the draft Utah 2004 303 (d) list of waters.

The segment of the Price River between Utah DEQ STORET Stations 493165 (Price River at Woodside) and 493161 (Price River confluence with Green River) is listed as non-supporting for Class 3C waters in the West Colorado Watershed Unit, Water Quality Assessment Report (DEQ 2000). As noted in the Utah DEQ assessment report, this segment of the Price River is listed as non-supporting due to low dissolved oxygen (DO) and excess dissolved iron. The chronic criterion of Class 3C surface waters for dissolved oxygen is a minimum of 5.0 mg/L (30 day average) and a dissolved iron concentration of 1.0 mg/L.

This segment of the Price River is located between the San Rafael Swell to the south and the Uinta Uplift province to the north. Bedrock in this area includes those of the Mancos Shale and Mesa Verde Group. The Mancos Shale is mainly comprised of marine mudstones and siltstones with interbedded sandstone members that have been found to contain high amounts of soluble salts (Halite, Gypsum) in the shale and sandstones. The Mesa Verde Group includes sandstones with interbedded shale and coal seams. Sandstone formations within the study area have been found to contain iron-containing minerals as part of their mineralogy.

DO and iron measurements from Utah DWQ STORET Stations 493165 and 493161 were used for the assessment report (DEQ 2000) and for this study. In order to account for natural sources of dissolved iron, stations 493281, 493239, and 493253 that are located upstream of 493165 and 493161, and within the Mancos Shale and Mesa Verde Group formations, were also examined. A summary of the data is provided below in Table 3-1.

Table 3-1 Segments Listed for Iron and Dissolved Oxygen

STORET Station	Name	Period of Record	Number of Samples		Range		Mean		Number of Exceedances		Percent Exceedance	
			Fe (mg/L)	DO (mg/L)	Fe (mg/L)	DO (mg/L)	Fe (mg/L)	DO (mg/L)	Fe (mg/L)	DO (mg/L)	Fe (mg/L)[1]	DO (mg/L)[2]
493165	Price River at Woodside	1976 - 2002	47	258	0.01-1.48	3.86-14.45	0.13	8.91	3[3]	1[4]	6%	0.4%
493161	Price River at mouth	1980 - 2002	19	12	0.01-4.49	4.3-10.6	0.56	7.43	3[5]	2[6]	16%	17%

Notes: 1. Utah DEQ Dissolved Iron Water Quality Criterion of 1.0 mg/L (Class 3C).
2. Utah DEQ Minimum Acute Dissolved Oxygen Water Quality Criterion of 5.0 mg/L (Class 3C)
3. 2/16/1995 (1.2 mg/L),8/8/1995 (1.2 mg/L), 2/3/2000 (1.48 mg/L).
4. 7/30/1998 (3.86 mg/L).
5. 10/21/1997 (4.49 mg./L), 5/25/1998 (1.65 mg/L), 8/19/2001 (2.87mg/L).
6. 6/23/1998 (4.3 mg/L), 10/21/1997 (4.7 mg/L).

Dissolved oxygen measurements from the Lower Price River are summarized in Table 3-1 for the range and mean of measurements for the period of record shown. As shown in Table 3-1, there are some limited exceedances of the 5.0 mg/L DO minimum set by the Utah DEQ (Table 3-1). However, there have not been any exceedances of the DO standard at these locations within the last three years, which indicates that there are no current impairments based on DO. Based on discussions with Tom Toole of the Utah Department of Water Quality, these segments will be removed as impaired in the next 305(b) listing, and have been petitioned for delisting in the draft Utah 2004 303 (d) list of waters.

Dissolved iron measurements from the Lower Price River are summarized in Table 3-1 for the minimum, maximum, and the mean for the period of record shown. For stations 493165 and 493161, the iron water quality standard was exceeded three times during the noted period of sampling. This is equivalent to exceeding the standard 6 percent and 16 percent of the time. In general, dissolved iron concentrations increase from station 493165 downstream to station 493161 at the Price River confluence with the Green River. Seasonal variations in dissolved iron concentration and natural sources could not be examined in this study due to the sporadic and limited data available.

Sources of natural dissolved iron include transport by surface run-off and physical contact of the Price River with the Mancos Shale and formations within the Mesa Verde Group. Precipitation data is reported as monthly totals; therefore daily run-off associated with daily measurements of iron exceedances could not be determined. The Mancos Shale and Mesa Verde Group is encountered in the upper and lower

reaches of the Price River. Dissolution of iron-bearing minerals from these formations where the Price River is in contact with the Mancos Shale and Mesa Verde Group is a possible contributor to elevated dissolved iron in the Price River. Since stations 493281, 493253, and 493239 are also located within the Mancos Shale and Mesa Verde Group, they were analyzed for exceedances of the iron water quality criteria. As shown in Table 3-1, iron exceeds the water quality standard once at stations 493281 (6.1 mg/L) and 493253 (6.81 mg/L). Based on the low occurrence of exceedances and lack of identified sources of iron, all of the reaches listed for dissolved iron have been delisted in the draft Utah 2004 303 (d) list of waters.

3.2 TDS Impairments- DEQ and EWCD Water Quality and Flow Data

TDS concentrations and flow data were collected by the DEQ at several monitoring sites within each of the three watersheds in the WCRW. These data were queried through the USEPA's STORET data retrieval system. The data collected at the 26 stations located within the WCRW were not consistent over the period of record. At times water chemistry and flow data were collected; other times only water chemistry or only flow data was collected. The EWCD has collected water chemistry and flow data for the San Rafael River and Muddy Creek watersheds from 1987 to the present. The EWCD consistently collected data at each of eleven monitoring stations during either the second or third week of each month. Data was also collected at eight additional monitoring stations, but only during 2001. Data from the DEQ and EWCD monitoring locations in the Price River, San Rafael River, and Muddy Creek watersheds are shown in Figures 3-1, 3-2, and 3-3, respectively. Monitoring station descriptions and period of record for data at each location are shown in Table 3-2.

In addition to the available data, there are several other studies that are planned or currently being conducted that may result in data that can be utilized to update the TMDL in the future. These studies include intensive sampling being conducted by the Utah DEQ in 2003, a three-year study on transit sources of TDS loading in the San Rafael River that is being lead by the BLM, and a water balance salinity study being conducted by Utah State University.

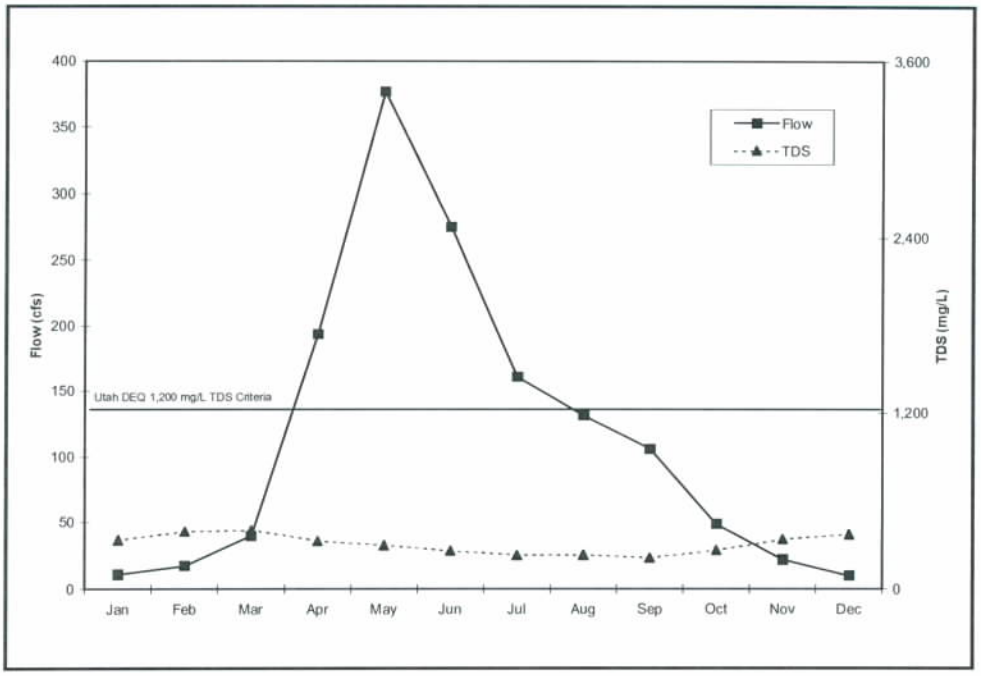


Figure 3-1 **Average Monthly Flow and TDS at STORET 493281 (Price River above Price River Coal)**

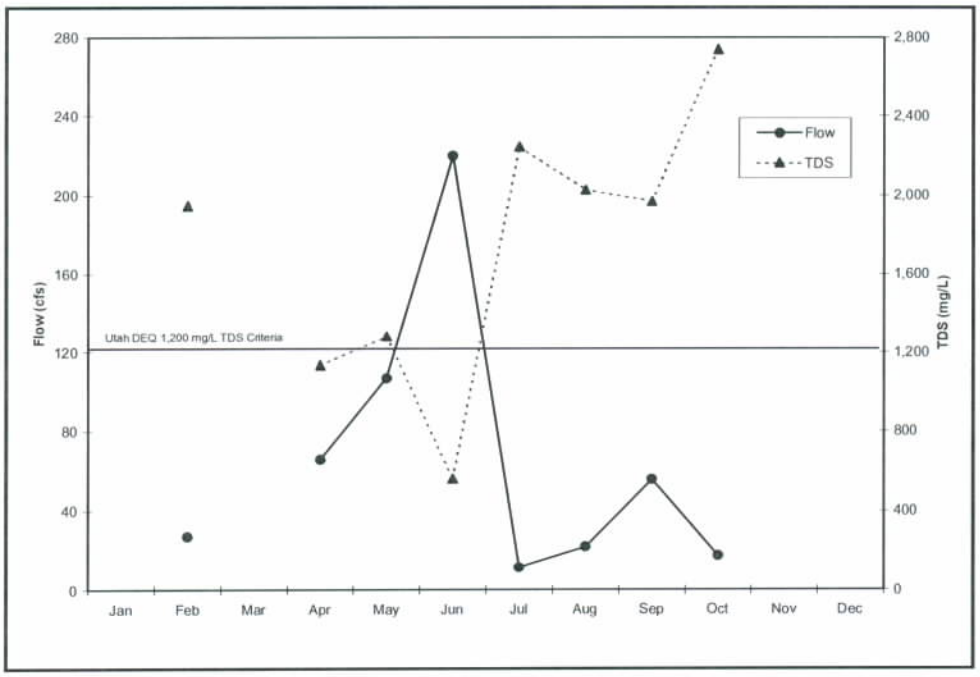


Figure 3-2 **Average Monthly Flow and TDS at STORET 493239 (Price River above Price WWTP at Wellington Bridge)**

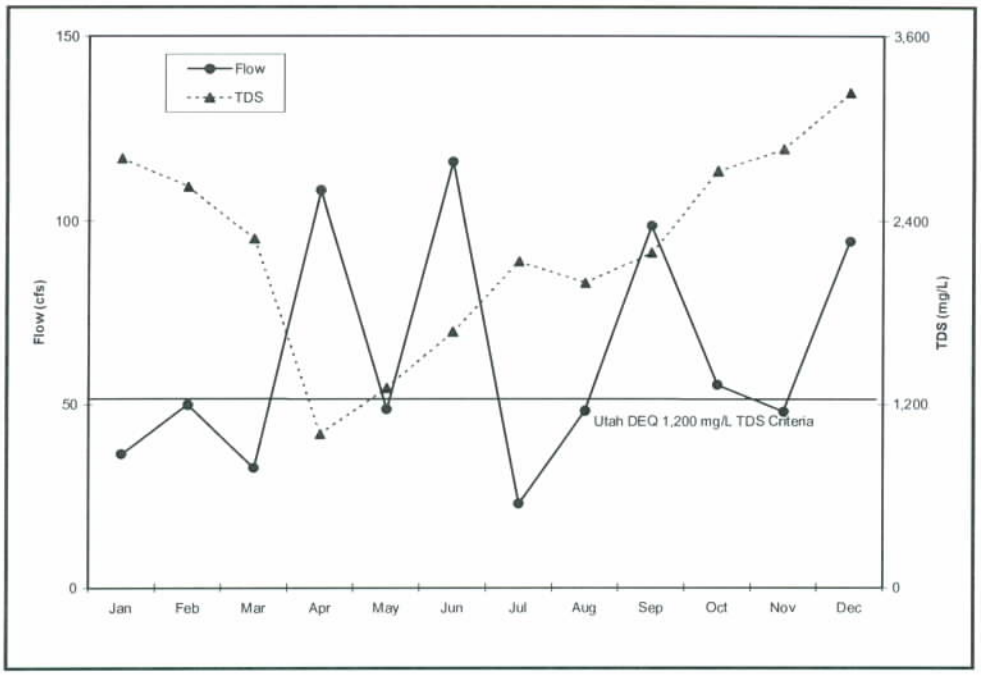


Figure 3-3 Average Monthly Flow and TDS at STORET 493165 (Price River near Woodside at US 6 crossing)

Table 3-2 DEQ and EWCD Monitoring Station Descriptions (shown on Maps 10, 11, and 12)

Station ID	Station Name	Start	End	SamplingEvents
	STORET #[1]			
493029	San Rafael R. at US 24 crossing	2/22/90	12/12/01	60
493034	San Rafael R. at Buckhorn Rd. crossing	6/12/92	6/10/98	11
493052	Huntington Cr. above Huntington lagoons outfall	4/17/90	6/10/98	30
493053	Huntington Cr. above Utah Power and Light	7/29/97	11/20/02	15
493080	Ferron Cr. below Ferron lagoons	8/03/90	10/17/02	37
493082	Ferron Cr. above Ferron lagoons at US 10 crossing	1/23/90	11/21/02	72
493093	Cottonwood Cr. at US 10 crossing in Castle Dale	2/20/90	6/10/98	32
493095	Cottonwood Cr. above Grimes wash	8/25/97	11/20/02	14
493161	Price R. at mouth	6/14/93	7/29/02	22
493165	Price R. near Woodside at US 6 crossing	3/21/90	8/30/01	55
493239	Price R. above Price WWTP at Wellington bridge	5/10/90	8/20/02	25
493253	Gordon Cr. above confluence with Price R.	4/4/90	8/20/02	16
493281	Price R. above Price River coal	2/11/92	8/21/01	70
493283	White R. at US 6 crossing	1/23/90	7/16/02	20
493286	Left fork White R. above USFS boundary	7/24/91	11/7/02	30
493288	Right fork White R. at USFS boundary	7/30/93	1/15/02	19
493309	Price R. below confluence with White R.	8/25/97	10/17/02	14
493332	Grassy Cr. trail above Sunnyside Coal 002	8/1/97	9/19/02	11
495500	Muddy Cr. at old US 24 crossing	4/18/90	9/17/02	70
495530	Muddy Cr. at I 70 crossing	1/23/90	8/21/02	88
495543	Quitchupah Cr. above USFS boundary	8/26/97	8/21/02	10
593148	Mud Cr. Above Scofield	8/25/97	11/21/02	16
593165	Fish Cr. Above Scofield Reservoir	6/10/92	8/21/01	21
593176	Ferron Cr. above Millsite Reservoir	6/4/91	11/21/02	29
	EWCD #[2,3]			
1	San Rafael River	1/87	12/01	180
2	Huntington Creek upper	1/87	12/01	180
3	Huntington Creek lower	1/87	12/01	180
4	Cottonwood Creek upper	1/87	12/01	180
5	Cottonwood Creek Bott Lane	1/01	12/01	12
6	Cottonwood Creek above Rock Canyon	1/01	12/01	12
7	Cottonwood Creek lower	1/87	12/01	180
8	Rock Canyon Creek upper	10/90	12/01	138
9	Rock Canyon Creek lower	10/90	12/01	138
10	Ferron Creek upper	1/87	12/01	180
11	Ferron Creek lower	1/87	12/01	180
12	Muddy Creek upper	1/87	12/01	180
13	Muddy Creek above Ivie Creek	1/01	12/01	12
14	Muddy Creek lower	1/87	12/01	180
15	Ivie Creek lower	1/01	12/01	180
16	Grimes Wash upper	1/01	12/01	109
17	Grimes Wash lower	1/01	12/01	12
18	Crandal Canyon Creek upper	1/01	12/01	12
19	Crandal Canyon Creek lower	1/01	12/01	12

1. Only data collected after 1990 is presented.
2. EWCD monitoring is continuing to the present. Only data through December 2001 was used in the assessment of water quality in the WCRW.
3. Flow measurements are also taken at the EWCD locations, and are used in the TMDL.

3.3 Flow Data

The two primary sources of flow data for the watershed are the USGS and the EWCD. As noted in Table 3-2, the EWCD database includes both flow and chemistry data. Additionally, the USGS has been measuring flows throughout the WCRW since the early 1900s. Stream flow monitoring station descriptions and period of record for each USGS location, in each of the three watersheds in the WCRW that has been recently (e.g., 1990-2000) sampled are provided in Tables 3-3, 3-4, and 3-5.

Table 3-3 USGS Flow Gages in the Price River Watershed

Station ID	Station Name	Date		No. of flow readings	Drainage Area (mi^2)
		Start	End		
9310500	Fish Creek above reservoir, near Scofield	6/1/1931	9/30/2001	23317	60.1
9310700	Mud Creek below Winter Quarters Canyon at Scofield	8/22/1978	9/30/2001	6991	29.1
9313000	Price River near Heiner	6/1/1934	9/30/2001	17689	455
9314500	Price River at Woodside	12/1/1945	9/30/2001	17566	1540

Table 3-4 USGS Flow Gages in the San Rafael Watershed

Site No.	Site Name	Date		No. of flow readings	Drainage Area (mi^2)
		Start	End		
9326500	Ferron Creek (upper station) near Ferron	10/1/1911	9/30/2001	24107	138
9328500	San Rafael River near Green River	10/1/1909	9/30/2001	23741	1628

Table 3-5 USGS Flow Gages in the Muddy Creek Watershed

Site No.	Site Name	Date		No. of flow readings	Drainage Area (mi^2)
		Start	End		
9330500	Muddy Creek near Emery	10/1/1910	9/30/2001	20382	105

3.4 Data Use and Limitations

In order to perform a representative assessment of water quality in each watershed in the WCRW, the available water chemistry and flow data were evaluated for limitations, so that the best available data could be used in the TMDL. The following limitations were encountered:

- Limited water chemistry data
- Limited flow data

- Inconsistencies and gaps between measurement dates

These limitations were taken into consideration when characterizing current water quality within each watershed. As described below, these limitations primarily affected the evaluation of water quality in the Price River watershed, as the data collected by the EWCD in the San Rafael River and Muddy Creek watersheds allowed for a more comprehensive evaluation of water quality in these watersheds.

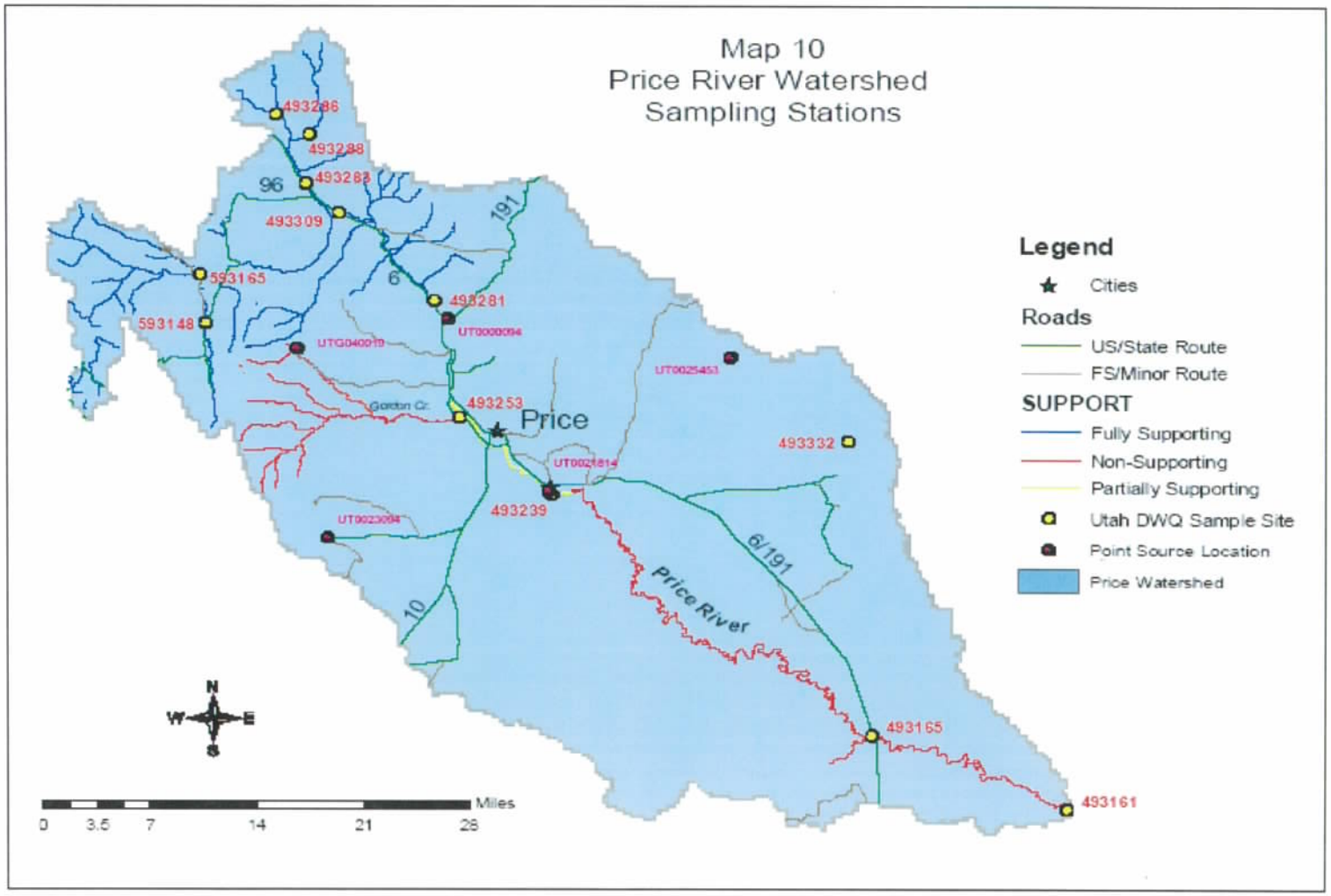
Although data obtained prior to 1990 exists, only data collected from 1990 forward were used in this study. Data was generally not consistently collected prior to 1990, and although these data were considered, it was determined that omission of these data would not result in mischaracterization of water chemistry and hydrology in the WCRW.

3.5 Water Quality Assessment

Water quality in each of the three watersheds in the WCRW was assessed based on the available TDS and flow data previously described. This assessment included an evaluation of the general spatial and temporal patterns in TDS concentrations in surface waters in the watersheds and confirmation of the existing impairment of streams within the watersheds. As discussed in the following sections, water quality assessment was sometimes restricted because of data limitations. The collection of data within the watersheds is an ongoing effort. Any additional data collected will be evaluated for its effect on the TMDLs established in the watersheds. If warranted, the TMDLs may be revised based on new data.

3.5.1 Price River Watershed

Table 3-6 provides a summary of the known water quality data available in the Price River watershed. The locations of the water quality monitoring stations listed in Table 3-6 are shown in Map 10. As shown in Table 3-6, historic TDS concentrations measured in the upper reaches of the watershed were below the criterion of 1,200 mg/L, and the monitored surface waters in the upper reaches are considered to be fully supporting of the agricultural beneficial use classification. Exceedances of the TDS criteria were measured in the middle and lower reaches of the watershed, where surface waters are considered to be only partially supporting or not supporting the agricultural beneficial use classification.


Map 10
Price River Watershed
Sampling Stations
Legend
Cities
Roads
US/State Route
FS/Minor Route
SUPPORT
Fully Supporting
Non-Supporting
Partially Supporting
Utah DWQ Sample Site
Point Source Location
Price Watershed
Price
Price River
Gordon Cr.
96
191
6
10
6/191
493286
493288
493283
493309
593165
593148
493281
UTG040010
UT0000094
UT0025453
493253
493332
UT0021814
493239
UT0023004
493165
493161
N
W
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Miles
0
3.5
7
14
21
28

The upper portion of the Price River watershed is primarily forest lands, with the typical land uses being livestock grazing and recreation. The middle portion of the Price River watershed is dominated by agriculture with significant irrigation and urban activities. Additionally, there are significant coal bed methane (CBM) reserves in this portion of the Price River watershed which are currently being exploited, as well as coal mines. Mancos Shale, a natural source of salts in the watershed is also prevalent in the middle portion of the watershed. These land uses and geologic characteristics of the middle portion of the watershed account for the noted variation in water quality in the watershed.

Table 3-6 Water Quality Data for the Price River Watershed

Site ID	Description	TDS (mg/L)				No. of samples	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
493161	Price River at mouth	652	3,442	1,618	1,781	20	14	NS
493165	Price River at Woodside	548	4,866	2,164	2,166	71	57	NS
493239	Price River above Price WWTP in Wellington	408	2,918	1,511	1,933	21	11	PS
493253	Pinnacle Creek above Confluence with Price River[2]	888	4,038	2,470	2,634	12	10	NS
493137	Gordon Creek above Price River confluence	1112	2254	1,765	2183	6	5	NS
493281	Price River above Price River Coal	172	518	297	300	72	0	FS
493283	White River at US 50 crossing	320	420	371	367	20	0	FS
493286	Left fork White River above Right fork White River	182	340	310	319	19	0	FS
493288	Right fork White River above Left fork White River	286	368	326	342	15	0	FS
493309	Price River below confluence with White River	206	374	293	312	10	0	FS
493332	Grassy Trail Creek above Sunnyside Mine[3]	316	538	381	442	10	0	PS
593148	Mud Creek above Scofield	236	906	413	458	11	0	FS
593165	Fish Creek above Scofield Reservoir	168	220	190	193	21	0	FS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)
[2] While Gordon Creek is listed as the impaired segment, the impairment listing was based on sampling of Pinnacle Creek. However, subsequent sampling of Gordon Creek demonstrates that it is also impaired due to TDS concentrations and Gordon Creek is listed in the draft Utah 2004 303 (d) list of impaired waters.
[3] This segment is listed due to pH (DEQ 2000)

3.5.1.1 Critical Seasonal Variations in TDS Concentrations

Average monthly TDS concentrations and flows measured at STORET monitoring stations Nos. 493281, 493239 and 493165, located in the upper, middle, and lower reaches of the Price River, are shown in

Figures 3-1, 3-2, and 3-3, respectively. Monitoring stations Nos. 49239 and 493165 were chosen as target sites in the Price River watershed.

As shown in Figure 3-1, seasonal variations in flow in the upper reach of the Price River are apparent, but little change in average TDS concentrations occur. The relative consistency in TDS concentrations in the upper reaches of the Price River points to the lack of TDS sources in the upper reaches of the watershed. Figures 3-2 and 3-3 show that TDS concentrations in the middle and lower reaches of the Price River, on average, exceed the water quality criterion throughout most of the year. The exception is average measured TDS concentrations in the spring/early summer when seasonal increases in flow appear to provide a dilution effect on TDS concentrations in the river. These patterns suggest that TDS loading to the Price River occurs throughout the year, influenced seasonally by irrigation diversions and return flows (increasing TDS concentrations) and spring run-off (decreasing TDS concentrations due to dilution).

3.5.1.2 Critical Flow verses TDS Concentrations

The data presented in Figure 3-1 shows that there are no significant seasonal or flow effects on TDS concentrations within the upper reaches of the Price River, confirming the absence of any significant TDS sources in the area. A comparison of Figures 3-1, 3-2 and 3-3 shows that while flow in the Price River decrease in the downstream reaches of the river (below STORET monitoring station 493281), TDS concentrations increase. This pattern points to the effect of irrigation diversions and natural stream losses from the Price River that occurs in the middle and lower reaches of the watershed and the sources (e.g., Mancos Shale) of TDS existing in the area. It also reflects the complex interaction between stream diversions, losses, irrigation return flows, and other inflows, and the resulting effect on water quality in the lower reaches of the Price River. While overall flow in the river is decreasing, it is apparent that surface water and/or groundwater inflows with very high TDS concentrations are entering the river, resulting in the higher TDS concentrations measured at the downstream monitoring stations. Given the complex hydrology within the watershed, the available data does not allow for a meaningful comparison of flow versus TDS concentrations in the lower reaches of the Price River.

3.5.2 San Rafael River Watershed

For purposes of this TMDL study, the San Rafael River watershed was divided into five sub-watersheds. These sub-watersheds are Huntington Creek, Cottonwood Creek, Rock Canyon Creek, Ferron Creek, and the lower San Rafael River. The five target sites established in the San Rafael watershed (see Section 2.2) were located in the downstream reaches of the major drainages in each of these five sub-watersheds. The analysis of sub-watersheds within the San Rafael River watershed was possible due to the amount of data

available. By establishing the five target sites in the San Rafael watershed, a more discrete assessment of water quality in the watershed could be performed.

3.5.2.1 Water Chemistry

Tables 3-7 through 3-11 provide a summary of measured water chemistry in the Huntington Creek, Cottonwood Creek, Rock Canyon Creek, Ferron Creek, and the lower San Rafael River sub-watersheds, respectively. The water chemistry data summarized in these tables was collected by both the DEQ and EWCD. The locations of the water quality monitoring stations listed in the tables are shown in Map 11.

As shown in Tables 3-7, 3-8, and 3-10, measured TDS concentrations in the upper reaches of the Huntington Creek, Cottonwood Creek, and Ferron Creek sub-watersheds were below the criterion of 1,200 mg/L, and the monitored surface waters in the upper reaches of these sub-watersheds are considered to be fully supporting of the agricultural beneficial use classification. Exceedances of the TDS criteria were noted in the middle to lower reaches of these sub-watersheds, where Huntington Creek, Cottonwood Creek, and Ferron Creek are considered to be non-supporting of the agricultural beneficial use classification. Similar to the Price River Watershed, the noted variations in water quality in these three sub-watersheds are attributed to land use and geologic characteristics of the sub-watersheds. Land use in the upper reaches of these sub-watersheds is primarily forest, along with some power generation and coal mining in the Huntington Creek sub-watershed, coal mining in the Cottonwood Creek sub-watershed, and CBM activities in the Ferron Creek sub-watershed. The middle and lower reaches of all three sub-watersheds are dominated by agriculture use, with significant irrigation and urban activities. Mancos Shale is also prevalent in the middle and lower reaches of the sub-watersheds.

As shown in Tables 3-9 and 3-11, measured TDS concentrations in Rock Canyon Creek and the San Rafael River have exceeded the TDS criterion throughout the monitored reaches of these waters, and Rock Canyon Creek and the San Rafael River are considered to be non-supporting of the agricultural beneficial use classification. The elevated TDS concentrations in Rock Canyon Creek are attributed to land use activity in the watershed (i.e., agriculture use, with irrigation and urban activities) and the presence of Mancos Shale. Additionally, the Hunter Power Plant is located in the Rock Canyon Creek subwatershed. While there are no existing UPDES permits for the plant, discharge of water to Rock Canyon Creek occurs from plant operations. Recognizing that this discharge needs to be permitted, the Department of Environmental Quality has initiated the permit process. It is expected that the issued permit will include a discharge limit for concentrations of TDS.

Table 3-7 Water Quality Data for the Huntington Creek Sub-watershed

Site ID	Description	TDS (mg/L)				# Samples	Number of Violations	Support [1]
		Min	Max	Mean	Upper 95% Confidence Interval			
493052	Huntington Creek above Lagoons	426	4,768	2,559	3,105	21	15	NS
493053	Huntington Creek above UP&L diversion	172	284	216	222	11	0	FS
EWCD-2	Huntington Creek upper	10	460	220	225	175	0	FS
EWCD-3	Huntington Creek lower	464	6,242	3,241	3,324	174	165	NS
EWCD-18	Crandal Canyon Creek upper	216	536	341	345	47	0	FS
EWCD-19	Crandal Canyon Creek lower	260	664	417	423	51	0	FS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)

Table 3-8 Water Quality Data for the Cottonwood Creek Sub-watershed

Site ID	Description	TDS (mg/L)				# Samples	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
493093	Cottonwood Creek above Castle Dale Lagoons	324	2,202	1,033	1,238	22	7	NS
493095	Cottonwood Creek above Grimes Wash	196	298	238	246	10	0	FS
EWCD-4	Cottonwood Creek upper	108	460	249	255	175	0	FS
EWCD-5	Cottonwood Creek at Bott Lane	690	1,800	1,113	1,208	12	5	NS
EWCD-6	Cottonwood Creek above Rock Canyon Creek	1,600	3,200	1,992	2,162	12	12	NS
EWCD-7	Cottonwood Creek lower	348	4,750	2,325	2,355	175	163	NS
EWCD-16	Grimes Wash upper	440	5,010	1,252	1,280	109	37	NS
EWCD-17	Grimes Wash lower	602	2,800	1,549	1,570	96	71	NS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)

Table 3-9 Water Quality Data for the Rock Canyon Creek Sub-watershed

Site ID	Description	TDS (mg/L)				# Samples	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
EWCD-8	Rock Canyon Creek upper	892	5,660	3,411	3,475	91	86	NS
EWCD-9	Rock Canyon Creek lower	696	7,750	3,583	3,624	135	134	NS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)

Table 3-10 Water Quality Data for the Ferron Creek Sub-watershed

Site ID	Description	TDS (mg/L)				# Samples	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
493080	Ferron Creek below Ferron Lagoons	958	1,678	1,318	2,316	2	1	FS
493082	Ferron Creek above Ferron Lagoons	308	958	758	832	21	0	FS
593176	Ferron Creek above Millsite Reservoir	214	366	286	291	23	0	FS
EWCD-10	Ferron Creek upper	48	756	350	360	175	0	FS
EWCD-11	Ferron Creek lower	448	7,260	2,692	2,734	174	164	FS

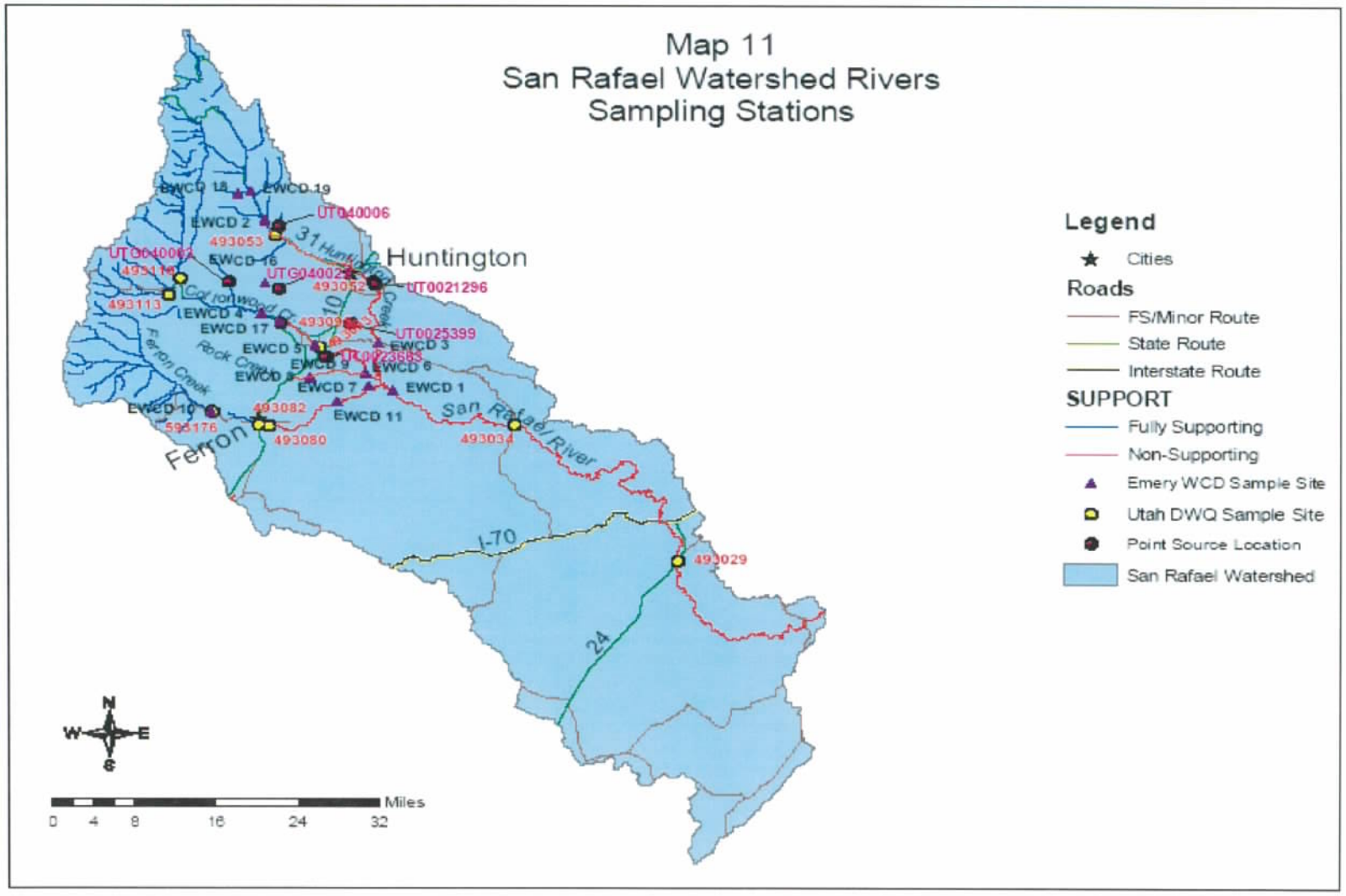
[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)

Table 3-11 Water Quality Data for the Lower San Rafael River Sub-watershed

Site ID	Description	TDS (mg/L)				# Samples	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
493029	San Rafael at U24 crossing	492	3,924	2,170	2,868	29	26	NS
493034	San Rafael at Buckhorn road	780	3,030	1,803	2,003	11	8	NS
EWCD-1	San Rafael River lower	480	5,070	2,549	2,580	175	164	NS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)

Given the measured concentrations of TDS in Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek, all which drain to the San Rafael River, the measured concentrations of TDS in the San Rafael River were not unexpected. As shown in Table 3-11, the mean concentration of TDS in the San Rafael River decreases in the lower reach of the river. This may be attributable to water inflows of lower TDS concentrations, consistent with the lack of any significant TDS sources in the lower San Rafael River watershed.


Map 11
San Rafael Watershed Rivers
Sampling Stations
Legend
Cities
Roads
FS/Minor Route
State Route
Interstate Route
SUPPORT
Fully Supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
Point Source Location
San Rafael Watershed
Huntington
Ferron
San Rafael River
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EWCD 5
EWCD 9
EWCD 6
EWCD 7
EWCD 1
EWCD 10
493082
EWCD 11
493080
493034
493029

3.5.2.2 Critical Seasonal Variations in TDS Concentrations

Monitoring stations EWCD-03 (Lower Huntington Creek), EWCD-07 (Lower Cottonwood Creek), EWCD-09 (Lower Rock Canyon Creek), EWCD-11 (Lower Ferron Creek) and Storet Monitoring Station 493029 (San Rafael at U24 crossing) were chosen as target sites for TMDL analysis in the San Rafael River watershed. Monitoring stations EWCD-03, EWCD-07, EWCD-09, and EWCD-11 were chosen as target sites because the measured water chemistry and flows at these locations reflect the effects of all TDS sources and hydrological processes (i.e., irrigation diversions, return flows, groundwater and surface water inflows) in their respective sub-watersheds. STORET monitoring station 493029 was chosen as a target site because the measured water chemistry and flows at this location reflect the effects of all significant TDS sources and hydrological processes within substantially the entire San Rafael River watershed.

The average monthly TDS concentrations and flows measured at monitoring stations EWCD-03, EWCD-07, EWCD-09, EWCD-011 are shown in Figures 3.4 through 3.7, respectively. Each of these figures shows similar relationships between flow and TDS concentrations attributed to irrigation activities and spring runoff occurring in the sub-watersheds. First, a decrease in average measured flow associated with an increase in average TDS concentration is noted in the month of April. This is followed by a significant increase in flows associated with a significant decrease in TDS concentrations; the highest average flows and, except for Huntington Creek, the lowest average TDS concentrations occurring in June. Average monthly flows then generally decrease, with some variation, associated with generally increasing TDS concentrations, with some variation over the months of July through October. Flows in the streams appear to be generally consistent over the months of November through February, rising or falling again in March.

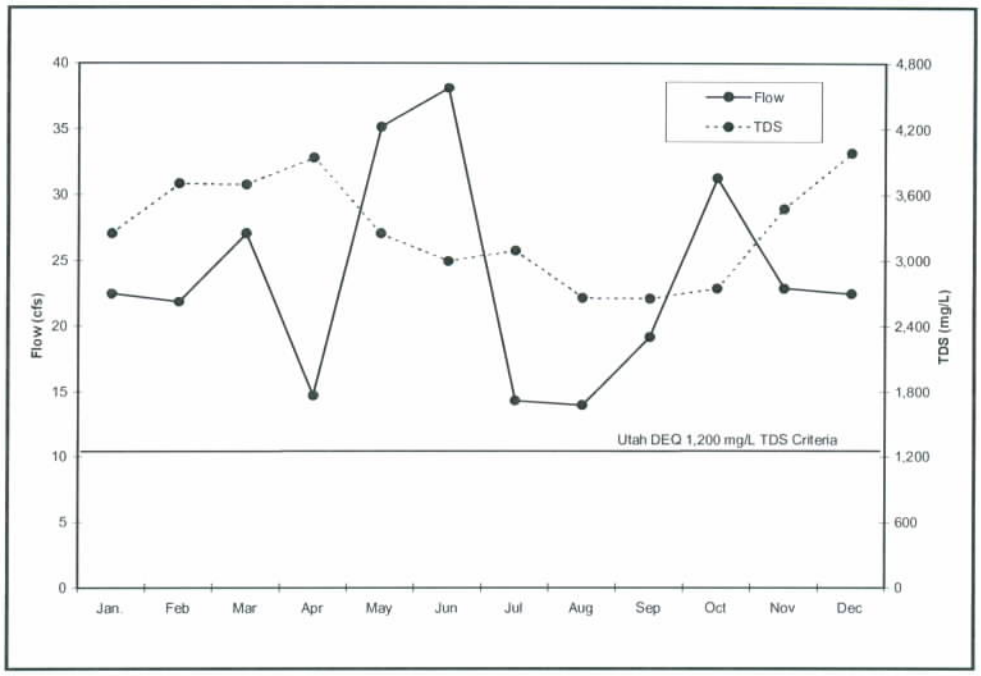


Figure 3-4 Average Monthly Flow and TDS for EWCD-03 (Lower Huntington Creek)

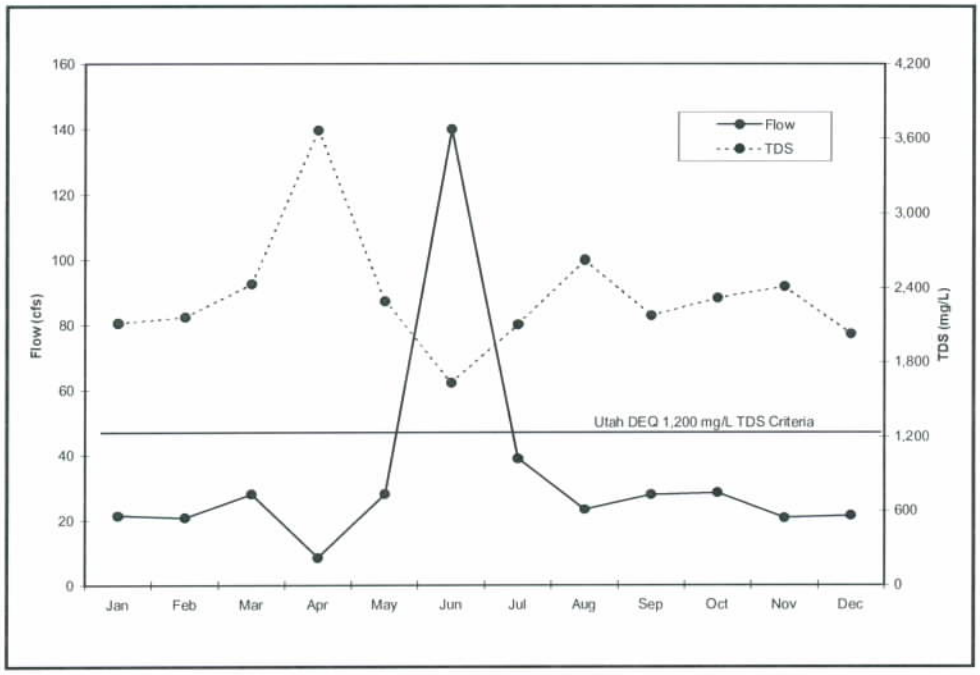


Figure 3-5 Average Monthly Flow and TDS for EWCD-07 (Lower Cottonwood Creek)

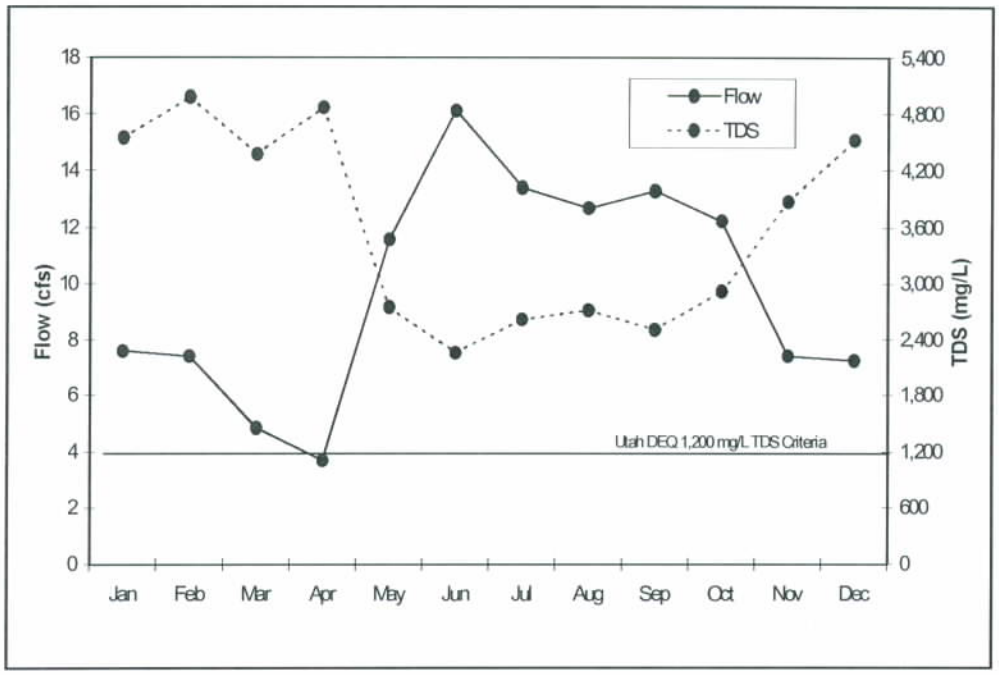


Figure 3-6 Average Monthly Flow and TDS for EWCD-09 (Lower Rock Canyon Creek)

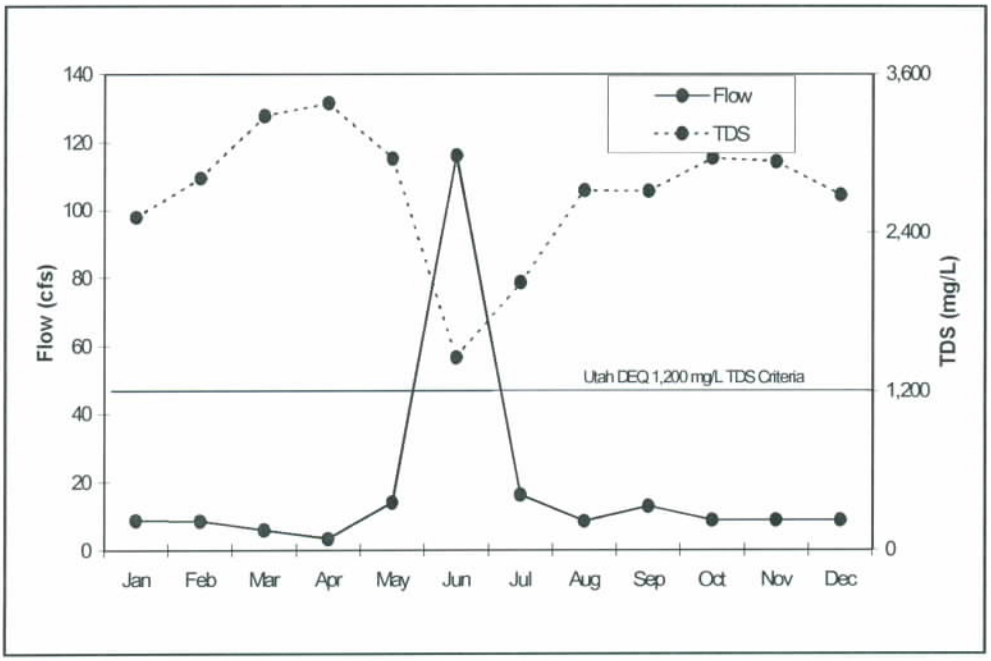


Figure 3-7 Average Monthly Flow and TDS for EWCD-11 (Lower Ferron Creek)

The decrease in average flow and increase in average TDS concentrations occurring in April may be due to the first significant diversions of surface water for irrigation during the year and associated high TDS concentration return flows. The decreased TDS concentration measurements in June are indicative of the seasonal dilution effect of increased flows occurring in this month. Between July and October, stream flow and measured TDS concentrations are subject to complex interactions between stream diversions, losses, irrigation return flows and other inflows to the streams. The more consistent flow patterns and associated TDS concentrations over the months of November through February are consistent with the decrease in runoff and irrigation activity over these months. Although seasonal variations in TDS concentrations are shown, it is noted that there is no one critical season for high TDS concentrations in Huntington, Cottonwood, Rock Canyon, and Ferron Creeks, as the average measured TDS concentrations in these creeks consistently exceed the TDS criterion of 1,200 mg/L over the entire year.

The average monthly TDS concentrations and flows measured at the STORET monitoring station 493029 are shown in Figure 3-8. The variations in average flow and TDS concentrations measured in the San Rafael River at this location reflect the collective contribution of inflows to the San Rafael River from Huntington, Cottonwood, Rock Canyon, and Ferron Creeks. As with these tributaries, it is noted that there is no one critical season for high TDS concentrations in the San Rafael River, as measured TDS concentrations in the lower San Rafael River consistently exceed the TDS criterion of 1,200 mg/L over the entire year.

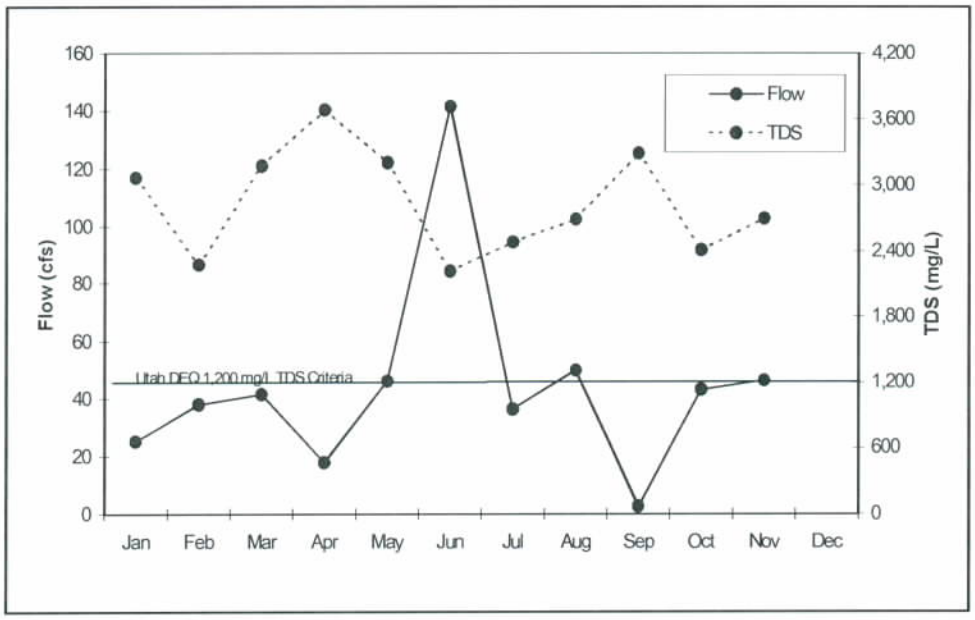


Figure 3-8 Average Monthly Flow and TDS for 493029 (San Rafael River at US 24 Crossing)

3.5.2.3 Critical Flow versus TDS Concentration

Figures 3-9 through 3-13 are plots of TDS concentrations verses flow at monitoring stations EWCD-03 through EWCD-11 and STORET monitoring station 493029, respectively. These plots show the trend of increasing TDS concentration with decreasing flow and the dilution effect of decreasing TDS concentration at high flows in each of the measured streams. The TDS concentrations are the highest during low flow conditions when it may be expected that groundwater inflows (including long-term irrigation return flow) with elevated TDS concentrations provide the majority of streamflow. The elevated TDS concentrations in groundwater are attributed to contact with the Mancos Shale (Laronne 1977), which is prevalent in the middle and lower portions of the Huntington Creek, Cottonwood Creek, Rock Canyon Creek, and Ferron Creek sub-watersheds. Although TDS concentrations decrease with increasing flows, TDS concentrations occur above the TDS water quality criterion throughout most of the range of flows. The consistently high TDS concentrations throughout the range of normal flows are attributed to continual loading from natural sources, irrigation return flows, and other inflows occurring over the range of these flows. As a practical matter, there is no critical flow, within the range of normally expected flows, above which the TDS criterion is attained in these stream reaches.

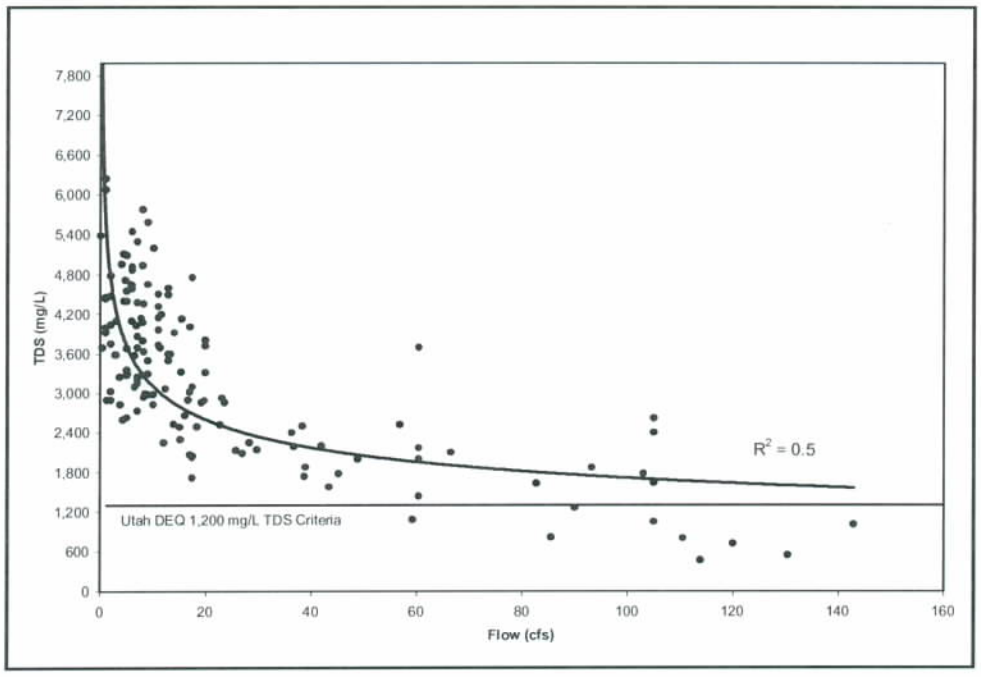


Figure 3.9 Flow verses TDS Regression Plot for EWCD-03 (Lower Huntington Creek)

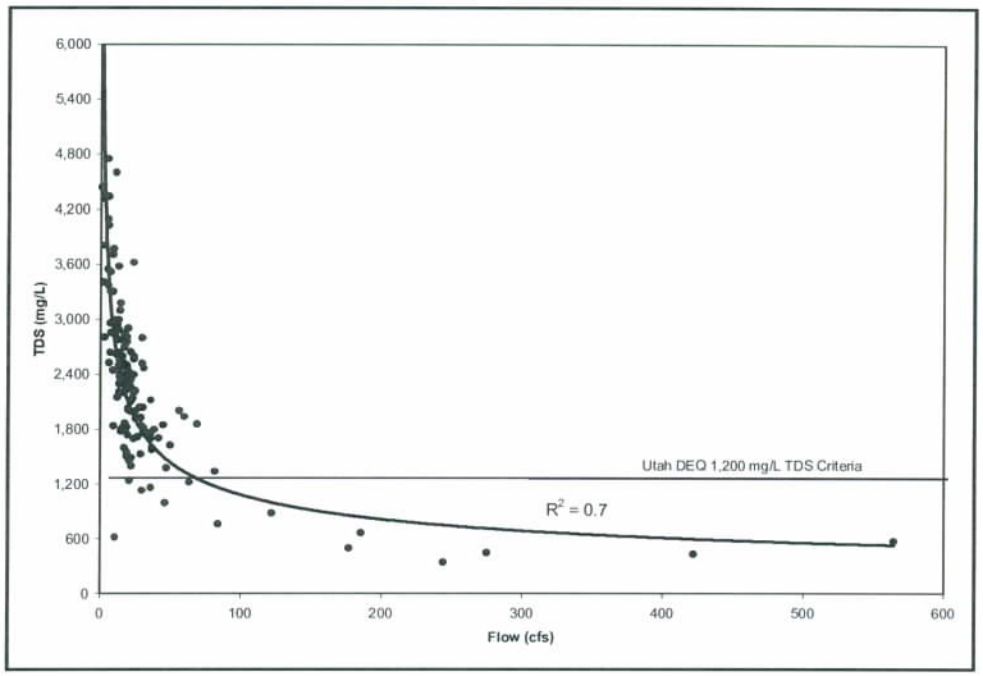


Figure 3-10 Flow verses TDS Regression Plot for EWCD-07 (Lower Cottonwood Creek)

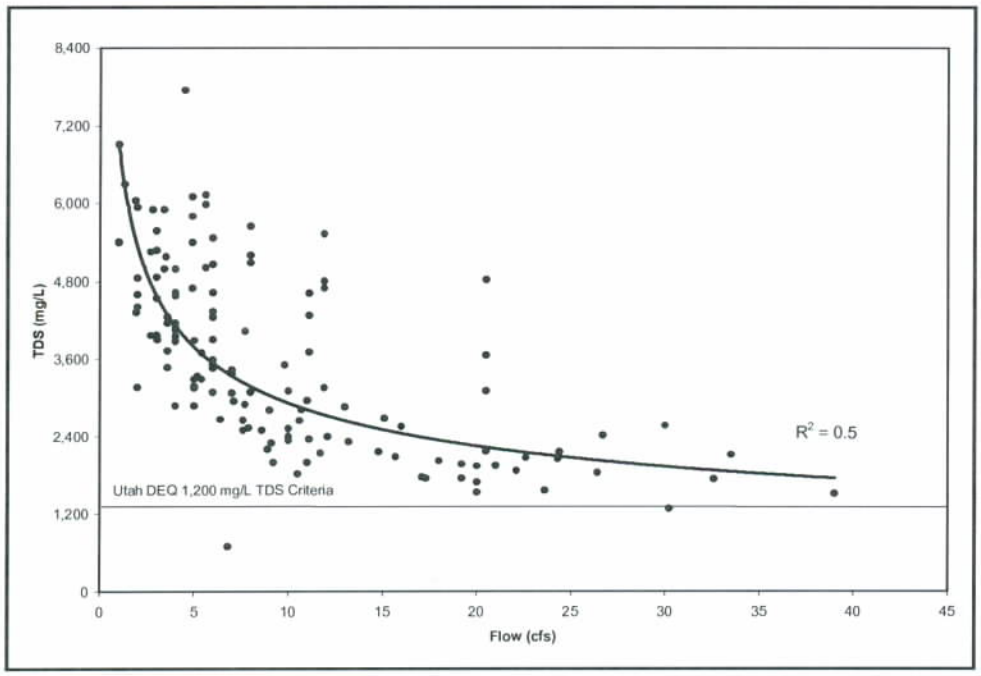


Figure 3-11 Flow verses TDS Regression Plot for EWCD-09 (Lower Rock Canyon Creek)

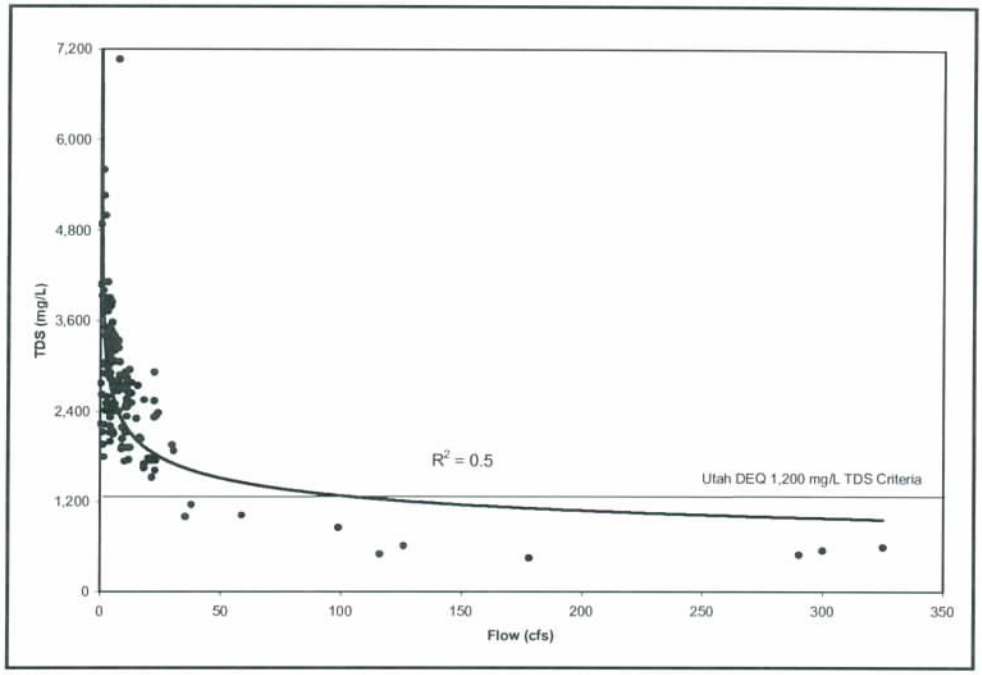


Figure 3-12 Flow verses TDS Regression Plot for EWCD-11 (Lower Ferron Creek)

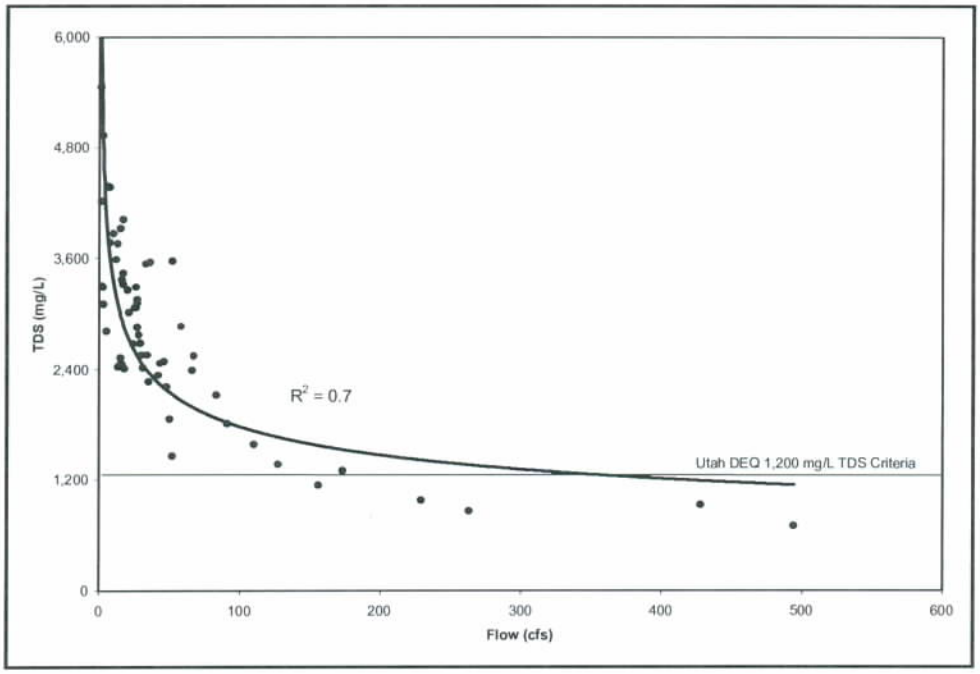


Figure 3-13 Flow verses TDS Regression Plot for 493029 (San Rafael River at US 24 Crossing)

3.5.3 Muddy Creek Watershed

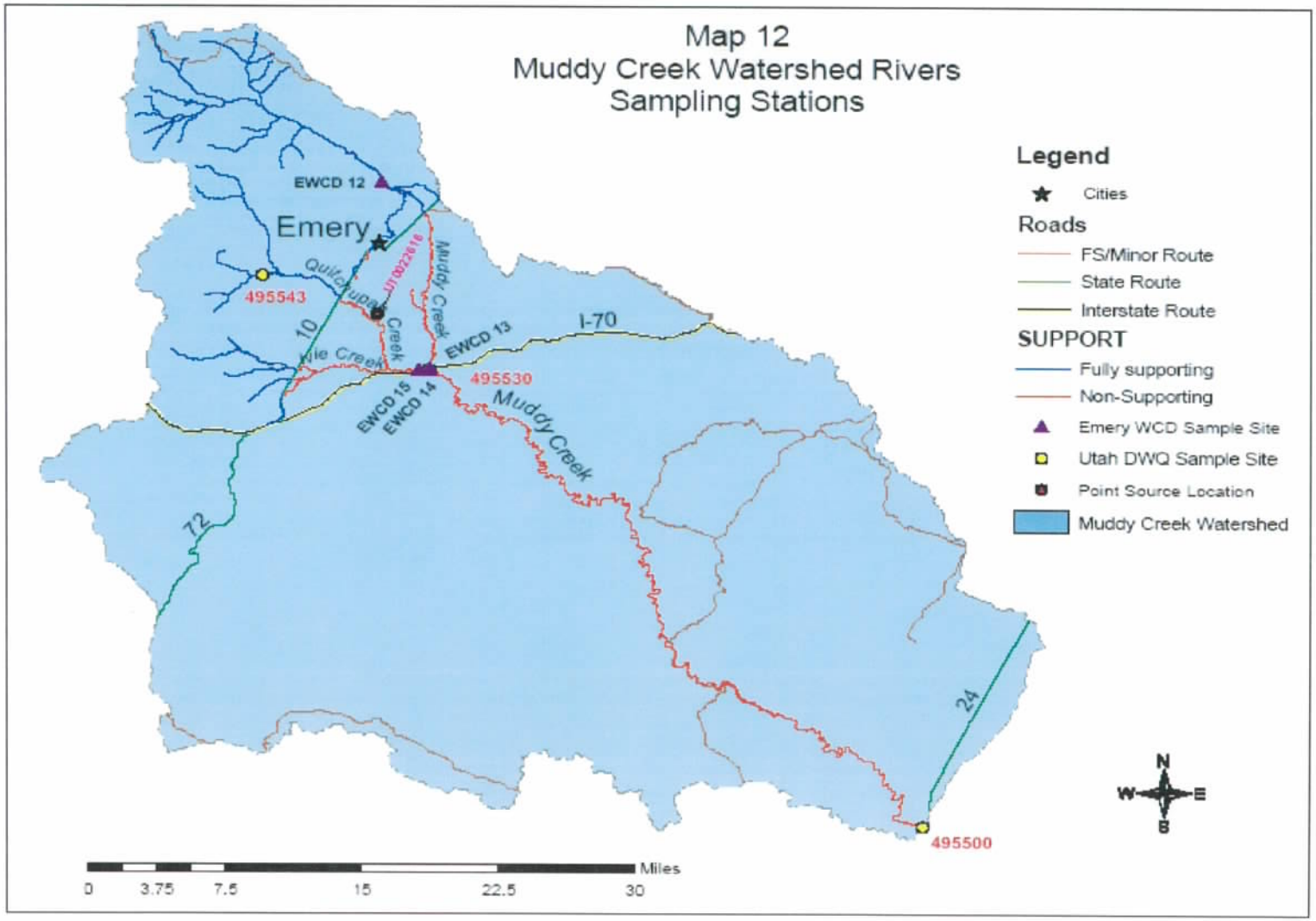
Table 3-12 provides a summary of the measured water chemistry in the Muddy Creek watershed. The locations of the water quality monitoring stations listed in Table 3-12 are shown in Map 12. As shown in Table 3-12, historic TDS concentrations measured in the upper reaches of the watershed were below the criterion of 1,200 mg/L, and the monitored surface waters in the upper reaches are considered to be fully supporting of the agricultural beneficial use classification. Exceedances of the TDS criteria were measured in the middle and lower reaches of the watershed, where surface waters are considered to be only partially supporting or non- supporting of the agricultural beneficial use classification.

The noted variations in water quality in the Muddy Creek watershed are attributed to land use and geologic characteristics of this watershed. The upper portion of the Muddy Creek watershed is primarily BLM and USFS administered lands. There is also some coal mining that occurs in this portion of the watershed. The middle portion of the Muddy Creek watershed is dominated by irrigated agriculture and urban (inhabited) areas. Mancos Shale is also prevalent in the middle portion of the watershed. These land use and geologic characteristics of the watershed account for the noted variation in water quality throughout the watershed.

Table 3-12 Water Quality Data for the Muddy Creek Watershed

Site ID	Description	TDS (mg/L)				Count	Number of Violations	Support[1]
		Min	Max	Mean	Upper 95% Confidence Interval			
495500	Muddy Creek at Old U24 crossing	806	6,080	3,276	3,736	63	57	NS
495530	Muddy Creek at I70 crossing	386	5,332	1,702	1,835	74	53	NS
495543	Quitchupah Creek above USFS boundary	466	852	675	724	10	0	FS
EWCD-12	Muddy Creek upper	60	648	274	282	175	0	FS
EWCD-13	Muddy Creek above Ivie Creek	620	4,900	2,284	3,531	12	4	NS
EWCD-14	Muddy Creek lower	416	4,580	1,829	1,735	173	141	NS
EWCD-15	Ivie Creek	740	3,100	1,711	1,925	12	10	NS

[1] NS = Not Supporting; PS = Partially Supporting; FS = Fully Supporting (as listed in the RFP for the TMDL)


Map 12
Muddy Creek Watershed Rivers
Sampling Stations
Legend
Cities
Roads
FS/Minor Route
State Route
Interstate Route
SUPPORT
Fully supporting
Non-Supporting
Emery WCD Sample Site
Utah DWQ Sample Site
Point Source Location
Muddy Creek Watershed
EWCD 12
Emery
495543
Quitchupah Creek
UT0022616
Muddy Creek
10
Nie Creek
EWCD 13
I-70
495530
EWCD 15
EWCD 14
Muddy Creek
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495500
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3.75
7.5
15
22.5
30

3.5.3.1 Critical Seasonal Variations in TDS Concentrations

Average monthly TDS concentrations and flows measured at STORET monitoring station 495500 (Muddy Creek at Old U24 Crossing) and monitoring station EWCD-14 (Lower Muddy Creek) are shown in Figures 3-14 and 3-15, respectively. Figures 3-14 and 3-15 show a generally similar seasonal pattern of average monthly flows and associated TDS concentrations attributed to similar irrigation activities and runoff patterns as described for the sub-watersheds in the San Rafael watershed. As with the sub-watersheds in the San Rafael watershed, although seasonal variations in TDS concentrations are shown, it is noted that there is no one critical season for high TDS concentrations in these reaches of Muddy Creek, as the average measured TDS concentrations consistently exceed the TDS criterion of 1,200 mg/L over the entire year.

3.5.3.2 Critical Flow verses TDS Concentrations

Figures 3-16 and 3-17 are plots of measured TDS concentrations verses flow at STORET monitoring station 495500 and monitoring station EWCD-14, respectively. These plots show a trend of increasing TDS concentration with decreasing flow and a dilution effect of decreasing TDS concentrations at high flows at each station. TDS concentrations are the highest during low flow conditions when it may be expected that groundwater inflows (including long-term irrigation return flow) with elevated TDS concentrations provide the majority of streamflow. The elevated TDS concentrations in groundwater are attributed to contact with the Mancos Shale (Laronne 1977), which is prevalent in the middle portion of the watershed. Although TDS concentrations decrease with increasing flows, TDS concentrations occur above the TDS water quality criterion throughout most of the range of flows. The consistently high TDS concentrations throughout the range of normal flows are attributed to the continual inflow of groundwater, irrigation return flows, and other inflows to the stream occurring over the range of these flows. As a practical matter, there is no critical flow, within the range of normally expected flows, above which the TDS criterion is attained in these stream reaches.

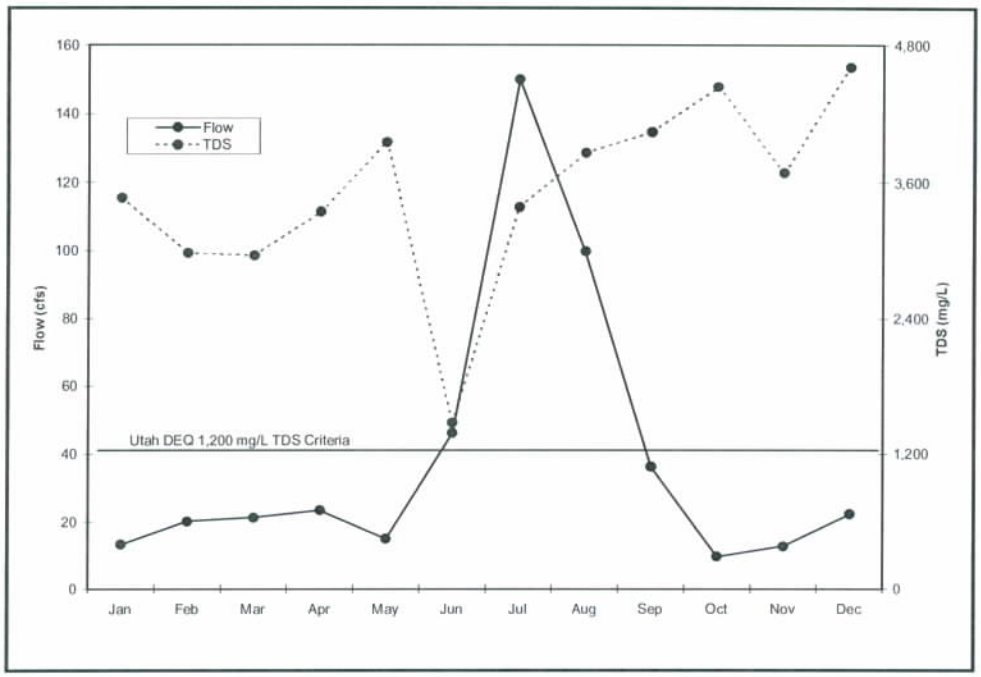

Figure 3-14 Average Monthly Flow and TDS for 495500 (Muddy Creek at Old US 24 Crossing)

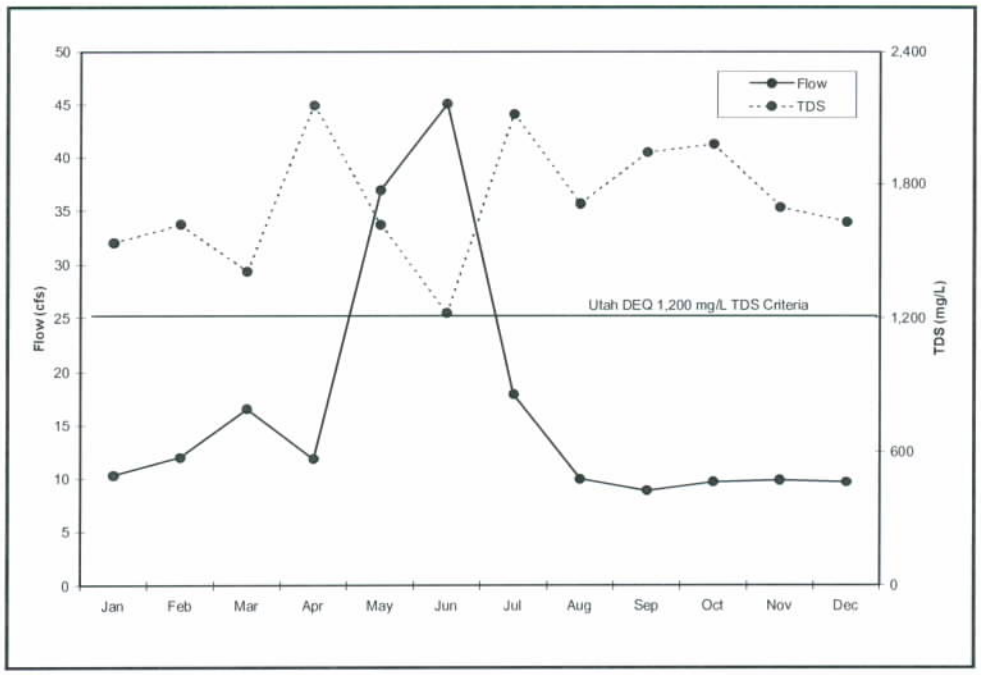

Figure 3-15 Average Monthly Flow and TDS for EWCD-14 (Lower Muddy Creek)

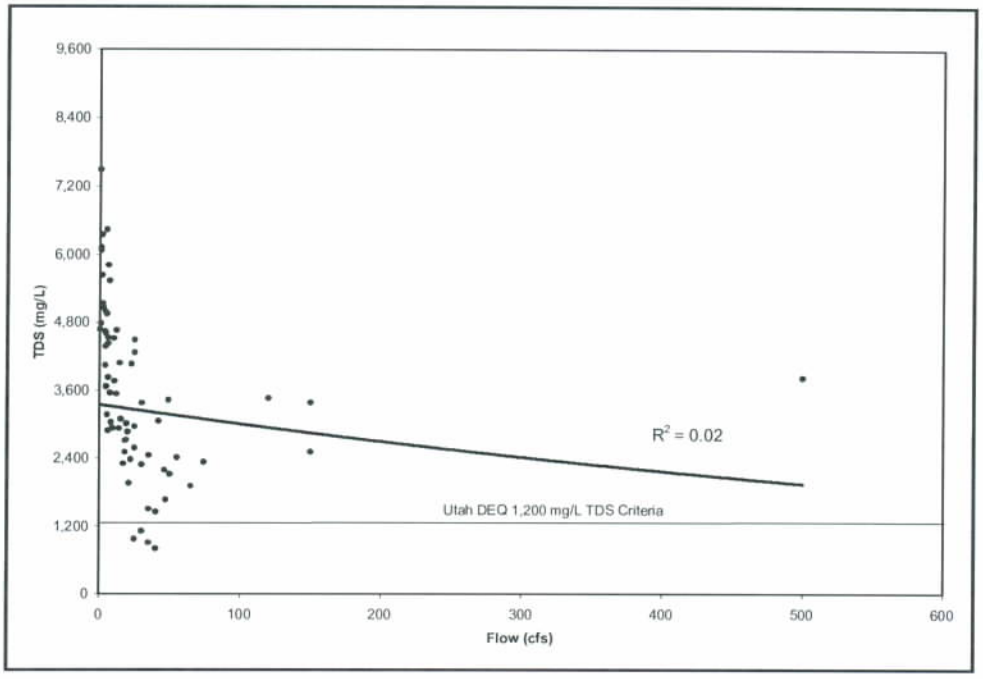

Figure 3-16 Flow verses TDS Regression Plot for 495500 (Muddy Creek at Old US 24 Crossing)

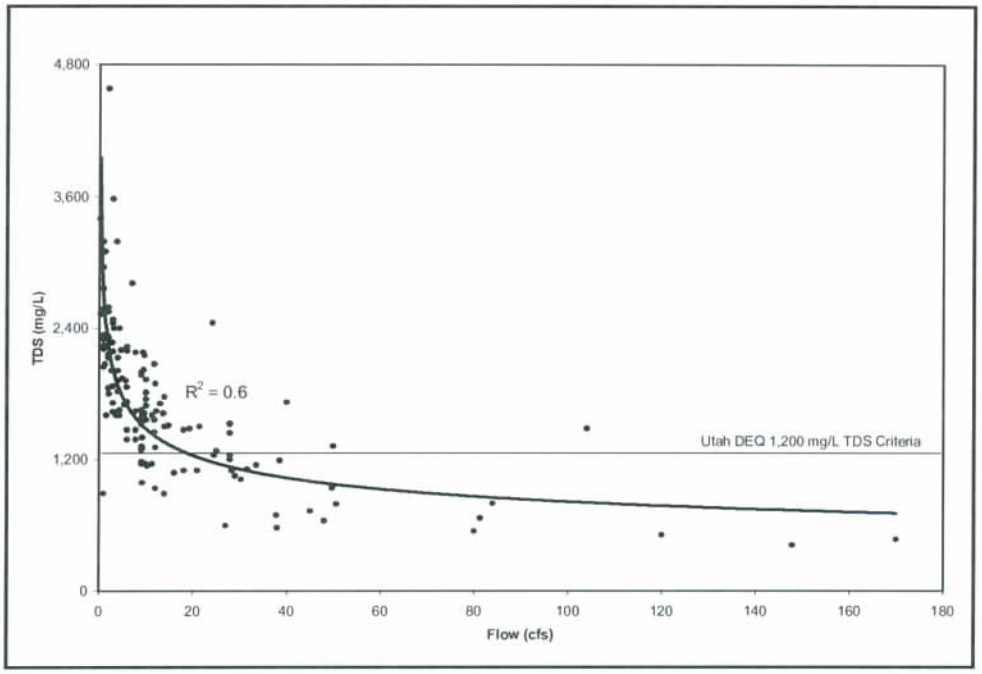

Figure 3-17 Flow verses TDS Regression Plot for EWCD-14 (Lower Muddy Creek)

3.5.4 Summary

The majority of the water quality standards violations occur in the middle and lower portions of the Study Area watersheds where agriculture and rangeland are the predominant land use. As discussed in Section 3.1, with only limited exceptions, TDS is the constituent of concern for the WCRW. The available data indicates that Grassy Creek, the sole segment listed for impairment from pH, should not be listed as impaired. Furthermore, there have not been any exceedances of the DO standard in any stream segment in the WCRW in the last three years. Segments listed as impaired due to DO will be removed in the next 305(b) listing. Based on the limited exceedances of the dissolved iron concentrations and the lack of any identified sources, all stream segments listed as impaired from iron have been delisted in the draft Utah 2004 303 (d) list of waters.

The primary factors in increased TDS loads in the middle and lower reaches of the Price, San Rafael, and Muddy Creek watersheds are from agricultural irrigation practices, surface runoff, and natural geological loadings. Increased surface run-off, and loading of TDS, is also associated with current irrigation practices. Irrigation water percolating through the soil and shale dissolves salts, principally carbonates and sulfates, and transports them to the natural drainages (Laronne 1977). Groundwater moving through the Mancos Shale formation, already affected by soils containing elevated salt levels, picks up additional salts from the shale and discharges the high TDS concentration into streams. Due to different geology and landuses, the upper portions of each of the watersheds generally have insignificant salt loadings relative to the downstream reaches. Specific non-point and point sources for each of the target locations are discussed in greater detail in Sections 4 and 6.

4.0 SOURCE ASSESSMENT

Data evaluation shows that both point and non-point sources are contributing TDS load to streams within the WCRW. The evaluation also shows non-point source pollution is the leading cause of excessive TDS concentrations within the watershed. Past work in the area (BOR and SCS 1993) estimates that irrigation, waste discharge, and natural geologic loadings results in an increase in TDS from approximately 300 mg/L above areas of agricultural irrigation use to greater than 2,000 mg/L below these areas.

4.1 Municipal and Industrial Sources

There are both municipal and industrial sources of TDS loading in the WCRW Study Area. Past work in the Colorado River Basin has estimated that municipal and industrial sources can increase salt loading by approximately 100 tons per 1,000 people per year (BOR 2001). Permitted municipal source discharges in the Study Area are associated with wastewater treatment facilities. Permitted industrial source discharges are associated with coal mine operations and power plants. These permitted point source discharges and discharge data are shown in Tables 4-1 and 4-2.

Wastewater treatment facilities located in Price, Huntington, Castle Dale, and Ferron contribute TDS load to the Price River, Huntington and Cottonwood Creeks, and Ferron Creek, respectively. However, the flow from these treatment plants is relatively small and the loads are limited (see Tables 4-1 and 4-2, permit numbers UT0021814, UT0021296, and UT0023663). General surface disturbance and run-off from urban areas, as well as leakage from municipal water supply lines also contributes non-point source loadings of TDS. Runoff rates and flows from urban areas can be 20 percent more than the runoff generated from grassland areas due to the many impervious surfaces in urban areas such as roads, buildings, and parking lots. Along with the possibility for additional erosion of high salt content soils, urban runoff can also contain road salts and other soluble materials that may contribute loading to the WCRW streams (Texas Non-Point Source Book 2003).

Coal mining activities can increase salts through the leaching of spoil materials, groundwater discharge, or erosion of disturbed surface material. Point source discharges are possible from the discharge of dewatering effluents, and from other controlled sources. Non-point discharges can also occur from uncontrolled sources and from increased surface disturbances. A study completed by USGS (1986b) observed that water from mines in the Book Cliffs area of the Price River watershed area contain TDS ranging from 800-1,600 mg/L, while water from mines in the coal resource areas of the San Rafael River watershed contain TDS concentrations of 50-750 mg/L. Most mining operations discharge relatively low annual loads of TDS into streams (see Tables 4-1 and 4-2).

Table 4-1 NPDES Permit Holders, Permit Numbers, and Locations in the WCRW[1]

PERMITEE[2]	PERMIT #	ISSUED	EXPIRES	FACILITY LOCATION
Andalex-West Ridge	UTG040023*	N/A	N/A	PO Box 902, Price
Andalex-Centennial	UTG040008*	9/01/98	4/30/03	PO Box 902, Huntington
Andalex-Wildcat	UTG040007*	6/01/98	4/30/03	PO Box 902, Price
Ark Land Company	UT0025453	7/31/02	7/31/07	18 miles east of Helper
Canyon Fuel-Banning	UTG040011*	5/29/98	4/30/03	PO Box 1029, Wellington
Castlegate Central Processing	UT0025437*	1/14/02	1/31/07	11 miles north of Helper
Castle Valley Special SSD	UT0023663	7/11/00	7/31/05	86 South First East, Castle Dale
Castle Valley SSD- Huntington	UT0021296	11/18/99	11/30/04	PO Box 877, Castle Dale
Consolidation Coal Company Emery Mine	UT0022616	6/17/99	6/30/04	PO Box 527, Emery
Co-Op Mining Company	UT040006	5/01/98	4/30/03	Bear/Trail Canyon Mines, Huntington
Cyprus Plateau Mining-Willow Creek	UTG040012*	1/12/00	4/30/03	847 Northwest Highway 191, Helper
East Carbon Water Treatment Plant	UTG640012*	5/08/98	4/31/03	Whimore Canyon above East Carbon
Emery Water Treatment	UTG640030*	5/08/98	5/31/03	Castle Dale
Ferron Sewerage System	UT0020052**	5/27/99	5/31/04	PO Box 820, Ferron
Genwal Resources	UT0024368**	8/07/95	8/31/05	PO box 1077, Price
Hiawatha Coal Company	UT0023094	9/09/99	9/30/04	PO Box 1201, Huntington
Horse Canyon Mine	UTG040013*	5/20/98	4/30/03	31 North Main St., Helper
Interwest Mining Co Des Be Dov	UTG040022	6/16/98	4/30/03	7 Miles NE of Castle Dale, Huntington
JW Operating Corp.	UT0025488*	N/A	N/A	Soldier Creek Canyon
Lodestar Energy - Horizon	UTG040019	5/04/99	4/30/03	H.C. Box 370, Helper
Lodestar Energy-Scofield	UTG040021*	8/07/98	4/30/03	Scofield Route, Helper
Mountain Coal Co.	UTG040004*	5/29/98	4/30/03	C/O Blackhawk Engineering, Wellington
Orangeville Water Treatment Plant	UTG640031*	5/08/98	5/31/03	NW of Orangeville, Castle Dale
Pacificorp-Carbon Plant	UT0000094	11/30/01	11/30/06	Hwy. 67191, 3 Miles North of Helper
Pacificorp-Deer Creek Coal	UT0023604**	11/18/02	12/31/07	Hwy. 31, 7 miles S. of Huntington
Pacificorp-Trail Mountain	UTG040003*	6/25/93	4/30/03	Sec 25 T17S R6E Alb&M, Orangeville
Pacificorp-West Mine	UT0023728*	1/22/03	12/31/07	PO Box 310, Huntington
Plateau Mining	UT0023736*	12/21/01	12/31/06	Star Point, Price
Price City Water Treatment Plant	UTG640035*	N/A	N/A	Price Canyon Highway 6, Price
Price River Water Improvement District	UT0021814	12/31/01	12/31/06	265 North Fairgrounds Road, Price
Price River Water Treatment Plant	UTG640034*	N/A	N/A	432 West 600 South, Price
Savage Industries	UTG040005**	5/29/98	4/30/03	Route 1 Box 146-H5, Wellington
Star Point Refuse Pile	UTG040025*	8/06/02	4/30/03	Sec. 10&15,T15S, R8E, Wattis
Sunnyside Cogeneration	UT0024759*	8/01/02	7/31/07	1 Power Plant Road, Sunnyside
Talon Resources Inc.	UT0025399	8/24/01	8/31/06	375 South Carbon Ave., A-10, Price
Utahamerican Energy	UTG040024*	N/A	N/A	Lila Canyon, Price
Wal-Mart Supercenter	UTR100812*	N/A	N/A	255 South Highway 55, Price

[1] CBM belowground discharge is not regulated under the UPDES program.

[2] There are two additional power plants (Hunter and Huntington) that are in the process of being permitted for discharge.

* No data available for this location from USEPA's PCS Environmental Warehouse Internet Database

** Three or less data observations available for this location from USEPA's PCS Environmental Warehouse Internet Database

Table 4-2 NPDES Permit Numbers, Flow, and TDS Data in the WCRW

Permittee[1] Name/Permit Number	Flow (cfs)			TDS (mg/L)		Load	
	Design Flow Rate	Existing Flow Mean	Existing Flow Range	Existing TDS Mean	Existing TDS Range	Existing Annual Load[2] (tons/year)	Waste Load[3] (tons/year)
Ark Land Company (UT0025453)	0.046	0.020	7.74×10^{-9} - 0.03	567	531-625	8	30
Canyon Fuel - SUFCO (UT0022918)	8.3	4.07	0.03-8.67	794	221-1,449	2,500	10,044
Castle Valley Special SSD (UT0023663)	1.09	0.6	0.31- 1.04	1,513	1,410-1,610	730	1278
Castle Valley SSD – Huntington (UT0021296)	0.619	3.56×10^{-7}	2.63×10^{-7} – 4.33×10^{-7}	2,738	2,400-3,205	0.001	730
Ferron Lagoons- Ferron (UT0020052)	0.84	0.81	0.57-0.96	1195	1070-1320	95	986
Consolidation Coal – Emery (UT0022616)	0.879	0.31	0.11-0.57	4,177	2,460-5,048	1,095	1,104
Co-Op Mining Company (UT040006)	0.78	0.06	1.42×10^{-4} – 0.21	594	296-998	35	670
Hiawatha Coal Company (UT0023094)	0.981	0.23	4.23×10^{-4} – 1.55	705	677-740	146	941
Interwest Mining Co Des Be Dov (UTG040022)	371.4	1.75×10^{-8}	9.28×10^{-9} – 3.09×10^{-8}	10,347	9,533-11,885	0.0002	NA[4]
Lodestar Energy – Horizon (UTG040019)	2.05	4.77×10^{-4}	7.74×10^{-6} – 0.89	382	317-482	258	1035
Pacific – Carbon Plant (UT0000094)	0.433	0.50	3.25×10^{-7} – 8.05×10^{-7}	298	190-510	146	552
Pacificorp – Trail Mountain (UTG040003)	36.46	0.08	0.01 – 0.13	3,035	1,452-7,070	233	138
Price River Water Imp. Dist (UT0021814)	6.2	2.17	1.70×10^{-6} – 2.48×10^{-6}	1,061	899-1,190	2,190	7,304
Talon Resources Inc. (UT0025399)	0.75	9.76×10^{-3}	2.77×10^{-3} – 0.02	327	157-628	3	889

[1] Although there are additional permitted discharges in the WCRW, flow and TDS data for at least four sampling periods is available from USEPA's PCS Environmental Warehouse Internet Database only for the locations listed

[2] Existing annual load from Section 6.3.1

[3] Waste load is calculated based on proposed permit limits as listed in Table 6-1 (permits may be concentration or load-based)

[4] Design flow is based on the 25 year 6-hour storm event only

An additional industrial activity in the Study Area is development of coal bed methane (CBM). The source coals for CBM are generally located in marine-derived formations such as the Mancos Shale, and development and production of CBM wells results in production of high saline waters, which are typically disposed of through evaporation and deep-well injection. Coal bed methane development and production activities first began in the Study Area in 1990, with more significant activity beginning in 1993-1994 in the Ferron Coals located in the Price River watershed. Water production from development

of CBM wells and deep well injection of produced water (produced water was injected into the Navajo and Wingate formations) peaked in the Study Area in 2001 and is now declining. (Hunt 2003)

The effects of CBM development were evaluated on an annual and monthly basis in the San Rafael and Price River watersheds. Any effects were assumed to occur by movement of high saline water into the surface streams as a result of development and production of the CBM wells. The evaluation was accomplished by comparing available measured surface water chemistry over time (pre-CBM to current), looking for any increasing trend in measured TDS concentrations in surface streams that might be attributable to CBM activity. While the analysis of surface water chemistry did not indicate that CBM development has resulted in increased TDS loading in the Study Area, the results of continued monitoring should be assessed for any future effects. The USGS is also currently working on a regional model to assess potential future water quality impacts, if any, of CBM development in Utah (Hunt 2003). Details of this study were not available at the time of this report.

Overall, the analysis of point source data revealed that the current impact of point source TDS on the WCRW streams is relatively minor (see additional discussion in Section 6.0).

4.2 Non-point Sources

While there are potential non-point source loadings of TDS from industrial and municipal sources, as discussed above, they are generally insignificant relative to the other non-point sources of TDS concentrations in the watershed. The most significant TDS loading are due to surface and sub-surface movement of water over the Mancos Shale geologic feature present in the area. Mancos Shale formations, which are known to be highly saline and soluble, dominate the middle portion of the WCRW, where irrigation is also ubiquitous. Ground water flows through the Mancos Shale and surface runoff over soils derived from Mancos Shale have been reported as resulting in substantial dissolution of salts (Apodaca 1998, Evangelou et al. 1984, Laronne 1977) and are the primary avenues by which TDS loadings are increased in the WCRW. Water quality data are shown in Appendix B. Specific types of non-point sources fore each of the listed impaired stream segments are summarized in Appendix A.

A previous water quality monitoring project (DEQ 2000) has determined that irrigation return flows, canal seepage, and stock pond seepage constitute a significant source of TDS in the WCRW. Nearly 400 miles of stream segments in the WCRW have been designated as non-supporting or partially supporting their beneficial use due to high TDS caused by agricultural activities. The BOR (2001) estimates that irrigation and other agricultural activities in the Price and San Rafael river sub-watersheds alone results in a salt loading of approximately 258,000 tons per year

Irrigation and associated canal seepage are the largest contributors of TDS in the WCRW. TDS loading associated with irrigation can occur from surface flow and from subsurface movement of return flows. Overland flow caused by over-irrigation can transport salts, as well as sediment, from the soil surface directly to streams. Salt has accumulated on the soil surface in many areas in the WCRW due to the dissolution of salts from the soil and subsurface materials. Below-ground irrigation return flows may eventually enter the groundwater and return to the stream. Data from stream gauges below irrigation areas in all sub-watersheds show significant increases in TDS loadings compared to data from gauges above irrigation areas. Increased TDS concentrations caused by irrigation return flows continue to degrade water quality as the water moves downstream and picks up increasing amounts of salts.

Seepage of water from unlined canals and stock ponds is also a significant contributor to the loading of streams in the WCRW. The BOR and SCS (1993) estimates that canal seepage increases the TDS load by 67.16 tons per mile of canal.

Runoff events are also a significant source of the total salt load in the WCRW. Previous studies have estimated that 21 percent of the salt load in the Price River and 14 percent of the salt load in the San Rafael River are related to runoff events caused by intense precipitation during thunderstorms (BOR 2001). Similar loading has been also been estimated for Muddy Creek (BOR 1987). Additionally, overland flow of snowmelt on lower elevation sites located on saline formations can significantly increase salinity.

Surface runoff over soil derived from Mancos Shale can potentially increase TDS by transporting salt laden soil particles into nearby streams. The aridity of the WCRW results in a net upward movement of water, which deposits salts on the soil surface. These salts are susceptible to movement by surface runoff from natural precipitation events, snowmelt, and over-irrigation (Laronne 1977). Runoff can be exacerbated by disturbances to the soil surface, such as forestry activities, overgrazing and recreational activities.

Improper forestry related activities can increase TDS loading by removing vegetative cover and other protective surfaces, such as pebbles and gravel, as well as loosening the soil surface, all of which increase the erosion potential caused by overland flow. Additionally, roads built for timber extraction are susceptible to erosion, as are all unpaved roads in the watershed. Both the road surface and the steep embankments can be severely eroded by relatively minor storms. However, due to the forested portions of the watershed occurring outside of the Mancos Shale, these practices generally contribute relatively insignificant salt loads.

Livestock and wildlife grazing can result in surface disturbance or compaction, which can alter infiltration, surface cover, and streambank stability. These changes can increase TDS loading in adjacent streams. Infiltration rates decrease, and runoff increases, as livestock or wildlife ground trampling increases. Dadkuh and Gifford (1980) found that untrampled soils exhibit more than two times the infiltration rate as trampled soils. They also reported that by increasing the cover of grasses from 30 percent to 50 percent, sediment production was decreased by more than 50 percent. Streambank degradation caused by watering animals in readily accessible streamside areas can also result in increased sediment production, and accompanying TDS loadings, in the WCRW.

Recreational activities are another potential source of TDS in the WCRW. The loss of vegetative cover and the loosening of soil particles associated with the use of recreational vehicles results in increased erosion potential and possible TDS loading into nearby streams. Recreational activities can also damage or remove the protective cryptogamic crust, which then results in increased sedimentation and associated TDS loading (Belnap et al. 2001).

5.0 LOADING CALCULATIONS

The ultimate goal of a TMDL is the attainment of water quality standards for impaired waters, were feasible and achievable. In order to meet the goal of the TMDL, the relationship between source loading and the loading capacity of the receiving water must be established. The loading capacity is the amount of a given pollutant that can be assimilated by a water body while still meeting the water quality standard for the water body. For this TMDL, the water quality criterion is 1,200 mg/L TDS.

This section describes the procedures used for determining the loading capacity and current TDS loading in the Price River, San Rafael River, and Muddy Creek watersheds. In conjunction with historical flow records, loading capacities were established for flows expected to occur in an average year in the Price River, San Rafael River, and Muddy Creek, as well as selected tributaries in these watersheds, for which target points were established. Existing loads, which were calculated from available monitoring data, were compared to loading capacities in order to evaluate critical conditions and calculate the necessary load reductions.

Each of the established target sites in the WCRW has a TMDL of TDS that can be carried before the TDS criterion is exceeded. This TMDL is equivalent to the loading capacity at each of the target sites, which is calculated by the following formula:

$$\text{Flow (cfs)} \times \text{TDS WQ Criterion (1,200 mg/L)} \times 2.71\times10^{-3} \text{ (Conversion Factor}^{1}\text{)} = \text{Load Capacity (tons/day)}$$

This same formula is used to calculate existing loads by substituting measured TDS concentrations at respective flows for the TDS water quality criterion.

Critical conditions represent the condition or conditions under which the loading capacity of a target site is exceeded and violation of TDS criterion occurs. These critical conditions can be dependent on environmental and other watershed factors, such as rainfall events when TDS loading to surface waters occurs in surface runoff to the Study Area streams, as well as watershed activities, such as irrigation that can result in TDS loading through surface and ground water return flows. Critical conditions in the Study Area are difficult to identify because of the dynamic combination of hydrology and loading conditions. Loading times that have the greatest impact on water quality conditions are difficult to distinguish, because of lags created by ground water flows, surface water diversions and other factors such as irrigation rates.

[1] Conversion listed is used to convert flows and TDS concentrations to arrive at the units of tons/day.

As discussed in Section 3.5, violations of the TDS water quality criterion occur during all months of the year at target sites in all three Study Area watersheds. As described in the following sections, based on the available water quality data, the TMDL water quality criterion is violated throughout the entire year and at all expected normal flow conditions throughout the watersheds. Therefore, critical conditions in each of the three watersheds exist at all flow conditions, and the TMDLs will be based on flow conditions and not specific seasonal periods. Establishing a TMDL for TDS under all critical flow conditions ensures that the TDS water quality criterion is met under all conditions.

5.1 Price River Watershed

As previously discussed, STORET monitoring stations 493239 (Price River above WWTP in Wellington) and 493165 (Price River at Woodside) were designated as target sites in the Price River watershed and assessed for temporal and spatial variations in flow. The daily stream flows measured at these monitoring stations were arranged in order of magnitude and divided into flow tiers. Each flow tier represents a range of measured flows, the highest measured flow within the range assigned a percentage (e.g., 10 percent, 20 percent) that reflects the chance of any measured stream flow being less than or equal to it. For example, higher measured flow (e.g., 90 cfs) would have a lower (e.g. 10 percent) chance of criterion exceedance while a lower flow (e.g., 10 cfs) would have a greater chance of exceedance. To evaluate the critical flow conditions at each target site, the maximum load capacity for each flow tier was calculated based on the highest measured flow within the tier range of flows and this load capacity compared with existing loads (minimum, maximum, average) calculated from the data. These results are shown in Tables 5-1 (monitoring station 493239) and 5-2 (monitoring station 493165). Plots of calculated loading capacity at each flow tier versus *average* existing load calculated from the data are shown for each monitoring station in Figures 5-1 and 5-2, respectively.

As shown in Table 5-1, maximum TDS loads for all but the 10 percent and 20 percent percentile groups exceeded the allowable load capacities for each percentile group. The plot of average existing load versus calculated loading capacity (Figure 5-1) is consistent with the water quality assessment results presented in Section 3.4.1, which show that, on average, the TDS water quality standard at this monitoring station is exceeded throughout the entire year, except during higher flow periods in the summer (see Figure 3-2). The results for monitoring station 493165 show that loading capacities are exceeded and critical conditions exist throughout the entire range of flow tiers (Table 5-2), although average existing loads do not exceed loading capacities at higher flow tiers (Figure 5-2).

Table 5-1 Loading Statistics for Station 493239, Price River Watershed (Map 10, Price River above Price WWTP at Wellington bridge)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	360	2	0	332	767	550	1,163
10% - 20%	100	3	0	114	299	178	323
20% - 30%	70	2	1	93	295	194	227
30% - 40%	45	3	1	72	242	144	146
40% - 50%	27	2	2	138	177	152	87
50% - 60%	19	3	3	121	141	131	61
60% - 70%	17	3	3	74	109	90	55
70% - 80%	14	2	2	96	116	106	47
80% - 90%	9	3	3	43	67	58	29
90% - 100%	5	2	2	25	41	33	15

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-2 Loading Statistics for Station 493165, Price River Watershed (Map 10, Price River near Woodside at US 6 crossing)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	236	5	2	471	1,612	826	763
10% - 20%	132	6	4	211	2,784	574	425
20% - 30%	72	6	6	255	513	361	232
30% - 40%	55	5	4	187	480	290	177
40% - 50%	50	6	5	74	358	262	161
50% - 60%	43	5	5	251	420	329	138
60% - 70%	36	6	6	187	279	220	117
70% - 80%	26	6	5	45	221	150	84
80% - 90%	20	5	5	115	188	145	63
90% - 100%	11	5	4	20	122	70	35

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

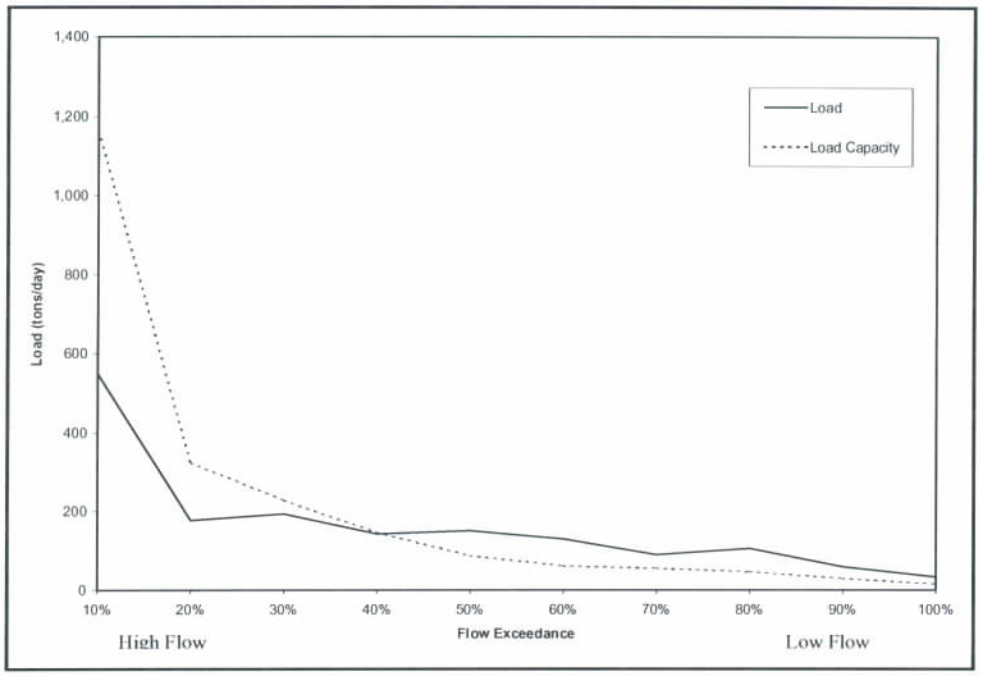

Figure 5-1 **Existing TDS Loading by Flow for Station 493239 (Map 10, Price River above Price WWTP at Wellington Bridge)**

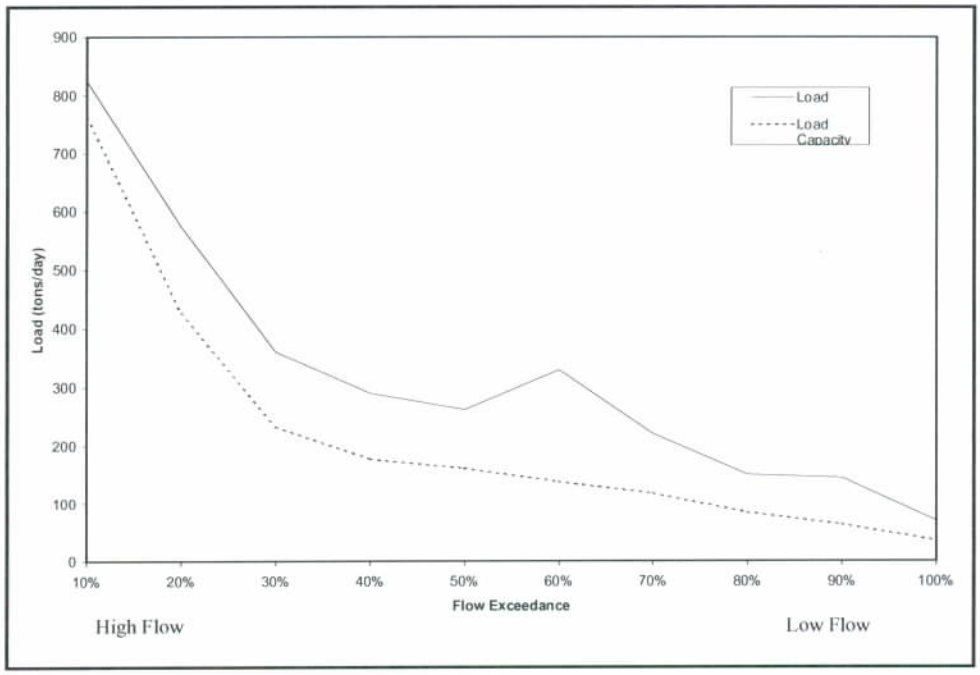

Figure 5-2 **Existing TDS Loading by Flow for Station 493165 (Map 10, Price River near Woodside at US 6 Crossing)**

5.2 San Rafael Watershed

Results of the analyses of loading capacities, existing loads, and critical conditions for target sites/monitoring stations EWCD-03 (Huntington Creek lower), EWCD-07 (Cottonwood Creek lower), EWCD-09 (Rock Canyon Creek lower), EWCD-11 (Ferron Creek lower), and STORET monitoring station 493029 (San Rafael at U24 crossing) in the San Rafael watershed are shown in Tables 5-3 through 5-7, and Figures 5-3 through 5-7, respectively. The results show that loading capacities are exceeded and critical conditions exist throughout the entire range of flow tiers at each of these monitoring stations (Tables 5-3 through 5-7), although average existing loads do not exceed loading capacities at higher flow tiers at monitoring stations EWCD-07, EWCD-11, and STORET monitoring station 493029 (Figures 5-4, 5-6, and 5-7, respectively).

Table 5-3 Loading Statistics for Station EWCD-03, Huntington Creek Watershed (Map 11, lower Huntington Creek)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	107	14	7	142	741	371	344
10% - 20%	50	15	14	181	602	281	163
20% - 30%	24	14	14	123	235	171	77
30% - 40%	17	14	14	81	223	129	53
40% - 50%	12	15	15	73	160	122	40
50% - 60%	9	14	14	65	141	93	29
60% - 70%	7	15	15	51	125	80	24
70% - 80%	6	14	14	45	88	65	18
80% - 90%	4	14	14	24	61	42	13
90% - 100%	1	14	14	1	26	13	4

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-4 Loading Statistics for Station EWCD-07, Cottonwood Creek Watershed (Map 11, lower Cottonwood Creek)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	175	14	6	173	882	332	566
10% - 20%	37	15	13	112	223	169	121
20% - 30%	27	14	13	90	223	149	89
30% - 40%	22	15	15	83	230	135	72
40% - 50%	20	14	14	79	156	117	64
50% - 60%	18	15	15	73	130	109	58
60% - 70%	15	14	14	73	125	100	50
70% - 80%	13	15	15	69	125	94	42
80% - 90%	9	14	13	18	136	70	29
90% - 100%	4	14	14	11	70	41	13

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-5 Loading Statistics for Station EWCD-09, Rock Canyon Creek Watershed (Map 11, lower Rock Canyon Creek)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	27	13	13	99	208	142	89
10% - 20%	19	14	14	82	267	120	61
20% - 30%	13	14	14	67	177	107	41
30% - 40%	10	13	13	51	138	75	33
40% - 50%	8	14	14	51	122	72	26
50% - 60%	6	13	12	13	88	61	20
60% - 70%	5	14	14	39	92	59	17
70% - 80%	4	14	14	31	94	51	13
80% - 90%	3	13	13	32	54	41	10
90% - 100%	2	13	13	15	38	24	6

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-6 Loading Statistics for Station EWCD-11, Ferron Creek Watershed (Map 11, lower Ferron Creek)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	120	14	4	95	522	225	386
10% - 20%	20	15	15	80	175	109	66
20% - 30%	12	14	14	56	114	83	40
30% - 40%	10	14	14	45	83	63	32
40% - 50%	7	15	15	40	139	60	23
50% - 60%	5	14	14	28	54	42	18
60% - 70%	4	15	15	22	47	33	14
70% - 80%	4	14	14	26	41	30	11
80% - 90%	2	14	14	11	30	20	7
90% - 100%	1	14	14	1	20	7	2

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-7 Loading Statistics for Station 493029, Lower San Rafael River Watershed (Map 11, San Rafael River at US 24 crossing)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	291	6	1	479	1,067	715	939
10% - 20%	91	6	6	425	474	457	293
20% - 30%	51	6	6	204	500	333	165
30% - 40%	37	6	6	214	345	276	120
40% - 50%	29	6	6	202	230	211	93
50% - 60%	25	6	6	171	230	204	80
60% - 70%	17	6	6	106	184	148	56
70% - 80%	14	7	7	85	145	115	46
80% - 90%	6	6	6	25	103	67	21
90% - 100%	2	5	5	14	36	21	6

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

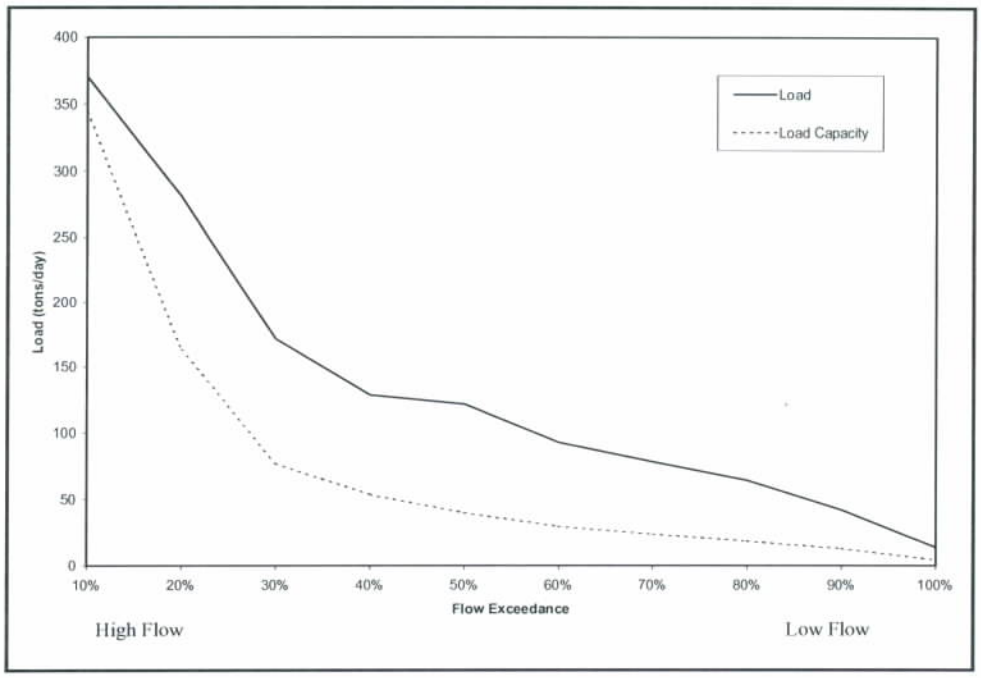

Figure 5-3 **Existing TDS Loading by Flow for Station EWCD-03 (Map 11, Lower Huntington Creek)**

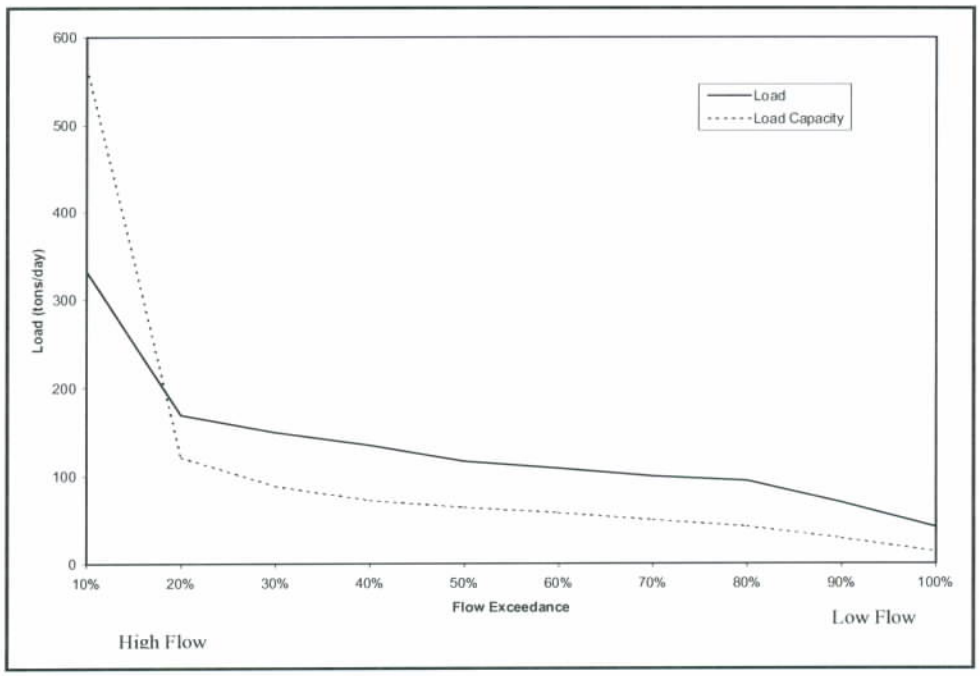

Figure 5-4 **Existing TDS Loading by Flow for Station EWCD-07 (Map 11, Lower Cottonwood Creek)**

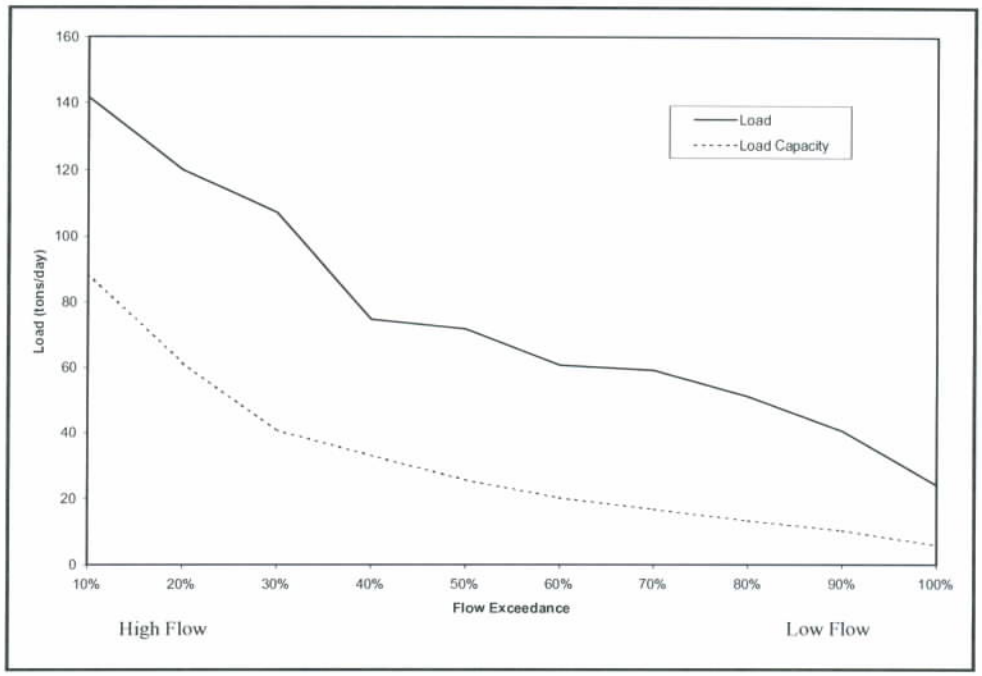

Figure 5-5 **Existing TDS Loading by Flow for Station EWCD-09 (Map 11, Lower Rock Canyon Creek)**

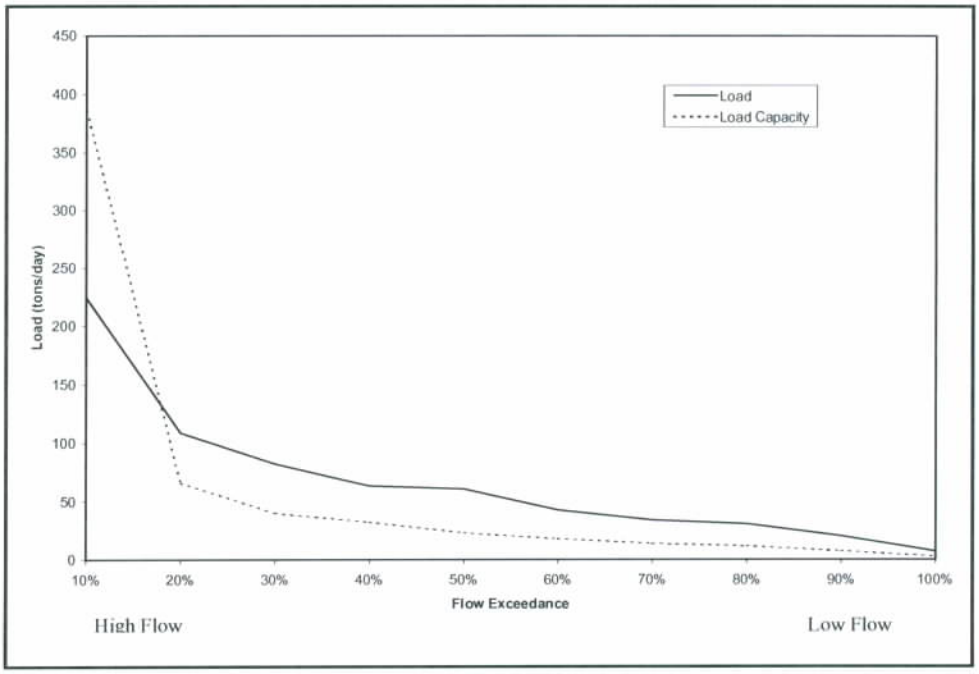

Figure 5-6 **Existing TDS Loading by Flow for Station EWCD-11 (Map 11, Lower Ferron Creek)**

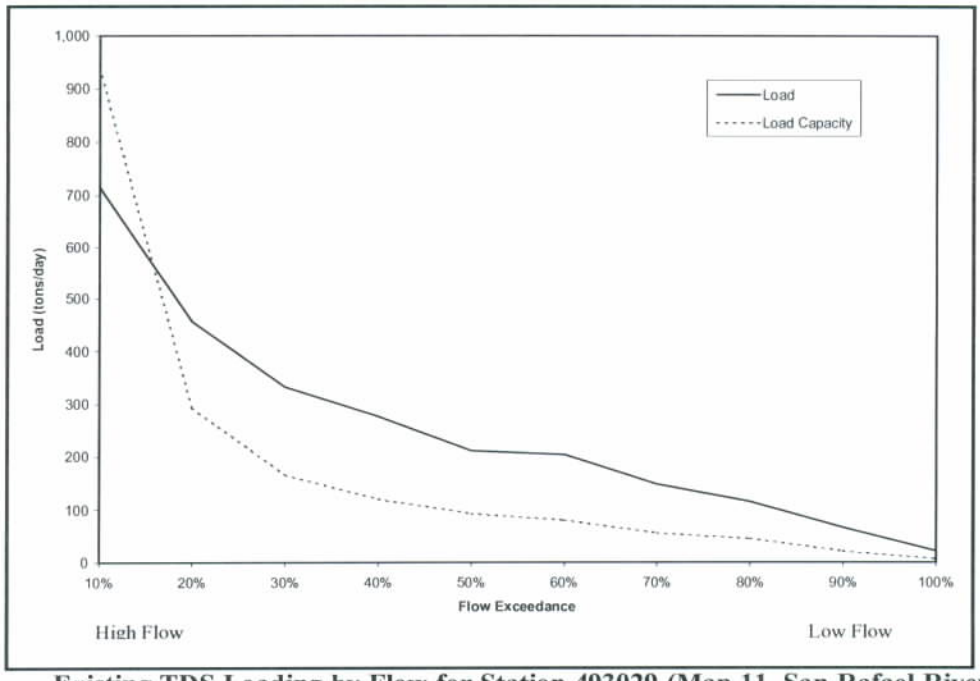

Figure 5-7 Existing TDS Loading by Flow for Station 493029 (Map 11, San Rafael River at US 24 crossing)

5.3 Muddy Creek

Results of the analyses of loading capacities, existing loads, and critical conditions for target sites/monitoring station EWCD-14 (Muddy Creek lower) and STORET monitoring station 495500 (Muddy Creek at old U24 crossing) in the Muddy Creek watershed are shown in Tables 5-8 and 5-9, and Figures 5-8 and 5-9, respectively. The results show that loading capacities are exceeded and critical conditions exist throughout the entire range of flow tiers at each of these monitoring stations (Tables 5-8 and 5-9), although average existing loads do not exceed loading capacities at higher flow tiers at monitoring station EWCD-14 (Figure 5-8).

Table 5-8 Loading Statistics for Station EWCD-14 Muddy Creek Watershed (Map 12, lower Muddy Creek)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	79	14	3	82	414	164	256
10% - 20%	30	14	6	43	115	88	97
20% - 30%	17	15	11	33	159	69	56
30% - 40%	11	14	11	30	66	46	36
40% - 50%	9	14	11	25	56	40	31
50% - 60%	8	15	14	28	53	37	26
60% - 70%	5	14	14	18	36	25	16
70% - 80%	3	14	14	13	33	20	11
80% - 90%	2	14	14	7	25	12	6
90% - 100%	1	14	13	2	9	6	3

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

Table 5-9 Loading Statistics for Station 495500, Muddy Creek Watershed (Map 12, Muddy Creek at old US 24 crossing)

Flow Exceedances	Average Flow (cfs)[1]	Number of Loads[2]	Water Quality Violations[3]	Existing Load (tons/day)[4]			Load Capacity (tons/day)[5]
				Minimum	Maximum	Average	
0% - 10%	159	7	7	334	5,151	1,402	514
10% - 20%	45	7	6	87	452	259	145
20% - 30%	31	7	5	86	287	185	102
30% - 40%	24	7	6	65	302	177	76
40% - 50%	18	7	7	106	155	133	58
50% - 60%	12	7	7	71	158	119	38
60% - 70%	7	8	8	47	105	74	21
70% - 80%	5	7	7	44	83	55	15
80% - 90%	2	7	7	23	54	34	8
90% - 100%	1	6	6	0	15	7	2

[1] Flow values shown represent the average measured flow within the respective flow tier over the period of 1/1990-12/2001.
[2] Equals the total number of available measurements (flow and TDS) within each flow tier from which loads were calculated (Appendix B).
[3] Number of times that the measured TDS concentrations exceeded 1,200 mg/L.
[4] Load (tons/day)= measured flow (cfs) x measured TDS concentration x Conversion Factor. Data is shown in Appendix B.
[5] Load capacity calculated as highest measured flow in each flow tier x TDS criterion of 1,200 mg/L x Conversion Factor.

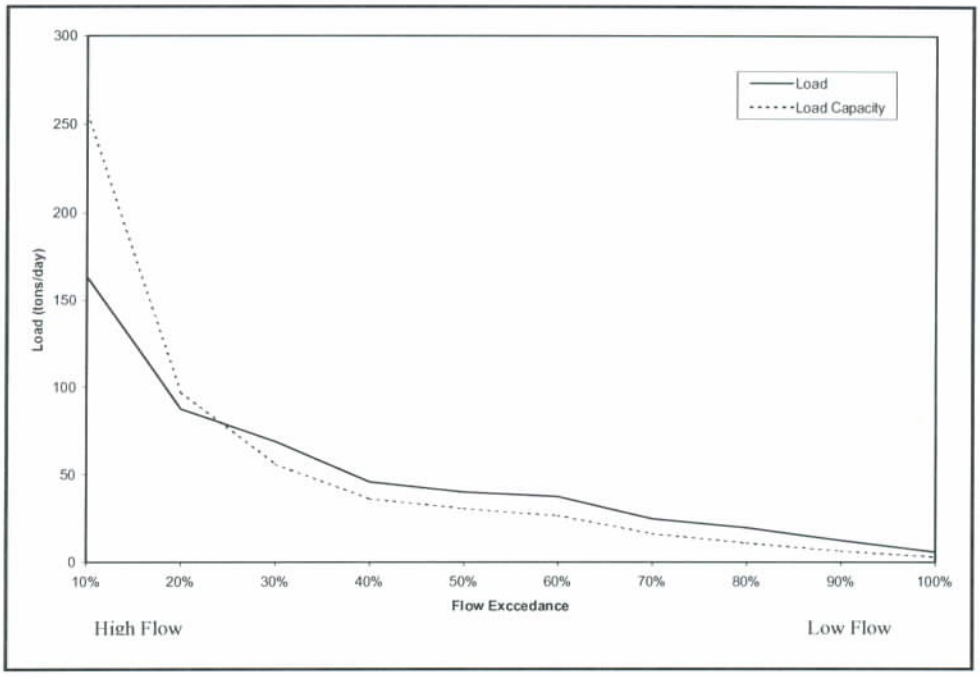

Figure 5-8 Existing TDS Loading by Flow for Station EWCD-14 (Map 12, Lower Muddy Creek)

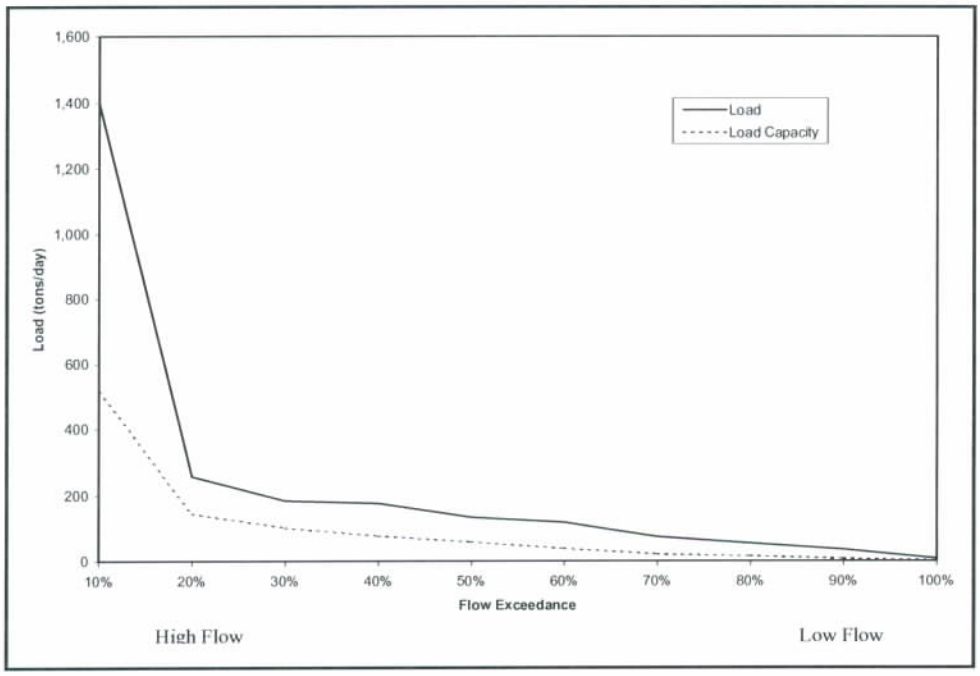

Figure 5-9 Existing TDS Loading by Flow for Station 495500 (Map 12, Muddy Creek at old US 24 crossing)

6.0 TMDL AND LOAD ALLOCATION

6.1 Description of TMDL Allocation

A TMDL is composed of the sum of individual waste load allocations (WLAs) for point sources, load allocations (LAs) for non-point sources and natural background loading (which is naturally occurring and cannot be controlled), and a margin of safety (MOS) that either implicitly or explicitly accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving streams. A TMDL is denoted by the equation:

$$TMDL = \Sigma\ WLAs + \Sigma\ LAs + MOS.$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving stream while still achieving water quality standards. For some pollutants, TMDLs are expressed as a mass-loading basis (e.g., pounds or kilograms per day). In some cases, a TMDL is expressed as another appropriate measure that is the relevant expression for the reduction of loadings of the specific pollutant needed to meet water quality standards or goals. The TMDLs for TDS for the Price River, San Rafael River, and Muddy Creek watershed are expressed on a mass-loading basis (tons/day) and represent the loading capacity of the watershed streams to assimilate TDS load and achieve the TDS water quality standard.

6.2 Margin of Safety

The MOS is a required part of the TMDL development process. There are two basic methods for incorporating the MOS:

- Implicitly incorporate the MOS using conservative model assumptions to develop allocations
- Explicitly specify a portion of the total TMDL (stream loading capacity) as the MOS.

For the Price River, San Rafael River, and Muddy Creek TMDLs, the MOS was calculated as 5 percent of stream loading capacity.

6.3 TMDL Allocations

The TMDLs and load allocations for the Price River, San Rafael River, and Muddy Creek watersheds were developed based on flow and water quality data over an 11-year period of record from 1990 to 2001. The average annual loading capacity/TMDL at each target site was calculated as the product of the average annual flow at the target site, the TDS standard criterion of 1,200 mg/L, and a conversion factor to express the average annual loading capacity/TMDL in tons/year TDS. The difference between the

TMDL and the existing average annual TDS load at each target (calculated using water quality and flow data at each target site over the 11-year period of record) plus the MOS represents the reduction in TDS loading required to meet the TMDL at that site. This reduction in TDS loading was, in turn, used to determine the allocation in TDS loading from non-point sources under the TMDLs.

The existing average annual TDS load at each target site is comprised of TDS loads from both point and non-point sources. The average annual point-source TDS load at each target site was calculated from discharge monitoring report data from permitted point-source dischargers located above the site (see Section 4, Tables 4-1 and 4-2). The average annual non-point source TDS load at each target site was calculated as the difference between the existing average annual TDS load and average annual point-source load. As shown in Tables 6-2 through 6-10, existing TDS load from point sources is generally much less than the non-point source load. At the lowest target site in each watershed, the point source load is less than 5% of the total existing load (Tables 6-3, 6-8, and 6-10). The existing point source load at all target sites is less than 10% of the existing load. This TMDL proposes to establish point source permits as the permits come open for review. The proposed limits listed in Table 6-1 will come into effect at that time. The resulting WLAs based on the limits listed in Table 6-1 are also listed in Tables 6-2 through 6-10. The reduction in TDS load required to meet the average annual loading capacity/TMDL at each target site was applied to non-point source loading to arrive at load allocations under the TMDLs, as based on the proposed new WLAs.

Tables 6-2 through 6-10 summarize the existing average annual point- and non-point source loads, loading capacity, reduction in TDS load to meet the loading capacity, and the waste load, load allocations, and MOS under the TMDL for each target site in the Price River, San Rafael River, and Muddy Creek watersheds.

Table 6-1 Proposed New Permit Limits for TDS for the Existing Point Sources in WCRW.

Permittee Name/Permit Number	Permit Limit (mg/L)	Loading (tons/year)	Annual Loading (tons/year)	Footnote(s)
Ark Land Company (UT0025453)	656		30	3
Canyon Fuel - SUFCO (UT0022918)		10,044	10,044	4
Castle Valley SSD – Castle Dale (UT0023663)		1,278	1,278	1,4
Castle Valley SSD – Huntington (UT0021296)		730	730	1,4
Ferron Lagoons- Ferron (UT0020052)		986	986	1,4
Consolidation Coal –Emery (UT0022616)		1,041	1,041	4
Co-Op Mining Company (UT040006)	880		670	3
Hiawatha Coal Company (UT0023094)	981		941	3
Interwest Mining Co- Des Be Dov (UTG040022)				2
Lodestar Energy – Horizon (UTG040019)	519		1,042	3
Pacific – Carbon Plant (UT0000094)				5
Pacificorp – Trail Mountain (UTG040003)	1136		14	3
Price River Water Imp. Dist (UT0021814)		7,304	7,304	1,4
Talon Resources Inc. (UT0025399)		889	889	4
Hunter Power Plant				5
Huntington Power Plant				5

1. It is recommended that Facilities conduct an (I&I) Inflow/Infiltration study to determine the extent of I&I from ground water into their collection systems, followed by a project to repair or replace defective sewer piping.
2. This mining facility does not have a mine water discharge (dry mine) thus is would not be required to have a UPDES Discharge Permit. The facility has constructed holding ponds designed to receive and hold a 10 year 24 hour storm event. The facility discharges from the storm water containment about once every three years. This is generally done to for preventative maintenance measures.
3. For concentration based discharge permit limit calculation purposes, if there were more that 20 TDS data points available, the 95th percentile of that data set was used; otherwise the average of data points, less than 20 were taken, plus two standard deviations.
4. Those facilities with outfall concentrations near or exceeding 1200 mg/L, permit limits are based on the design flow of the facility and the water quality standard of 1200 mg/L to determine an annual loading permit limit in tons per year.
5. When UPDES permits are renewed for Pacific Carbon Plant or written for the Hunter and Huntington Power plants, waste load allocations will be developed to insure the discharges from these facilities will not violate the instream water quality standard for TDS of 1200 mg/L.

6.3.1 Existing Conditions

The existing condition represents TDS loadings in the Price River, San Rafael River, and Muddy Creek watersheds calculated using existing monitoring data. As discussed in Section 5, existing loads were calculated for days that had recorded flow and TDS concentrations. The average annual TDS loadings are summarized in Tables 6-2 through 6-10. These tables also list the estimated existing TDS loads from specific point sources and the proposed waste load allocations for these existing point sources. The derivation of these values is summarized in Table 6-1. Permit limits were set using three methods: 1) for current discharges that are less than the 1,200 mg/L, the 95th percentile TDS concentrations was set as the permit limit; 2) for discharges that are at or slightly above the 1,200 mg/l criteria, a total annual load of the design flow x 1,200 mg/L is used, and 3) for discharges that occur where there is sufficient mixing capacity, the permit limit is established to prevent exceedance of the 1,200 mg/L criteria..

The estimated allocation of the non-point load to different sources (e.g., canal seepage, irrigation return flows, erosion) for each watershed is provided in the Project Implementation Plan (Appendix A). For the Price River-Wellington (Storet 493239), the table is shown for the average annual period (Table 6-2a) and for the defined critical condition (Table 6-2b), which is for the 40-100 percent flow exceedance (Table 5-1).

Table 6-2a Summary of Average Annual TDS Load and TMDL Load Allocation for the Price River Watershed from Coal Creek to Carbon Canal Diversion (based on UTDEQ STORET Station 493239- Price River above Price WWTP at Wellington Bridge)

Source	Existing TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040019[a]	*258*	*1,042*
NPDES UT0023094[b]	*146*	*941*
NPDES UT0000094[c]	*146*	
NPDES UT0025453[d]	*8*	*30*
NPDES UT0021814[e]	*2,190*	*7,304*
Total Point Source Load	2,748	9,317
Non-Point Source Load[2]	62,874	
Total Existing Load[3]	65,622	
Loading Capacity[4]	79,847	
Margin of Safety[5]	3,992	
Load Reduction Required to Meet Loading Capacity[6]	0	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	9,317	0%
Non-Point Source	66,538	0%
Margin of Safety	3,992	Not Applicable

Notes:
a. Lodestar Energy Inc. – Horizon, H.C. Box 370, Helper, UT. Data collected from 3/31/2000 – 12/31/2002.
b. Mine discharge. Hiawatha Coal Company, P.O. Box 1201, Huntington UT. Data collected from 8/31/2000 – 12/31/2002.
c. Pacific- Carbon Plant. Data collected from 12/31/2001 – 12/31/2002.
d. Ark Land Company. Data collected from 8/31/2002 – 11/30/2002. Due to high flow during the 8/31/2002 – 10/31/2002 period only the data from 11/30/2002 is used.
e. Price Waste Water Treatment Plant. Data collected from 1/31/2002 – 12/31/2002.
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (67.7 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-2b Summary of Average TDS Load and TMDL Load Allocation for critical conditions in the Price River Watershed from Coal Creek to Carbon Canal Diversion (based on UTDEQ STORET Station 493239- Price River above Price WWTP at Wellington Bridge)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040019[a]	*258*	*1,042*
NPDES UT0023094[b]	*146*	*941*
NPDES UT0000094[c]	*146*	
NPDES UT0025453[d]	*8*	*30*
NPDES UT0021814[e]	*2,190*	*7,304*
Total Point Source Load	2,748	9,317
Non-Point Source Load[2]	52,732	
Total Existing Load[3]	55,480	
Loading Capacity[4]	31,755	
Margin of Safety[5]	1,588	
Load Reduction Required to Meet Loading Capacity[6]	25,313	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	9,317	0%
Non-Point Source	20,850	60%
Margin of Safety	1,588	Not Applicable

Notes:
a. Lodestar Energy Inc. – Horizon, H.C. Box 370, Helper, UT. Data collected from 3/31/2000 – 12/31/2002.
b. Mine discharge. Hiawatha Coal Company, P.O. Box 1201, Huntington UT. Data collected from 8/31/2000 – 12/31/2002.
c. Pacific- Carbon Plant. Data collected from 12/31/2001 – 12/31/2002.
d. Ark Land Company. Data collected from 8/31/2002 – 11/30/2002. Due to high flow during the 8/31/2002 – 10/31/2002 period only the data from 11/30/2002 is used.
e. Price Waste Water Treatment Plant. Data collected from 1/31/2002 – 12/31/2002.
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (67.7 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-3 Summary of Average Annual TDS Load and TMDL Load Allocation for the Price River Watershed from Confluence of Green River to Soldier Creek Confluence (based on UTDEQ STORET Station 493165- Price River near Woodside at US 6 Crossing)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040019[a]	*258*	*1,042*
NPDES UT0023094[b]	*146*	*941*
NPDES UT0000094[c]	*146*	
NPDES UT0025453[d]	*8*	*30*
NPDES UT0021814[e]	*2,190*	*7,304*
Total Point Source Load	2,748	9,317
Non-Point Source Load[2]	126,849	
Total Existing Load[3]	129,597	
Loading Capacity[4]	74,200	
Margin of Safety[5]	3,710	
Load Reduction Required to Meet Loading Capacity[6]	59,107	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	9,317	0%
Non-Point Source	61,173	52%
Margin of Safety	3,710	Not Applicable

Notes:
a. Lodestar Energy Inc. – Horizon, H.C. Box 370, Helper, UT. Data collected from 3/31/2000 – 12/31/2002.
b. Mine discharge. Hiawatha Coal Company, P.O. Box 1201, Huntington UT. Data collected from 8/31/2000 – 12/31/2002.
c. Pacific- Carbon Plant. Data collected from 12/31/2001 – 12/31/2002.
d. Ark Land Company. Data collected from 8/31/2002 – 11/30/2002. Due to high flow during the 8/31/2002 – 10/31/2002 period only the data from 11/30/2002 is used.
e. Price Waste Water Treatment Plant. Data collected from 1/31/2002 – 12/31/2002.
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (62.9 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-4 Summary of Average Annual TDS Load and TMDL Load Allocation for the Huntington Creek Watershed from Confluence with Cottonwood Creek Upstream to USFS Boundary (based on EWCD-03- Lower Huntington Creek)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040006[a]	*35*	*670*
NPDES UT0021296[b]	*0.001*	*730*
Total Point Source Load	35	1,400
Non-Point Source Load[2]	58,504	
Total Existing Load[3]	58,539	
Loading Capacity[4]	27,776	
Margin of Safety[5]	1,389	
Load Reduction Required to Meet Loading Capacity[6]	32,152	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	1,400	0%
Non-Point Source	24,987	57%
Margin of Safety	1,389	Not Applicable

Notes:
a. Co-Op Mining – Bear/Trail Mines. Data collected from 5/30/1998 – 12/31/2002.
b. Castle Valley SSD (Huntington). Data collected from 10/31/2002 – 12/31/2002.
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (23.5 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-5 Summary of Average Annual TDS Load and TMDL Load Allocation for the Cottonwood Creek Watershed from the Confluence of Huntington Creek to Highway 57 (based on EWCD-07- Lower Cottonwood Creek)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040003[a]	*233*	*14*
NPDES UTG040022[b]	*0.0002*	*0*
NPDES UT0025399[c]	*3*	*889*
NPDES UT0023663[d]	*730*	*1,278*
Total Point Source Load	966	2,181
Non-Point Source Load[2]	67,041	
Total Existing Load[3]	68,007	
Loading Capacity[4]	39,940	
Margin of Safety[5]	1,997	
Load Reduction Required to Meet Loading Capacity[6]	30,064	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	2,181	0%
Non-Point Source	35,762	47%
Margin of Safety	1,997	Not Applicable

Notes:
a. Pacificorp – Trail Mtn. Mine. Data collected from 1/31/1998 – 5/30/1998.
b. Interwest Mining Co.- Des Be Dov. Data collected from 10/31/2001 – 12/31/2001.
c. Talon Resources Inc. Data collected from 6/30/2002 – 12/31/2002.
d. Castle Valley Special Service. Sewer system. Data collected from 9/30/2002 – 11/30/2002.
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (33.8 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-6 Summary of Average Annual TDS Load and TMDL Load Allocation for the Rock Canyon Creek Watershed from Confluence with Cottonwood Creek to Headwaters (based on EWCD-09- Lower Rock Canyon Creek)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
*None**		
Total Point Source Load	0	
Non-Point Source Load[2]	31,905	
Total Existing Load[3]	31,905	
Loading Capacity[4]	11,500	
Margin of Safety[5]	575	
Load Reduction Required to Meet Loading Capacity[6]	20,980	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	0	0%
Non-Point Source	10,925	66%
Margin of Safety	575	Not Applicable

Notes: * While there is no existing UPDES permit, the Hunter Power Plant (PacifiCorp) operations results in discharge to Rock Creek, permitting is underway

1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (9.7 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-7 Summary of Average Annual TDS Load and TMDL Load Allocation for the Ferron Creek Watershed from Confluence with the San Rafael River to Headwaters (based on EWCD-11- Lower Ferron Creek)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UT0020052[a]	*95*	*986*
Total Point Source Load	95	986
Non-Point Source Load[2]	44,788	
Total Existing Load[3]	44,883	
Loading Capacity[4]	21,558	
Margin of Safety[5]	1,078	
Load Reduction Required to Meet Loading Capacity[6]	24,403	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	986	0%
Non-Point Source	19,494	57%
Margin of Safety	1,078	Not Applicable

Notes: a. Ferron Lagoon

1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (18.3 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-8 Summary of Average Annual TDS Load and TMDL Load Allocation for the Lower San Rafael River Watershed from Confluence with the Green River to Confluence with Huntington Creek (based on UTDEQ STORET 493029- San Rafael River at US 24 Crossing)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UTG040006[a]	*35*	*670*
NPDES UT0021296[b]	*0.001*	*730*
NPDES UTG040003[c]	*233*	*14*
NPDES UTG040022[d]	*0.0002*	
NPDES UT0025399[e]	*3*	*889*
NPDES UT0023663[f]	*730*	*1,278*
NPDES UT0020052[g]	*95*	*986*
Total Point Source Load	1,096	4,567
Non-Point Source Load[2]	136,425	
Total Existing Load[3]	137,521	
Loading Capacity[4]	101,524	
Margin of Safety[5]	5,076	
Load Reduction Required to Meet Loading Capacity[6]	41,073	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	4,567	0%
Non-Point Source	91,881	33%
Margin of Safety	5,076	Not Applicable

Notes:
a. Co-Op Mining Company. Data collected from 5/30/1998-12/31/2002.
b. Castle Valley SSD-Huntington, Data collected from 10/31/2002-12/31/2002.
c. Pacificorp – Trail Mtn. Mine. Data collected from 1/31/1998 – 5/30/1998.
d. Interwest Mining CO-DES-BEE. Data collected from 10/31/2001 – 12/31/2001.
e. Talon Resources Inc. Data collected from 6/30/2002 – 12/31/2002.
f. Castle Valley Special Service. Sewer system. Data collected from 9/30/2002 – 11/30/2002.
g. Ferron Lagoons
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (86.0 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-9 Summary of Average Annual TDS Load and TMDL Load Allocation for the Upper Muddy Creek Watershed from Confluence with Ivie Creek to Highway 10 (based on EWCD-14- Lower Muddy Creek)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UT0022616[a]	*1,095*	*1,041*
NPDES UT0022918[b]	*2,500*	*10,044*
Total Point Source Load	3,595	11,085
Non-Point Source Load[2]	50,767	
Total Existing Load[3]	54,362	
Loading Capacity[4]	19,916	
Margin of Safety[5]	996	
Load Reduction Required to Meet Loading Capacity[6]	35,442	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	11,085	0%
Non-Point Source	7,835	85%
Margin of Safety	996	Not Applicable

Notes:
a. Consolidation Coal CO-Underground Mine. Data collected from 9/30/1999 – 9/30/2002. Due to high flow from 9/30/1999 – 3/31/2000, only data from 4/30/2000 – 9/30/2002 was used for existing load calculations.
b. Canyon Fuel-SUFCO. Data collected from 5/2001-6/2003
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (16.9 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

Table 6-10 Summary of Average Annual TDS Load and TMDL Load Allocation for the Lower Muddy Creek Watershed from Confluence with the Fremont River to Ivie Creek Confluence (based on UTDEQ STORET 495500- Muddy Creek at Old US 24 Crossing)

Source	TDS Load (tons/year)	WLA[1] (tons/year)
Point Source		
NPDES UT0022616[a]	*1,095*	*1,041*
NPDES UT0022918[b]	*2,500*	*10,044*
Total Point Source Load	3,595	11,085
Non-Point Source Load[2]	85,155	
Total Existing Load[3]	88,750	
Loading Capacity[4]	34,590	
Margin of Safety[5]	1,729	
Load Reduction Required to Meet Loading Capacity[6]	55,889	

Source	TMDL TDS Load Allocation[7] (tons/year)	% of Reduction in Existing Load to Achieve Allocation
Point Source	11,085	0%
Non-Point Source	21,776	76%
Margin of Safety	1,729	Not Applicable

Notes:
a. Consolidation Coal CO-Underground Mine. Data collected from 9/30/1999 – 9/30/2002. Due to high flow from 9/30/1999 – 3/31/2000, only data from 4/30/2000 – 9/30/2002 was used for existing load calculations.
b. Canyon Fuel-SUFCO. Data collected from 5/2001-6/2003
1. Waste load allocations (WLA) are discussed in Table 6-1 (permit limits may be concentration or load-based)
2. Non-point source load = total existing load – point source load
3. Total existing load calculated based on available flow and water chemistry data over 11-year period (1990 – 2001)
4. Loading capacity = average annual flow (29.3 cfs) for period of 1/1990-12/2001 x 1,200 mg/L x conversion factor
5. Margin of safety = 5% of loading capacity
6. Load reduction = total existing load – (loading capacity - margin of safety)
7. Point source is listed from WLA. Non-point= loading capacity- WLA- margin of safety

6.3.2 Summary of TDS Load Allocation

As discussed in Section 5-1, observed flow and TDS measurements were used to calculate the loading capacity for each watershed based on the existing criteria of 1,200 mg/L. The TDS load at each of the target sites within each watershed includes contributions from point and non-point sources, which also includes background sources. The point and non-point allocations for each location, along with a margin of safety, are summarized in Tables 6-2 through 6-10. As discussed in the Project Implementation Plan (PIP; Appendix A), attainment of the 1,200 mg/L may not be feasible at all locations in the WCRW due to natural loading of TDS. While the recommendations contained in the PIP will reduce in-stream load of TDS, there is uncertainty in what TDS concentrations will result. For these locations, site specific criteria are recommended. The recommended values and the basis for theses values is provided in Appendix A.

7.0 PUBLIC PARTICIPATION

Two meetings were held in Price, UT with the Price-San Rafael Rivers Watershed Committee. The initial meeting was held in November 2002, with a subsequent meeting in May of 2003. Participants in the watershed committee, which was organized to provide local input into watershed issues in the West Colorado Watershed, include:

- San Rafael Soil Conservation District
- Price River Soil Conservation District
- Green River Soil Conservation District
- Muddy Creek Irrigation Company
- Ferron Canal and Reservoir Company
- Cottonwood Creek Irrigation Company
- Huntington/Cleveland Irrigation Company
- Price River Irrigation Company
- Carbon Canal Irrigation Company
- North Carbon Irrigation Company
- Emery County Commissioners
- Emery County Public Lands Council
- Emery County Water Conservancy District
- Price River Water Conservancy District
- Carbon County Commissioners
- Carbon County Planning and Zoning
- Utah Association of Conservation Districts (Zone 7)
- Utah Division of Water Quality
- Utah Division of Water Rights
- Utah Division of Wildlife Resources
- Bureau of Land Management
- US Forest Service
- Natural Resources Conservation Service
- Castleland RC&D Council
- US Fish and Wildlife Service
- Bureau of Reclamation
- Local cities and communities
- Other interested parties

The Price-San Rafael Rivers Watershed Committee is committed to the maintaining or improving the quality of water within its jurisdiction. There is a desire to work with all interests to keep the river systems as clean as possible, given the geologic constraints of the area, and still maintain economically viable communities.

It is important to have local input in order to affect water quality improvements and practices. Local irrigation companies and shareholders involved in agricultural production are already actively

participating in the Colorado River Salinity Control Program to reduce salt (TDS) loading into the river systems through improved irrigation practices. This proven program will help reduce salt loading into the Price/San Rafael/Green/Colorado River systems. With local support, this and other water quality improvement practices can be implemented as may be recommended in the TMDL.

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APPENDIX A

PROJECT IMPLEMENTATION PLAN

1.0 INTRODUCTION

The load reduction of TDS into WCRW streams is primarily associated with nonpoint sources. The implementation of best management practices (BMPs) aimed at controlling these sources is voluntary. The implementation plan was developed utilizing USEPA guidance for 319 projects while also considering the ongoing irrigation conversion program. At a minimum, the implementation plan will address the implementation options listed below. Additional management or treatment options may also be considered as the implementation is developed and refined during implementation of management activities.

1.1 TDS Sources

The majority of TDS loading in the WCRW streams is associated with nonpoint sources. Therefore, best management practices aimed at reducing TDS loading will focus on nonpoint sources. However, in order to limit TDS loadings from all sources, the inclusion of a concentration or loading limit in future UPDES permits is also recommended. Permit limits will generally be based on the 1,200 mg/L criteria, unless site specific considerations (i.e., site specific standards) support a different value. The derivation of each proposed permit limit is provided in Section 6.4.1 of the main report.

While there are several stream segments within the three subwatersheds- Price River, San Rafael River, and Muddy Creek- that are listed as impaired, the BMPs discussed are directed at decreasing load within the entire watershed and associated subwatersheds. Table A-1 lists each of the listed segments and the identified non-point sources of TDS load in each stream segment and the BMPs recommended for each type of source. The term Urban is meant to reflect areas of human inhabitation with concurrent occurrence of roads and other impervious services. This includes smaller rural towns such as Ferron and Emery.

Table A-1. Non-point sources and recommended BMPs for each impaired stream reach

PRICE RIVER		
Non-supporting segment[1]	**Identified nonpoint source**	**Recommended BMPs**
Pinnacle Creek and Gordon Creek from confluence with Price River to headwaters	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes
Price River and tributaries from Coal Creek confluence to Carbon Canal diversion	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas

Table A-1. Non-point sources and recommended BMPs for each impaired stream (continued)

PRICE RIVER (continued)		
Non-supporting segment[1]	**Identified non-point source**	**Recommended BMP's**
Price River and tributaries from near Woodside to Soldier Creek confluence	Surface runoff	Plant vegetation buffer strips
	Livestock grazing	Move cattle out of pastures before overgrazing
	Recreational activities	Fence around sensitive areas, revegetate bare areas, close trails /roads that are eroded, implement education programs that focus on responsible use
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abut-ments, cribs, rock diversion structures Restore/revegetate failing streambanks
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
Price River and tributaries from confluence with Green River to near Woodside	Surface runoff	Plant vegetation buffer strips
	Livestock grazing	Move cattle out of pastures before overgrazing
	Recreational activities	Fence around sensitive areas, revegetate bare areas, close trails /roads that are eroded, implement BMPs for roads and trails and enhance education programs that focus on responsible use
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambanks
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds

Table A-1. Non-point sources and recommended BMPs for each impaired stream (continued)

SAN RAFAEL RIVER		
Non-supporting segment[1]	**Identified non-point source**	**Recommended BMP's**
Cottonwood Creek from the confluence with Huntington Creek to Highway 57	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambanks
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes
Huntington Creek and tributaries from confluence with Cottonwood Creek upstream to USFS boundary	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes

Table A-1. Non-point sources and recommended BMPs for each impaired stream (continued)

SAN RAFAEL RIVER(continued)		
Non-supporting segment[1]	**Identified non-point source**	**Recommended BMP's**
Rock Canyon Creek from confluence with Cottonwood Creek to headwaters	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
San Rafael River from Buckhorn Crossing to the confluence with Huntington Creek and Cottonwood Creek	Surface runoff	Plant vegetation buffer strips, monitor cattle grazing pressure, limit recreation near streams
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
San Rafael River from the confluence with the Green River to Buckhorn Crossing	Surface runoff	Plant vegetation buffer strips
	Livestock grazing	Move cattle out of pastures before overgrazing
	Recreational activities	Fence around sensitive areas, revegetate bare areas, close trails /roads that are eroded, implement education programs that focus on responsible use
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambanks

Table A-1. Non-point sources and recommended BMPs for each impaired stream (continued)

MUDDY CREEK WATERSHED		
Non-supporting segment[1]	**Identified non-point source**	**Recommended BMP's**
Muddy Creek and tributaries from Quitchipah Creek confluence to the Utah Highway 10 bridge	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes
Quitchupah Creek from the confluence with Ivie Creek to the Utah Highway 10 bridge	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes

Table A-1. Non-point sources and recommended BMPs for each impaired stream (continued)

MUDDY CREEK WATERSHED (continued)		
Non-supporting segment[1]	**Identified non-point source**	**Recommended BMP's**
Ivie Creek and tributaries from the confluence with Muddy Creek to Utah Highway 10	Irrigation return flows	Increase irrigation efficiency through the use of sprinkler type irrigation systems Improved surface irrigation techniques such as automated water control valves, water measuring devices, gated pipe, borders, water control structures, and tailwater recovery systems
	Canal seepage	Line canals with concrete
	Stockwater pond seepage	Install membrane liners
	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Urban runoff	Install vegetation filter strips along roadsides, construct detention ponds
	Forest	Minimize access roads and stream crossings, install culverts, revegetate slopes
Muddy Creek from the confluence with Fremont River to Quitchupah Creek confluence	Surface runoff	Plant vegetation buffer strips
	Streambank erosion	Construct fences and in-stream livestock watering stations to prevent streambank damage Stabilize streambanks with log abutments, cribs, rock diversion structures Restore/revegetate failing streambank areas
	Recreation	Minimize access roads and stream crossings, install culverts, revegetate slopes

[1] Listed segments are consistent with the draft Utah 2004 303 (d) list of waters. The target sites discussed in the main report cover these segments (though not at each listed segment). Target sites were selected based on the availability of sufficient data to allow for loading calculations.

Estimated TDS loading from different non-point sources are listed for each of the target sites in the Price River, San Rafael River, and Muddy Creek watersheds in Tables A-2 through A-10. These locations are shown on Map 2 in the main report. Loadings for each target site were estimated using percentage of total area or by percentage of stream length for each target site. While we believe these estimates are a fair representative of actual conditions in the watershed, they are only estimates. While the sum of loadings from the different segments equals the values calculated in the Main Report for each of the three watersheds (i.e., total load at location 493165 in the Price, 493029 in the San Rafael, and 495500 in Muddy Creek), the loadings in each segment do not necessarily equal the values listed in Tables 6-2 through 6-10. This difference results from the approach used to estimate the source of loadings in each of the segments. Therefore, caution is advised in interpreting these data. The methods used to derive the allocation are discussed in Appendix Section 2.0.

Table A-2. Price River watershed (UTDEQ STORET Station 493239- Price River near Wellington) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	66,470	55,980
Canal seepage	4,677	3,692
Winter water replacement	18,806	14,685
Surface erosion	3,555	1,997
Streambank erosion	112	84
Urban areas	90	28
Forest	204	64
Totals	**93,914**	**76,530**
Ambient loading	**2,030**	**0**
TOTAL LOADING	**95,944**	**18,314 (post BMP)**

Table A-3. Price River watershed (between UTDEQ STORET Station 493239 and UTDEQ STORET Station 493165- Price River near Woodside at US 6 Crossing) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	17,368	13,995
Canal seepage	1,569	923
Winter water replacement	4,676	3,671
Surface erosion	6,601	3,709
Streambank erosion	167	125
Urban areas	5	1
Forest	11	3
Totals	**30,397**	**22,427**
Ambient loading	**508**	**0**
TOTAL LOADING	**30,905**	**7,078 (post BMP)**

Table A-4. San Rafael watershed (EWCD 3- lower Huntington Creek) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	27,809	17,586
Canal seepage	1,994	1,163
Winter water replacement	7,974	5,085
Surface erosion	3,218	1,869
Streambank erosion	51	38
Urban areas	13	4
Forest	80	24
Totals	**41,139**	**25,769**
Ambient loading	**2,214**	**0**
TOTAL LOADING	**43,353**	**17,584 (post BMP)**

Table A-5. San Rafael watershed (EWCD 9- lower Rock Canyon Creek) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	11,961	7,537
Canal seepage	854	498
Winter water replacement	3,417	2,179
Surface erosion	2,146	1,246
Streambank erosion	25	19
Urban areas	4	1
Forest	34	7
Totals	**18,441**	**11,487**
Ambient loading	**949**	**0**
TOTAL LOADING	**19,390**	**7,903 (post BMP)**

Table A-6. San Rafael watershed (EWCD 7- lower Cottonwood Creek) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	23,827	15,074
Canal seepage	1,709	997
Winter water replacement	3,417	2,179
Surface erosion	3,218	1,869
Streambank erosion	51	38
Urban areas	12	4
Forest	69	21
Totals	**32,303**	**20,182**
Ambient loading	**1,898**	**0**
TOTAL LOADING	**34,201**	**14,114 (post BMP)**

Table A-7. San Rafael watershed (EWCD 11- lower Ferron Creek) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	15,948	10,049
Canal seepage	1,139	664
Winter water replacement	4,557	2,906
Surface erosion	3,218	1,869
Streambank erosion	51	38
Urban areas	8	2
Forest	46	14
Totals	**24,967**	**15,542**
Ambient loading	**1,265**	**0**
TOTAL LOADING	**26,232**	**10,690 (post BMP)**

Table A-8. San Rafael watershed (river segment from confluence with Huntington Creek, Cottonwood Creek and Ferron Creek to UTDEQ STORET 493029 - San Rafael River at US 24 Crossing) non-point TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	0	0
Canal seepage	0	0
Winter water replacement	3,417	2,187
Surface erosion	9,756	5,607
Streambank erosion	76	57
Urban areas	0	0
Forest	0	0
Totals	**13,249**	**7,851**
Ambient loading	**0**[1]	**0**
TOTAL LOADING	**13,249**	**5,398 (post BMP)**

1. While the methodology used to estimate the loading for each source indicates that all of the load can be accounted for and that there is no residual ambient loading in this segment, there is likely some natural (ambient) loading that does occur.

Table A-9. Muddy Creek watershed (headwaters to EWCD-14) nonpoint TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	24,600	18,950
Canal seepage	360	247
Winter water replacement	1,240	1,030
Surface erosion	5,251	3,344
Streambank erosion	60	45
Urban areas	6	2
Forest	148	45
Totals	**31,665**	**23,663**
Ambient loading	**30,570**	**0**
TOTAL LOADING	**62,235**	**40,672 (post BMP)**

Table A-10. Muddy Creek watershed (stream segment from EWCD-14 to UTDEQ STORET 495500) nonpoint TDS sources, loadings, and reductions

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	6,210	4,737
Canal seepage	90	62
Winter water replacement	360	256
Surface erosion	8,426	5,015
Streambank erosion	91	68
Urban areas	0	0
Forest	0	0
Totals	**15,177**	**10,138**
Ambient loading	**7,743**	**0**
TOTAL LOADING	**22,920**	**13,182 (post BMP)**

As indicated in Tables A-2 through A-8, the annual ambient TDS loadings to the Price and San Rafael River watersheds is approximately 2 to 5% of the existing annual load. This loading is attributed to natural 'background' loading that results primarily from groundwater discharge to the system. It is important to note that some degree of surface erosion and stream bank erosion is also natural to the system, and should be considered as background loading as well. The allocation of non-point source TDS loading in the Muddy Creek watershed is unique from the Price and San Rafael. In Muddy Creek, between 34 and 49% of the annual load is from ambient loading (Tables A-9 and A-10). This finding is in agreement with other studies in the Muddy Creek watershed which have reported that much of the annual load results from inputs from salt washes that occur within the watershed (BOR 1987, Miller 2003). Additionally, the Muddy Creek portion of the WCRW has less irrigated acreage than does the Price and San Rafael watersheds, which results in less return flow loadings of TDS.

1.2 Potential Best Management Practices (BMPs)

As listed in Tables A-2 through A-10, the majority of nonpoint source TDS loads in the WCRW watersheds, especially in the upper Price and to a lesser extent in the upper portions of the San Rafael watersheds, are associated with irrigation practices. Other nonpoint TDS sources include animal grazing, forestry related activities, urban runoff, erosion, stock pond seepage, and recreational activities. BMP's have been identified for each of these TDS sources.

The implementation of BMPs will aid in the preservation of current water uses by reducing the TDS loadings throughout the watershed. The following list of BMP options provides some potential management activities that can reduce TDS loadings to streams in the Study Area:

- Increase irrigation efficiency thereby reducing deep percolation of surface water
- Control canal and ditch seepage by limiting infiltration losses

- Install membrane liners on stockwater ponds to prevent seepage
- Create vegetated buffer strips along streams and ditches to reduce erosion
- Revegetate stream banks with soil holding species, use rock barbs to divert flow from banks, and re-slope steep streambanks to allow for vegetation establishment
- Maintain plant cover with proper grazing strategies
- Identify areas where due to erodible soils, grazing may not be sustainable due to wind erodible soils
- Improve riparian condition by excluding grazing and through planting wetland species
- Limit recreational vehicle usage to non-sensitive areas away from streams
- Identify and improved roads and trails that don't meet best practices
- Revegetate coal mine spoil to prevent erosion and deep percolation
- Plug abandoned wells to prevent saline discharge into streams
- Construct stormwater retention ponds in urban areas

2.0 RECOMMENDATIONS

The BMPs recommended for application within the WCRW are described below.

2.1 Irrigation

Mitigation of irrigation associated TDS would be accomplished by installing gravity pressure sprinkler systems, pump pressurized sprinkler systems, or through surface irrigation improvements. Sprinkler systems improvements would include mains and laterals, pipelines with risers, sprinkler hardware, pumps and motors, and water measuring devices. Surface irrigation improvements would include water measuring devices, water control structures, land leveling, pipelines, gated pipe, borders, automated water control valves, and tail water recovery systems (BOR and SCS 1993). Soil moisture meters should be used by all irrigators to ensure that excessive amounts of water are not applied to fields. Additionally, technical assistance provided to irrigation companies and landowners alike would result in improved management of water delivery and application.

Under the RP (Resource Protection) plan, there are approximately 17,000 acres under consideration for irrigation improvements for the Price River watershed and 19,000 acres under consideration for irrigation improvements in the San Rafael River watershed. Current furrow irrigation practices in the WCRW have a water use efficiency of 35% or less (BOR and SCS 1993). The projected on-farm irrigation efficiency for the RP plan using a combination of improved surface irrigation, pressure sprinkler irrigation, and gravity sprinkler systems is 60%. The RP plan is projected to decrease the salt load in the Price River watershed by 69,975 tons per year and by 50,245 tons per year in the San Rafael River watershed (BOR and SCS 1993). Application of the same irrigation improvements to the 5,500 irrigated acres in the Muddy Creek watershed could potentially reduce the annual salt load in the WCRW by an additional 23,687 tons, or by 143,907 tons per year in the entire Study Area. Uses of newer center pivot irrigation systems, which have an average efficiency of 77.5% (Texas A&M 2001), could reduce the annual salt load in the WCRW by 169,080 tons per year. Center pivot irrigation systems that employ the use of 16 inch drop heads would increase efficiency to 85-90% (Texas A&M 2001), resulting in a potential reduction of 183,469 tons of salt entering the WCRW streams. The efficiency of furrow irrigation could be increased to 75% (NCSU 2003) with the installation of surge flow irrigation valves. If this technology was employed on all of the Study Area's irrigated acreage, the annual salt load reduction in the WCRW watersheds could total 179,884 tons.

2.2 Open Lateral Replacement

Seepage from open laterals that supply water for irrigation purposes could be reduced by replacing open laterals and canals with pipe. Replacing 100% of the 69 miles of open laterals and canals in the Price River watershed and 87 miles of open laterals in the San Rafael watershed could potentially reduce the salt load by nearly 8,000 tons per year (BOR and SCS 1993). Replacing all 9 miles of open laterals and canals in the Muddy Creek watershed could potentially reduce the salt load into the WCRW streams by an additional 460 tons per year.

2.3 Winter Water Replacement

Water delivery canals for livestock and municipal use that are operated in the winter cause additional TDS loading due to seepage. Winter water could be supplied from other sources and the canals could be dewatered during the winter months. Additionally, stock ponds could be lined with impervious materials to prevent seepage. According to BOR and SCS (1993), dewatering of the Price River and San Rafael area canal systems in winter and lining stock ponds could result in a load reduction of 18,356 and 14,529 tons of salt per year, respectively. While the number of stock ponds in the Muddy Creek watershed is unknown, the application of similar BMPs in this watershed would be expected to produce a proportional load reduction on a per pond basis.

2.4 Surface Erosion

The main factor controlling sediment production due to surface erosion is the percentage of grass cover (Dadkuh and Gifford 1980). The presence of grass aids in binding soil particles together as well as slowing overland flow and allowing sediment to settle out of suspension. Grass cover percentages of 50% or more minimize the amount of sediment production on rangelands. While rangelands in the WCRW would benefit from improved range condition through seeding efforts, the cost would be prohibitively high for the amount of salt removed. The most effective means for improving grass cover on rangelands is through proper grazing management. Livestock producers should be educated about range management practices that maintain or enhance vegetation cover in the Study Area, especially as it relates to soil type and erodibility. Through the employment of strategies such as controlling overall livestock density and distribution, and season of use, livestock can be used successfully for vegetation management.

Roads in the lower portion Study Area can significantly increase the loading into nearby streams. The lack of vegetative cover on road surfaces and ditch slopes can allow sediment to flow unimpeded into

streams and other water bodies. As mentioned previously, grass cover can significantly reduce the amount of sediment production. Vegetation buffers strips that are 50 feet wide along both sides of roads could be expected to reduce sediment production by at least 50%. Additional measures for improvements include identification of roads and trails that are not built to best standards and implementing improvements to limit erosion.

Recreational activities result in a reduction in vegetative ground cover and increased soil compaction which can eventually lead to higher rates of runoff and erosion. The impacts of recreation on stream loading can be reduced by maintaining sufficient ground cover in areas susceptible to erosion, such as campsites, trails, and vehicle usage areas. BMPs would include fencing to eliminate usage in sensitive areas, revegetation of bare areas, and select road/trail closures. Education programs that focus on responsible use of resources are perhaps the most effective means for reducing the impact from recreational activities.

Vegetation filter strips along streams can measurably reduce sediment inflow to the streams. The recommended width for buffer strips along streams and other water bodies is 50 feet. If both sides of a stream are buffered, the resulting filter strips would occupy approximately 12 acres over the course of one mile of stream length. It is estimated that 50 foot wide buffer strips on both sides of a stream could reduce sedimentation from 56 to 95% (Leeds et al. 2003, Parsons et al. 1994, Snyder et al. 1998). The current estimates of surface erosion induced TDS loading are 10,156 tons per year in the Price River watershed, 21,455 tons per year in the San Rafael River watershed, and 14,377 tons per year in the Muddy Creek watershed. After the implementation of filter strips to control erosion and assuming a 60% sediment reduction estimate, a potential TDS reduction of 6,094, 12,873, and 8,626 tons per year from barren land, roads, rangeland, and agricultural land in the Price River, San Rafael River, and Muddy Creek watersheds, respectively, may be realized.

2.5 Streambank Erosion

Based on published literature (Rosgen 2000, Bouquetriver 2003), it is estimated that unstable stream banks in the WCRW add approximately 684 tons of salt per year to streams. Of this total, the Price River watershed contributes 279 tons, the San Rafael River watershed contributes 254 tons, and the Muddy Creek watershed contributes 151 tons per year. Areas where livestock and wildlife cross streams or where they frequently water can cause vegetation loss, and ultimately, bank failure. Salt loading due to erosion can be reduced by installing fencing to concentrate livestock in engineered in-stream watering stations. Fencing will keep livestock out of sensitive areas and allow for restoration of the site. Erosion

can also be lessened by restoring/stabilizing stream banks with log abutments, cribs, rock diversion structures, and revegetation of streambank areas that are in imminent danger of failing, or have already failed. Restoration/revegetation efforts on streambank areas can reduce salt loading from unstable stream banks in the WCRW by 75%. It is estimated that approximately 5%, or 100 miles, of stream banks in the WCRW are contributing to the salt load through bank failure.

2.6 Gully Erosion

Gully erosion can also be a significant source of TDS loading in the WCRW. Utilized BMPs and hydromodification practices should focus on prevention rather than restoration. The primary cause of gully erosion in related to transportation routes, which berm sheet flow, convert to channel flow, and discharge with accelerated velocity to create gullies. Headcutting from improperly installed culverts at drains and crossings can also contribute to erosion. Gullies can also abe created when soil is compacted and vegetation removed. Earlier discussed BMPs for surface erosion are applicable for limiting gully erosion as well.

2.7 Urban Runoff

Urban areas increase the total amount of runoff because of the many impervious surfaces, such as roads, roofs, and parking lots. New development in urban areas (any inhabited areas) can also potentially increase sediment yields due to disturbed soil conditions commonly found near construction sites. Urban runoff may contain salt-laden sediment and dissolved road salts that potentially add up to 138 tons of salt annually in the WCRW. Urban areas in the Price River watershed contribute 95 tons of salt annually, while urban areas in the San Rafael and Muddy Creek watersheds adds an additional annual load of 37 tons and 6 tons, respectively. Vegetation filter strips located along roadsides can help prevent erosion and thus salt laden soil from reaching streams in the Study Area. Detention ponds can control runoff rates and allow sediment to settle (USEPA 2003a, Law et al. 1998). An estimated 29 tons of salt can be removed each year from WCRW streams by the application of vegetative filter strips and detention ponds in urban areas in the Price River watershed. Applying these same BMPs to urban areas in the San Rafael and Muddy Creek watersheds can result in a load reduction of 11 tons and 2 tons annually, respectively.

2.8 Forest Runoff

Most forested areas have low sediment yields because soils are generally stable and vegetative cover is high. Erosion problems are usually associated with surface disturbance through logging, grazing, or recreational activities. Forests in the WCRW are not intensively used for logging, though grazing and

recreational activities do occur. The main source of sediment in forests of the WCRW is vehicle use of forest access roads. The Muddy Creek watershed also contains steep canyons that increase loadings at certain times of the year. Sediment loss associated with forest roads can range from 6.8 tons per acre at a slope of 1%, to 32.3 tons per acre at a 6% slope (SFRA 2002). Even though forested areas are not underlain by Mancos shale formations, it is estimated that approximately 215 tons of salt from the Price River, 229 tons of salt from the San Rafael River, and 45 tons of salt from the Muddy Creek watersheds are added to the loading of WCRW streams due to forest roads. It is estimated that the existing salt load could be reduced by 30% through the adoption of forest road BMPs such as revegetation of cut and fill slopes, installing culverts, avoiding development of forest roads when possible, minimizing stream crossings, and other similar measures. This would equate to an annual salt load reduction of 67 tons in the Price River watershed, 66 tons in the San Rafael watershed, and 45 tons in the Muddy Creek watershed.

3.0 COSTS

Cost effectiveness is a primary criterion for BMP selection. Some of the BMPs described in Section 2 are relatively inexpensive to implement, while others are probably cost prohibitive. A summary of estimated costs for these BMPs is presented below. These costs, which are in 2003 dollars, are a general estimate only. Actual costs may vary depending on local economies, transportation costs, inflation, etc.

3.1 Irrigation Improvement

Irrigation improvement was originally presented by the BOR and SCS (1993) and included pressurized sprinkler systems, gravity sprinkler systems, and improved surface irrigation. The following irrigation improvement increment is essentially the same as that of the BOR, but with improved irrigation efficiencies due to ongoing irrigation R&D and the resulting improved technologies.

A good portion of the agricultural land in the WCRW is well adapted to center pivot sprinkler or other wheel type irrigation practices, such as hand lines. The total initial cost of a new 80 acre center pivot irrigation system is approximately $947 per acre and the total annual operating costs, including labor, fuel and oil, repairs and maintenance, depreciation, and interest are approximately $58 per acre (Tyson and Curtis 1997). Total annual cost for the useful life of this system (20 years) is approximately $230 per irrigated acre and the cost of salt removed is $58 per ton (Table A-11). When full length drop-down tubes (low heads) are used with this system, the percent efficiency increases to an average of 87.5% (NMOSE 2001) and the cost of salt removed drops to $54 per ton (Table A-11).

Surge flow surface irrigation systems are a cost effective means of reducing irrigation return flows and thus salt loading. The total annual cost of a surge flow system is approximately $75 per acre, which includes all PVC piping, valves, and operating expenses (Texas A&M 2001). The cost for removing one ton of salt per year from WCRW streams with surge flow irrigation is approximately $20. Installation costs, and thus the costs of removing salts, would be less on existing PVC irrigation piping.

3.2 Canal Seepage/Winter Water

In 1993 the BOR and SCS estimated that canals delivering water for livestock and municipal use during the winter months cause additional salt loading to WCRW streams due to seepage from canals and stock ponds. Dewatering WCRW canals in winter and by excavating stock ponds, lining stock ponds with PVC or clay liners, installing waterers, and fencing out livestock, would reduce the salt load by an estimated 32,880 tons per year. The BOR and SCS estimated that the cost for this project would be $499,400, or

$15 per ton of salt removed in 1989 dollars. Based on 2003 prices this project would cost approximately $23 per ton of salt removed from the system (Table A-11).

3.3 Surface Erosion Reduction

As previously stated, filter strips would reduce surface erosion and the resulting salt loading in the WCRW streams. Initial costs for the installation of filter strips would be confined to tillage and seeding operations. Tillage operations would consist of disking the area prior to seeding. Seeding operations would be performed with a rangeland drill. The total cost of tilling, seed, and seeding operations of filter strips would cost approximately $400 per acre, or $4800 per mile (USEPA 2003b). Assuming that approximately 10% of the streambank areas are in need of filter strips, the total mileage of streambank filter strips would be approximately 200 miles. The annual cost to remove salts from the WCRW streams due to surface erosion is approximately $32 per ton (Table A-11).

3.4 Streambank Restoration/Stabilization

Streambank restoration and stabilization would include activities such as grading damaged streambank areas, seeding/transplanting where vegetation is sparse or non-existent, and fencing to exclude livestock. The costs associated with streambank restoration/revegetation and fencing is estimated at approximately $5000 per mile, resulting in a cost of $974 per ton of salt removed (Purdue University 2003, USEPA 2003b) (Table A-11).

3.5 Forest Related Activities

Cost analysis was not performed for this salt loading source because of the relatively minor effects on salt loading into the WCRW streams. Additionally, the costs associated with BMPs for this source are highly variable and are likely not competitive with the other treatment options presented.

Table A-11. Salt loading sources, BMPs, costs, efficiencies, and salt removed per year in the WCRW

BMP Assessment Table				
Source	**Alternative BMP**	**Annual Cost /ton (2003)**	**Efficiency**	**Tons of salt removed/year**
Current on-farm systems (BOR and SCS 1993)	Pressure and gravity irrigation, improved surface irrigation (SCS on-farm improvements)	$58	50 - 65%	143,907
Current off-farm delivery systems (BOR and SCS 1993)	Replacement of open laterals (RP)	$181	100%	8,246
Furrow irrigation	Center Pivot Irrigation gravity/pump	$58	75-80%	169,080
Furrow irrigation	Center Pivot Irrigation with low heads (16")	$54	85-90%	183,469
Furrow irrigation	Furrow Irrigation with Surge Valves	$20	80-90%	179,884
Unlined stockwater ponds, canal seepage	Excavation, PVC liner and waterers	$22	100%	N/A
Denuded land	Vegetation Buffer Strips	$32	60%	27,409
Damaged streambanks	Stabilization with grading, seeding, transplanting	$974	75%	513

4.0 MONITORING PROGRAM

In developing this TMDL, it has been noted that there is an inadequate amount of data to completely characterize all of the components of the TMDL. Given these data limitations, it is suggested that further data be collected and the TMDL be refined, as appropriate, based on the results of additional analysis (a more complete data set would include monthly data over the entire year to better evaluate both high-flow and low-flow periods). Nonetheless, the results of this TMDL can provide a basis for future data collection and implementation of some of the actions and management measures required to implement the allocations provided in this report. As new data becomes available through monitoring efforts, elements of the TMDL may be changed to reflect this new information.

Several implementation components directed towards reduction of TDS loading can be established while new data is being developed. It is noted, however, that uncertainties exist regarding the potential effectiveness of some of these recommended practices, and that implementation of the recommended practices may be constrained by other factors. Issues such as water rights, in-stream flows, and restrictions on land application will also need to be considered during the development of specific control programs. Alternative options to treat discharge waters may also be required if TMDL endpoints cannot be achieved through the current implementation strategy. These options will be evaluated at the appropriate time, after implementation of the current recommendations and collection of additional data.

Salt loading in the Muddy Creek watershed differs from that of the Price River and San Rafael river watersheds due to the abundance of springs and salt washes in the area. Although implementation of BMPs may reduce salt loading in the Price River and San Rafael River watersheds to acceptable levels, BMP implementation in the Muddy Creek watershed will not reduce salt loading to the extent necessary to meet current water quality criteria. Natural springs and salt washes in the Muddy Creek watershed are a significant source of salts, and BMPs will have little effect, if any, on reducing the salt load from these sources.

4.1 Future Water Quality Monitoring

A water-monitoring program needs to be conducted to further validate or define loading sources, and to monitor stream responses to implementation actions. Continued water quality monitoring is essential for evaluating the effects of BMPs and the progress of meeting water quality standards. The program should be designed to measure stream flows conditions over an entire year, encompassing both the spring-runoff period and the low flow period. At a minimum, TDS and flow should be monitored at the target points.

4.2 Summary

As shown in Table A-5, the cost and effectiveness of the listed BMPs is quite variable. BMP selection criteria should include not only cost and effectiveness of the BMP, but also the ease of putting the particular BMP in place. Once a particular BMP has been shown to reduce salt loading, other BMPs will likely be adopted.

In the final analysis, no matter which BMPs are put into place in the WCRW, salt loading will be reduced. However, it must be noted that while BMPs will decrease the salt *load* into WCRW streams, the concentration of TDS in certain stream segments may still not meet the numeric criteria for these waters. Because the ability to meet the water quality criteria is not solely dependent on the TDS load, a monitoring program is critical to understanding the ultimate impact of BMP implementation on TDS concentrations in the WCRW.

5.0 SITE-SPECIFIC CRITERIA

As discussed in Appendix Section 4.0, salt loading in the Muddy Creek watershed differs from that of the Price River and San Rafael river watersheds due to the abundance of springs and salt washes in the area. While implementation of BMPs will reduce salt loading in the Price River and San Rafael River watersheds, BMP implementation in the Muddy Creek watershed will not reduce salt loading to the extent necessary to meet current water quality criteria. While implementation of the BMPs, will reduce salt loadings in each of the watersheds, it *may not* reduce the concentration of TDS in the watersheds, due to potential concurrent reductions in flow. While the stream reaches are identified as impaired due to exceedance of numeric criteria, the purpose of the TMDL process is to reduce load and to lower TDS concentrations in each reach.

Due to the uncertainty in what are achievable TDS concentrations in each watershed, it is recommended that the selection of site-specific TDS criteria be established at this time. The site-specific criteria should be revisited after implementation of BMPs and subsequent monitoring of the resulting changes in the TDS concentrations in each of the stream reaches. In order to establish site-specific criteria, the dataset from 1990 to 2001 was reviewed for the lower stations in each watershed, and the 90th percentile TDS concentration determined. This 90th percentile was selected as the criteria for many of the segments. This recognizes that much of the WCRW is a groundwater-dominated system, and that due to the presence of Mancos Shale, will have elevated TDS concentrations. While the State would like to achieve the current 1,200 mg/L criterion, it is unlikely that it can be achieved, except in the highest portions of the watersheds. This designation also recognizes that, with only minor exceptions, water used for irrigation in the WCRW is sourced from the upper portion of the watersheds, where TDS levels are typically less then 500 mg/L and therefore meet the agricultural criteria of 1,200 mg/L. The calculated 90th percentile values for each of the target sites evaluated in the main report are listed in Table A-12. While the Muddy Creek value of 5,800 mg/L seems quite high, the BOR (1987) states that surface flows from salt washes in the watershed "exhibit average flow-weighted concentrations of about 5,600 mg/L TDS" and that concentrations of TDS in groundwater that discharges to Muddy Creek average about 6,700 mg/L TDS. The calculated value of 5,800 mg/L falls within these reported concentrations.

While the 90th percentile TDS value may be an appropriate site-specific criteria for some of the target sites, it is anticipated that due to significant reductions in TDS loadings through BMP implementation, concentrations less than the 90th percentile can be achieved at some locations. An example is the Wellington Bridge target site in the Price watershed, where agricultural BMPs will reduce salt loads and should reduce the concentration of TDS. It is the recommendation of this TMDL to establish a site-

specific criteria of 1,700 mg/L. This concentration is based on realizing 50% of the potential BMP load reduction shown in Table A-2. It is expected that reductions in the middle portion of the Price watershed will be reflected by some decrease in TDS concentrations in the bottom portion of the watershed. Similar reductions may be realized in the middle portion of the San Rafael watershed, as shown in Table A-12. Because of the high natural loadings in the Muddy Creek watershed, the 90th percentile is recommended as the site-specific criteria in the portion of the WCRW.

Table A-12. 90th Percentile Values of TDS at each Target Site and Site Specific Criteria

Target Site	90th Percentile TDS (mg/L)	Listed Stream Reaches Above or Near Target Site	Recommended Criteria (mg/L)
Price River			
493239- Above WWTP at Wellington Bridge	3,800	Pinnacle[1] and Gordon Creeks and their tributaries from confluence with Price River to headwaters	3,800
	2,800	Price River and tributaries from Coal Creek to Carbon Canal diversion	1,700[3]
493165- Lower Price River near Woodside	3,200	Price River and tributaries from confluence with Green River to near Woodside	3,000
	3,200	Price River and tributaries from near Woodside to Soldier Creek confluence	3,000
San Rafael River			
EWCD-03- Lower Huntington Creek	4,800	Huntington Creek tributaries from the confluence with Cottonwood Creek to Utah Highway 10	4,800
	Insufficient data	Huntington Creek and tributaries from Highway 10 crossing to USFS boundary	1,200[2]
EWCD-07- Lower Cottonwood Creek	3,500	Cottonwood Creek from the confluence with Huntington Creek to Highway 57	3,500[4]
EWCD-09- Lower Rock Canyon Creek	5,400	Rock Canyon Creek from confluence with Cottonwood Creek to headwaters[1]	3,500[4]
EWCD-11- Lower Ferron Creek	4,000	Ferron Creek from confluence with San Rafael River to Highway 10[1]	3,500[4]
493029- San Rafael at US 24 Crossing	4,100	San Rafael River from the confluence with the Green River to Buckhorn Crossing	4,100
	4,100	San Rafael River from Buckhorn Crossing to the confluence with Huntington Creek and Cottonwood Creek	3,500[4]
Muddy Creek			
EWCD-14- Lower Muddy Creek	2,600	Muddy Creek and its tributaries from Quitchupah Creek confluence to the Highway 10	2,600
	2,600	Quitchupah Creek from confluence with Ivie Creek to Highway 10	2,600
	2,600	Ivie Creek and its tributaries from the confluence with Muddy Creek to Highway 10	2,600
495500- Muddy Creek at Old US24 Crossing	5,800	Muddy Creek from the confluence with Fremont River to Quitchupah Creek confluence	5,800

1. Though not listed in the draft Utah 2004 303(d) list, data indicates that these reaches are impaired by TDS. The more extensive data for Pinnacle was used to establish criteria for both Pinnacle and Gordon Creeks.
2. The existing criterion of 1,200 mg/L may be achievable after implementation of BMPs, if not a site-specific criterion will be recommended
3. Based on achievement of 50% of the potential load reduction listed in Table A-2 multiplied by the 90th percentile.
4. Based on the analysis of the most current data, a value of 3,500 mg/L may be attainable.

6.0 REFERENCES

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APPENDIX B

WATER QUALITY DATA USED FOR LOAD CALCULATIONS

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
STORET 493239	5/10/90	18	2,318	109	57
	6/21/90	20	2,244	121	65
	8/30/90	9	2,746	67	29
	10/11/90	12	2,956	96	39
	5/21/91	12	2,016	65	39
	7/18/91	17	1,890	86	54
	9/12/91	56	1,970	295	180
	10/24/91	17	2,568	116	54
	4/2/92	24	2,128	138	78
	5/14/92	30	2,194	177	97
	7/6/92	6	2,664	43	19
	7/9/92	6	2,532	41	19
	8/20/92	3	2,918	25	10
	10/8/92	18	2,908	141	58
	4/1/93	100	1,112	299	323
	4/29/93	46	582	72	148
	5/16/96	85	408	93	275
	8/1/97	50	882	119	162
	8/28/97	40	2,244	242	129
	2/19/98	27	1,948	142	87
	4/2/98	100	424	114	323
	5/7/98	100	442	119	323
	5/21/98	500	570	767	1,616
	6/25/98	220	560	332	711
	8/20/02	17	1,604	74	55
STORET 493165	3/21/90	40	2,334	251	129
	5/2/90	35	2,440	230	113
	7/4/90	13	2,386	84	42
	8/9/90	25	2,086	140	81
	9/19/90	250	2,394	1,612	808
	10/31/90	18	3,722	180	58
	12/12/90	19	3,684	188	61
	2/15/91	18	2,508	122	58
	3/27/91	23	1,550	96	74
	5/10/91	8	938	20	26
	6/28/91	230	820	508	743
	8/7/91	75	1,308	264	242
	9/18/91	38	1,964	201	123
	11/13/91	47	2,626	332	152
	1/15/92	28	2,936	221	90
	2/26/92	73	1,908	375	236
	4/8/92	175	624	294	565
	5/13/92	24	694	45	78
	7/23/92	20	2,214	119	65
	9/2/92	40	2,734	294	129
	10/14/92	3	3,336	27	10
	6/23/93	60	1,156	187	194
	7/31/93	40	1,732	187	129
	8/27/93	45	2,934	356	145
	9/17/93	200	1,380	743	646
	10/29/93	75	2,492	503	242
	11/19/93	43	3,630	420	139
	1/14/94	45	2,672	324	145
	2/18/94	30	2,922	236	97
	4/1/94	120	654	211	388
	5/6/94	50	548	74	162
	5/20/94	200	874	471	646

6/24/94	300	986	797	969
9/14/94	50	1,564	211	162
10/27/94	125	1,342	452	404
12/16/94	170	2,784	1,274	549
2/10/95	70	2,722	513	226
6/23/95	50	1,770	238	162
8/4/95	40	1,746	188	129
9/29/95	100	1,502	404	323

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
STORET 493165 (cont)	2/2/96	59	3,046	480	189
	3/22/96	35	2,964	279	113
	5/24/96	51	1,748	241	165
	7/26/96	20	2,166	115	64
	9/20/96	12	3,002	99	40
	11/8/96	51	2,604	358	165
	4/25/97	69	1,374	255	223
	6/27/97	28	2,648	200	90
	8/22/97	52	1,942	272	168
	7/27/00	21	2,166	122	68
	9/21/00	100	3,002	808	323
	11/9/00	51	2,604	358	165
	4/26/01	69	1,374	255	223
	6/28/01	28	2,648	200	90
	8/23/01	52	1,942	272	168
EWCD-03	Jan-90	7.0	3,224	61	23
	Feb-90	7.0	3,870	73	23
	Mar-90	6.0	4,590	74	19
	Apr-90	4.0	4,960	53	13
	May-90	2.0	4,480	24	6
	Jun-90	1.0	4,460	12	3
	Jul-90	0.3	3,700	3	1
	Sep-90	2.9	3,590	28	9
	Oct-90	5.0	3,360	45	16
	Nov-90	5.9	4,100	65	19
	Dec-90	9.0	2,980	72	29
	Jan-91	9.0	3,500	85	29
	Feb-91	9.0	3,300	80	29
	Mar-91	17.0	4,010	184	55
	Apr-91	3.0	3,590	29	10
	May-91	5.0	5,094	69	16
	Jun-91	7.0	2,732	51	23
	Jul-91	1.0	3,932	11	3
	Aug-91	7.0	3,252	61	23
	Sep-91	10.0	2,980	80	32
	Oct-91	15.0	2,486	100	48
	Nov-91	14.0	3,922	148	45
	Dec-91	5.0	3,686	50	16
	Jan-92	5.0	3,278	44	16
	Feb-92	5.0	4,556	61	16
	Mar-92	9.0	4,656	113	29
	Apr-92	8.0	4,942	106	26
	May-92	8.0	4,076	88	26
	Jun-92	1.0	6,242	17	3
	Jul-92	2.0	4,042	22	6
	Aug-92	2.0	3,756	20	6
	Sep-92	3.0	4,100	33	10
	Oct-92	2.0	4,790	26	6
	Nov-92	5.0	4,400	59	16
	Dec-92	6.0	4,870	79	19
	Jan-93	6.0	4,642	75	19
	Feb-93	6.0	4,920	79	19
	Mar-93	9.0	5,590	135	29
	Apr-93	8.0	3,800	82	26
	May-93	1.0	4,440	12	3
	Jun-93	10.0	2,830	76	32
	Jul-93	7.0	3,160	60	23
	Aug-93	5.0	2,630	35	16
	Sep-93	12.0	2,250	73	39
	Oct-93	23.0	2,930	181	74
	Nov-93	11.0	4,320	128	36
	Dec-93	11.0	3,740	111	36
	Jan-94	11.0	4,150	123	36

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-03 (cont)	Feb-94	11.0	3,970	118	36
	Mar-94	11.0	4,510	134	36
	Apr-94	1.0	6,080	16	3
	May-94	7.0	4,380	83	23
	Jun-94	0.0	5,390	1	0
	Jul-94	2.0	3,030	16	6
	Aug-94	2.0	2,900	16	6
	Sep-94	3.8	2,830	29	12
	Oct-94	6.8	4,030	74	22
	Nov-94	8.0	3,800	82	26
	Dec-94	8.0	5,780	125	26
	Jan-95	7.7	4,140	86	25
	Feb-95	4.7	4,720	59	15
	Mar-95	6.0	5,450	88	19
	Apr-95	4.4	5,120	61	14
	May-95	5.8	4,650	73	19
	Jun-95	48.8	2,000	263	158
	Jul-95	66.5	2,100	376	215
	Aug-95	25.7	2,130	147	83
	Sep-95	18.3	2,490	123	59
	Oct-95	36.3	2,400	235	117
	Nov-95	8.2	3,640	80	26
	Dec-95	8.2	4,360	96	26
	Jan-96	8.2	2,940	65	26
	Feb-96	8.2	3,280	72	26
	Mar-96	16.9	3,020	137	55
	Apr-96	5.1	3,300	45	16
	May-96	113.8	464	142	368
	Jun-96	59.2	1,080	172	191
	Jul-96	19.1	2,860	147	62
	Aug-96	17.4	2,050	96	56
	Sep-96	56.9	2,520	386	184
	Oct-96	23.5	2,860	181	76
	Nov-96	17.4	3,100	145	56
	Dec-96	17.4	4,760	223	56
	Jan-97	17.4	2,030	95	56
	Feb-97	17.4	1,720	81	56
	Mar-97	142.9	1,010	389	462
	Apr-97	85.5	808	186	276
	May-97	130.4	544	191	421
	Jun-97	90.0	1,260	305	291
	Jul-97	38.9	1,880	197	126
	Aug-97	38.3	2,500	258	124
	Sep-97	36.7	2,190	216	119
	Oct-97	110.5	800	238	357
	Nov-97	60.4	1,440	234	195
	Dec-97	60.4	2,000	325	195
	Jan-98	60.4	2,170	353	195
	Feb-98	60.4	3,700	602	195
	Mar-98	38.7	1,740	181	125
	Apr-98	29.7	2,140	171	96
	May-98	93.2	1,870	469	301
	Jun-98	103.0	1,780	494	333
	Jul-98	16.0	2,660	115	52
	Aug-98	17.0	2,070	95	55
	Sep-98	43.4	1,580	185	140
	Oct-98	82.7	1,630	363	267
	Nov-98	105.0	1,050	297	339
	Dec-98	105.0	2,400	679	339
	Jan-99	105.0	1,640	464	339
	Feb-99	105.0	2,620	741	339
	Mar-99	15.3	3,330	137	49
	Apr-99	10.1	5,200	141	33

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-03 (cont)	May-99	22.7	2,520	154	73
	Jun-99	120.0	720	233	388
	Jul-99	13.9	2,530	95	45
	Aug-99	28.3	2,250	171	91
	Sep-99	26.9	2,090	151	87
	Oct-99	45.2	1,780	217	146
	Nov-99	19.9	3,720	199	64
	Dec-99	19.9	3,320	177	64
	Jan-00	19.9	3,810	204	64
	Feb-00	15.4	4,130	171	50
	Mar-00	41.9	2,200	248	135
	Apr-00	6.5	3,580	63	21
	May-00	19.7	2,890	153	64
	Jun-00	12.3	3,070	102	40
	Jul-00	3.7	3,250	32	12
	Aug-00	4.3	2,600	30	14
	Sep-00	15.1	2,300	94	49
	Oct-00	16.6	2,900	130	54
	Nov-00	12.9	4,500	156	42
	Dec-00	12.9	4,600	160	42
	Jan-01	12.9	3,500	122	42
	Feb-01	12.9	3,600	125	42
	Mar-01	11.5	4,200	130	37
	Apr-01	11.3	3,700	113	37
	May-01	13.2	3,600	128	43
	Jun-01	4.5	4,400	53	15
	Jul-01	1.0	4,000	11	3
	Aug-01	6.5	3,100	54	21
	Sep-01	1.2	2,900	9	4
	Oct-01	8.5	3,000	69	27
	Nov-01	7.0	3,700	70	23
	Dec-01	7.0	5,300	100	23
EWCD-07	Jan-90	15.0	1,796	145,088	96,941
	Feb-90	15.0	1,780	143,796	96,941
	Mar-90	14.0	2,370	178,694	90,478
	Apr-90	6.0	4,030	130,224	38,776
	May-90	12.0	2,150	138,948	77,553
	Jun-90	12.0	2,950	190,650	77,553
	Jul-90	3.0	2,810	45,401	19,388
	Aug-90	2.3	3,410	42,607	14,994
	Sep-90	9.4	1,840	92,654	60,426
	Oct-90	28.0	2,040	307,625	180,956
	Nov-90	14.4	2,480	191,796	92,805
	Dec-90	17.0	1,600	146,488	109,866
	Jan-91	17.0	2,380	217,901	109,866
	Feb-91	17.0	2,350	215,155	109,866
	Mar-91	13.0	2,890	202,337	84,015
	Apr-91	3.0	4,356	70,379	19,388
	May-91	9.0	3,306	160,243	58,164
	Jun-91	13.0	2,494	174,612	84,015
	Jul-91	9.0	2,448	118,656	58,164
	Aug-91	17.0	2,842	260,200	109,866
	Sep-91	21.0	2,422	273,922	135,717
	Oct-91	16.0	2,516	216,803	103,404
	Nov-91	20.0	2,442	263,033	129,254
	Dec-91	19.0	1,552	158,811	122,792
	Jan-92	19.0	1,506	154,104	122,792
	Feb-92	19.0	1,828	187,053	122,792
	Mar-92	16.0	2,400	206,807	103,404
	Apr-92	3.0	4,330	69,959	19,388
	May-92	20.0	2,904	312,796	129,254
	Jun-92	11.0	2,818	166,943	71,090
	Jul-92	7.0	2,962	111,665	45,239

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-07 (cont)	Aug-92	11.0	4,602	272,630	71,090
	Sep-92	5.0	3,550	95,594	32,314
	Oct-92	9.5	3,770	193,088	61,460
	Nov-92	16.0	2,600	224,041	103,404
	Dec-92	22.0	2,250	266,587	142,180
	Jan-93	22.0	1,492	176,777	142,180
	Feb-93	22.0	1,400	165,876	142,180
	Mar-93	14.0	3,100	233,735	90,478
	Apr-93	9.0	3,710	179,825	58,164
	May-93	10.0	3,000	161,568	64,627
	Jun-93	29.0	1,930	301,432	187,419
	Jul-93	25.0	2,220	298,901	161,568
	Aug-93	14.0	2,400	180,956	90,478
	Sep-93	17.0	2,520	230,719	109,866
	Oct-93	31.0	2,470	412,375	200,344
	Nov-93	19.0	2,760	282,421	122,792
	Dec-93	19.0	2,480	253,769	122,792
	Jan-94	19.0	2,490	254,793	122,792
	Feb-94	19.0	2,240	229,211	122,792
	Mar-94	17.0	2,700	247,199	109,866
	Apr-94	6.0	4,340	140,241	38,776
	May-94	24.0	2,570	332,184	155,105
	Jun-94	7.0	2,640	99,526	45,239
	Jul-94	2.0	4,320	46,532	12,925
	Aug-94	0.9	4,440	21,043	5,687
	Sep-94	7.0	3,310	124,784	45,239
	Oct-94	19.1	2,810	288,294	123,115
	Nov-94	12.7	2,780	190,294	82,141
	Dec-94	13.0	3,000	210,038	84,015
	Jan-95	13.0	3,580	250,646	84,015
	Feb-95	11.0	2,630	155,805	71,090
	Mar-95	6.2	2,530	84,206	39,940
	Apr-95	3.0	3,810	61,557	19,388
	May-95	23.0	2,140	265,079	148,643
	Jun-95	47.0	1,380	349,310	303,748
	Jul-95	185.6	664	663,713	1,199,481
	Aug-95	68.9	1,860	690,186	445,281
	Sep-95	21.7	2,120	247,759	140,241
	Oct-95	16.3	2,530	222,097	105,342
	Nov-95	19.6	2,320	244,894	126,669
	Dec-95	19.6	2,030	214,282	126,669
	Jan-96	19.6	2,020	213,227	126,669
	Feb-96	19.6	1,740	183,671	126,669
	Mar-96	16.5	1,830	162,618	106,635
	Apr-96	7.2	3,520	136,493	46,532
	May-96	29.4	1,840	291,339	190,004
	Jun-96	564.7	580	1,763,924	3,649,498
	Jul-96	44.7	1,850	445,263	288,819
	Aug-96	10.6	620	35,261	68,246
	Sep-96	81.6	1,340	588,955	527,423
	Oct-96	38.3	1,800	370,992	247,328
	Nov-96	35.9	1,750	338,350	232,012
	Dec-96	35.9	2,120	409,887	232,012
	Jan-97	35.9	1,700	328,683	232,012
	Feb-97	35.9	1,160	224,278	232,012
	Mar-97	177.0	500	476,626	1,143,901
	Apr-97	17.5	1,870	176,244	113,098
	May-97	25.0	1,920	258,509	161,568
	Jun-97	244.0	348	457,302	1,576,904
	Jul-97	31.0	1,820	303,856	200,344
	Aug-97	59.6	1,940	622,705	385,178
	Sep-97	63.2	1,220	415,251	408,444
	Oct-97	49.9	1,630	438,049	322,490

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-07 (cont)	Nov-97	20.9	2,340	263,388	135,071
	Dec-97	20.9	1,460	164,336	135,071
	Jan-98	20.9	1,240	139,573	135,071
	Feb-98	20.9	2,300	258,886	135,071
	Mar-98	14.6	3,180	250,043	94,356
	Apr-98	30.9	1,770	294,555	199,698
	May-98	121.9	884	580,350	787,806
	Jun-98	275.0	452	669,430	1,777,248
	Jul-98	84.0	764	345,626	542,868
	Aug-98	30.3	2,040	332,895	195,820
	Sep-98	41.6	1,710	383,110	268,849
	Oct-98	56.0	2,010	606,203	361,912
	Nov-98	21.5	2,650	306,845	138,948
	Dec-98	21.5	2,100	243,160	138,948
	Jan-99	21.5	2,000	231,581	138,948
	Feb-99	21.5	2,340	270,950	138,948
	Mar-99	14.8	2,560	204,050	95,648
	Apr-99	5.3	4,750	135,582	34,252
	May-99	15.9	2,780	238,054	102,757
	Jun-99	422.1	436	991,142	2,727,914
	Jul-99	46.0	996	246,747	297,285
	Aug-99	36.9	1,580	313,991	238,474
	Sep-99	36.9	1,600	317,966	238,474
	Oct-99	34.5	1,760	327,014	222,964
	Nov-99	29.6	2,520	401,723	191,297
	Dec-99	29.6	1,130	180,138	191,297
	Jan-00	29.6	2,800	446,359	191,297
	Feb-00	23.6	3,620	460,103	152,520
	Mar-00	13.5	2,640	191,943	87,247
	Apr-00	5.5	3,370	99,822	35,545
	May-00	26.6	1,720	246,402	171,908
	Jun-00	28.8	1,530	237,311	186,126
	Jul-00	13.3	2,210	158,299	85,954
	Aug-00	7.5	2,860	115,521	48,470
	Sep-00	14.2	2,200	168,246	91,771
	Oct-00	23.7	2,200	280,805	153,166
	Nov-00	23.7	1,700	216,986	153,166
	Dec-00	23.7	2,200	280,805	153,166
	Jan-01	23.7	2,400	306,333	153,166
	Feb-01	23.7	2,600	331,861	153,166
	Mar-01	19.1	2,500	257,162	123,438
	Apr-01	5.3	4,100	117,029	34,252
	May-01	18.3	2,300	226,680	118,268
	Jun-01	25.1	2,000	270,357	162,214
	Jul-01	17.2	2,200	203,791	111,159
	Aug-01	19.3	2,900	301,432	124,730
	Sep-01	13.6	2,300	168,462	87,893
	Oct-01	17.8	2,300	220,486	115,036
	Nov-01	14.0	2,600	196,036	90,478
	Dec-01	14.0	2,400	180,956	90,478
EWCD-09	Oct-90	20.0	1,940	104	65
	Nov-90	3.0	4,550	37	10
	Dec-90	5.0	2,880	39	16
	Jan-91	6.0	4,250	69	19
	Feb-91	6.0	4,630	75	19
	Mar-91	3.0	5,280	43	10
	Apr-91	1.0	6,916	19	3
	May-91	3.0	4,874	39	10
	Jun-91	5.0	3,160	43	16
	Jul-91	4.0	2,884	31	13
	Aug-91	11.0	2,960	88	36
	Sep-91	7.0	3,074	58	23
	Oct-91	10.0	2,526	68	32

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-09 (cont)	Nov-91	10.0	3,108	84	32
	Dec-91	3.0	3,972	32	10
	Jan-92	2.0	3,166	17	6
	Feb-92	2.0	4,600	25	6
	Mar-92	4.0	4,994	54	13
	Apr-92	2.0	4,856	26	6
	May-92	7.0	3,370	64	23
	Jun-92	5.0	3,182	43	16
	Jul-92	4.0	4,052	44	13
	Aug-92	4.0	4,630	50	13
	Sep-92	3.0	3,950	32	10
	Oct-92	3.0	5,580	45	10
	Nov-92	5.0	3,890	52	16
	Dec-92	8.0	5,650	122	26
	Jan-93	8.0	5,204	112	26
	Feb-93	8.0	5,090	110	26
	Mar-93	6.0	3,460	56	19
	Apr-93	4.0	4,160	45	13
	May-93	6.0	3,590	58	19
	Jun-93	21.0	1,950	110	68
	Jul-93	16.0	2,560	110	52
	Aug-93	10.0	2,340	63	32
	Sep-93	8.0	3,090	67	26
	Oct-93	7.0	3,430	65	23
	Nov-93	6.0	4,340	70	19
	Dec-93	6.0	3,090	50	19
	Jan-94	6.0	5,070	82	19
	Feb-94	6.0	5,470	88	19
	Mar-94	4.0	4,100	44	13
	Apr-94	2.0	5,940	32	6
	May-94	9.0	2,810	68	29
	Jun-94	5.0	3,290	44	16
	Jul-94	2.0	4,410	24	6
	Aug-94	1.0	5,400	15	3
	Sep-94	5.2	3,330	46	17
	Oct-94	6.0	3,520	57	19
	Nov-94	4.0	3,950	43	13
	Dec-94	4.0	3,880	42	13
	Jan-95	4.0	4,580	49	13
	Feb-95	3.1	3,900	32	10
	Mar-95	1.9	4,330	23	6
	Apr-95	1.0	5,410	15	3
	May-95	11.0	2,000	59	36
	Jun-95	20.0	1,690	91	65
	Jul-95	32.6	1,740	153	105
	Aug-95	33.5	2,120	191	108
	Sep-95	15.7	2,080	88	51
	Oct-95	6.4	2,670	46	21
	Nov-95	3.6	4,260	41	12
	Dec-95	3.6	3,470	34	12
	Jan-96	3.6	3,730	36	12
	Feb-96	3.6	4,160	40	12
	Mar-96	5.4	3,290	48	17
	Apr-96	2.7	5,260	38	9
	May-96	9.2	2,000	50	30
	Jun-96	20.0	1,530	82	65
	Jul-96	22.6	2,070	126	73
	Aug-96	6.8	696	13	22
	Sep-96	24.4	2,160	142	79
	Oct-96	13.0	2,860	100	42
	Nov-96	20.5	2,170	120	66
	Dec-96	20.5	4,830	267	66
	Jan-97	20.5	3,110	172	66
	Feb-97	20.5	3,660	202	66
	Mar-97	9.8	3,510	93	32

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-09 (cont)	Apr-97	7.9	2,540	54	26
	May-97	7.6	2,660	54	25
	Jun-97	30.2	1,280	104	98
	Jul-97	11.7	2,140	67	38
	Aug-97	26.4	1,840	131	85
	Sep-97	23.6	1,560	99	76
	Oct-97	19.2	1,970	102	62
	Nov-97	11.1	2,360	71	36
	Dec-97	11.1	3,710	111	36
	Jan-98	11.1	4,280	128	36
	Feb-98	11.1	4,620	138	36
	Mar-98	7.7	4,030	84	25
	Apr-98	13.2	2,320	82	43
	May-98	39.0	1,510	159	126
	Jun-98	30.0	2,570	208	97
	Jul-98	19.2	1,750	90	62
	Aug-98	15.1	2,680	109	49
	Sep-98	24.3	2,050	134	79
	Oct-98	26.7	2,420	174	86
	Nov-98	11.9	3,160	101	38
	Dec-98	11.9	4,810	154	38
	Jan-99	11.9	4,700	151	38
	Feb-99	11.9	5,530	177	38
	Mar-99	3.5	5,180	49	11
	Apr-99	2.8	5,900	44	9
	May-99	10.7	2,820	81	35
	Jun-99	22.1	1,870	111	71
	Jul-99	14.8	2,160	86	48
	Aug-99	17.1	1,770	82	55
	Sep-99	17.1	1,770	82	55
	Oct-99	18.0	2,020	98	58
	Nov-99	5.6	5,020	76	18
	Dec-99	5.6	5,980	90	18
	Jan-00	5.6	6,130	92	18
	Feb-00	4.5	7,750	94	15
	Mar-00	1.9	6,040	31	6
	Apr-00	2.7	3,970	29	9
	May-00	17.3	1,750	82	56
	Jun-00	10.5	1,820	51	34
	Jul-00	10.6	2,650	76	34
	Aug-00	7.1	2,950	56	23
	Sep-00	9.1	2,300	56	29
	Oct-00	12.1	2,400	78	39
	Nov-00	4.9	4,700	62	16
	Dec-00	4.9	6,100	80	16
	Jan-01	4.9	5,800	77	16
	Feb-01	4.9	5,400	71	16
	Mar-01	6.0	3,900	63	19
	Apr-01	1.3	6,300	22	4
	May-01	7.7	2,900	60	25
	Jun-01	8.6	2,500	58	28
	Jul-01	10.0	2,400	65	32
	Aug-01	7.6	2,500	51	25
	Sep-01	8.9	2,200	53	29
	Oct-01	5.4	3,700	54	17
	Nov-01	3.4	5,000	46	11
	Dec-01	3.4	5,900	54	11
EWCD-11	Jan-90	5.0	2,144	29	16
	Feb-90	5.0	2,110	28	16
	Mar-90	4.0	3,048	33	13
	Apr-90	2.0	3,410	18	6
	May-90	0.0	4,880	1	0
	Jun-90	1.0	2,130	6	3
	Jul-90	0.2	2,240	1	1
	Aug-90	1.4	1,800	7	4

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-11 (cont)	Sep-90	1.8	2,230	11	6
	Oct-90	4.0	2,920	31	13
	Nov-90	4.5	3,400	41	15
	Dec-90	4.0	2,120	23	13
	Jan-91	4.0	2,210	24	13
	Feb-91	4.0	2,330	25	13
	Mar-91	5.0	3,440	46	16
	Apr-91	1.0	1,966	5	3
	May-91	2.0	4,994	27	6
	Jun-91	126.0	612	208	407
	Jul-91	4.0	2,486	27	13
	Aug-91	6.0	2,506	40	19
	Sep-91	7.0	2,804	53	23
	Oct-91	4.0	2,844	31	13
	Nov-91	6.0	3,258	53	19
	Dec-91	4.0	2,508	27	13
	Jan-92	4.0	2,414	26	13
	Feb-92	4.0	3,284	35	13
	Mar-92	6.0	3,214	52	19
	Apr-92	3.0	3,516	28	10
	May-92	6.0	3,218	52	19
	Jun-92	1.0	3,046	8	3
	Jul-92	2.0	2,916	16	6
	Aug-92	2.0	2,910	16	6
	Sep-92	0.1	4,080	1	0
	Oct-92	4.0	3,180	34	13
	Nov-92	4.0	3,150	34	13
	Dec-92	6.0	3,300	53	19
	Jan-93	6.0	2,412	39	19
	Feb-93	6.0	2,740	44	19
	Mar-93	6.0	3,070	50	19
	Apr-93	3.0	4,110	33	10
	May-93	23.0	1,750	108	74
	Jun-93	178.0	448	215	575
	Jul-93	18.0	1,700	82	58
	Aug-93	9.0	2,040	49	29
	Sep-93	9.0	1,930	47	29
	Oct-93	12.0	2,960	96	39
	Nov-93	11.0	2,790	83	36
	Dec-93	11.0	2,680	79	36
	Jan-94	11.0	2,340	69	36
	Feb-94	11.0	2,710	80	36
	Mar-94	5.0	3,350	45	16
	Apr-94	3.0	3,730	30	10
	May-94	1.0	4,000	11	3
	Jun-94	0.6	3,930	6	2
	Jul-94	0.1	2,780	1	0
	Aug-94	0.6	2,630	4	2
	Sep-94	1.0	7,260	20	3
	Oct-94	4.8	3,580	46	16
	Nov-94	8.0	3,060	66	26
	Dec-94	8.0	2,750	59	26
	Jan-95	8.0	2,890	62	26
	Feb-95	5.1	3,320	45	16
	Mar-95	4.2	3,490	39	14
	Apr-95	2.0	3,800	20	6
	May-95	9.0	2,190	53	29
	Jun-95	18.0	1,650	80	58
	Jul-95	98.8	856	228	319
	Aug-95	23.1	2,350	146	75
	Sep-95	21.4	1,520	88	69
	Oct-95	11.4	1,920	59	37
	Nov-95	10.8	2,460	72	35

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-11 (cont)	Dec-95	10.8	2,510	73	35
	Jan-96	10.8	2,570	75	35
	Feb-96	10.8	2,860	83	35
	Mar-96	2.8	3,430	26	9
	Apr-96	6.6	2,680	48	21
	May-96	22.7	1,620	99	73
	Jun-96	290.1	495	387	937
	Jul-96	20.9	1,750	98	68
	Aug-96	7.3	7,060	139	24
	Sep-96	15.0	2,310	93	48
	Oct-96	8.3	2,730	61	27
	Nov-96	10.5	2,120	60	34
	Dec-96	10.5	2,470	70	34
	Jan-97	10.5	2,460	70	34
	Feb-97	10.5	2,930	83	34
	Mar-97	15.4	2,750	114	50
	Apr-97	6.1	2,760	45	20
	May-97	37.8	1,160	118	122
	Jun-97	116.0	504	157	375
	Jul-97	11.8	1,760	56	38
	Aug-97	23.9	2,390	154	77
	Sep-97	30.4	1,880	154	98
	Oct-97	16.3	2,060	90	53
	Nov-97	22.2	1,800	108	72
	Dec-97	22.2	2,330	139	72
	Jan-98	22.2	2,550	152	72
	Feb-98	22.2	2,930	175	72
	Mar-98	7.4	3,250	65	24
	Apr-98	4.5	3,360	41	15
	May-98	58.7	1,020	161	190
	Jun-98	300.0	548	443	969
	Jul-98	22.7	1,620	99	73
	Aug-98	12.2	1,920	63	39
	Sep-98	29.8	1,960	157	96
	Oct-98	18.1	2,560	125	58
	Nov-98	12.7	2,790	95	41
	Dec-98	12.7	2,650	91	41
	Jan-99	12.7	2,520	86	41
	Feb-99	12.7	2,650	91	41
	Mar-99	5.9	3,400	54	19
	Apr-99	4.5	3,850	47	15
	May-99	1.5	5,260	21	5
	Jun-99	325.0	596	522	1050
	Jul-99	10.1	1,740	47	33
	Aug-99	5.5	2,110	31	18
	Sep-99	19.9	1,780	95	64
	Oct-99	16.8	2,040	92	54
	Nov-99	7.4	3,340	67	24
	Dec-99	7.4	2,410	48	24
	Jan-00	7.4	2,680	53	24
	Feb-00	7.4	2,830	56	24
	Mar-00	4.5	3,070	37	15
	Apr-00	2.1	3,520	20	7
	May-00	3.6	2,880	28	12
	Jun-00	2.3	2,510	16	7
	Jul-00	2.1	2,420	14	7
	Aug-00	1.5	3,030	12	5
	Oct-00	3.2	3,200	28	10
	Nov-00	3.2	3,300	28	10
	Dec-00	3.2	3,400	29	10
	Jan-01	3.2	3,000	26	10
	Feb-01	3.2	3,100	27	10
	Mar-01	3.9	3,900	41	13

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-11 (cont)	Apr-01	2.8	3,900	29	9
	May-01	2.8	2,600	20	9
	Jun-01	35.4	1,000	95	114
	Jul-01	4.1	2,000	22	13
	Aug-01	8.7	1,900	45	28
	Sep-01	5.3	2,100	30	17
	Oct-01	1.0	5,600	15	3
	Nov-01	4.4	3,800	45	14
	Dec-01	4.4	3,100	37	14
STORET 493029	2/22/90	35	2,270	214	113
	3/27/90	13	3,760	132	42
	4/20/90	6	4,380	71	19
	5/24/90	3	4,930	36	9
	6/20/90	1	5,460	15	3
	8/20/90	17	3,320	152	55
	10/17/90	24	2,680	173	78
	11/26/90	21	3,020	171	68
	3/29/91	20	3,260	176	65
	4/25/91	8	3,770	77	25
	5/23/91	7	4,370	86	24
	6/24/91	52	1,460	204	168
	7/26/91	91	1,810	444	294
	10/2/91	43	2,470	286	139
	11/25/91	26	3,070	215	84
	3/10/92	127	1,370	469	410
	4/22/92	17	4,020	184	55
	5/29/92	46	2,490	308	149
	6/19/92	2	3,300	20	7
	7/20/92	3	3,110	25	10
	8/13/92	5	2,820	39	16
	11/16/92	28	2,780	210	90
	2/25/93	50	1,860	250	162
	3/26/93	36	3,560	345	116
	4/27/93	33	3,540	315	107
	5/21/93	173	1,300	606	559
	6/23/93	263	858	608	850
	7/23/93	15	2,530	102	48
	8/25/93	18	2,410	117	58
	10/4/93	30	2,560	207	97
	11/16/93	58	2,870	448	187
	3/21/94	26	3,290	230	84
	4/19/94	10	3,870	103	32
	5/25/94	12	3,590	116	39
	6/23/94	13	2,430	85	42
	8/31/94	229	978	603	740
	10/5/94	31	2,420	202	100
	11/21/94	27	3,160	230	87
	3/27/95	17	3,440	157	55
	5/31/95	66	2,390	425	213
	10/30/95	83	2,120	474	268
	3/20/96	52	3,570	500	168
	4/24/96	27	2,860	208	87
	6/6/96	428	926	1067	1383
	6/27/96	156	1,140	479	504
	8/1/96	42	2,340	265	136
	8/16/96	16	2,460	106	52
	11/22/96	67	2,550	460	217
	11/19/97	110	1,586	470	355
	6/3/98	494	696	926	1596
	4/13/99	15	3,924	158	48
	10/16/00	48	2,210	286	155
	11/29/00	34	2,560	234	110
	1/9/01	25	3,070	207	81

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
STORET 493029 (cont)	2/20/01	29	2,690	210	94
	4/3/01	27	3,120	227	87
	5/11/01	16	3,370	145	52
	6/21/01	15	2,460	99	48
	8/1/01	1	4,220	14	4
	9/6/01	3	3,290	23	8
EWCD-14	1/1/90	12.0	1,892	122,275	77,553
	2/1/90	12.0	1,310	84,662	77,553
	3/1/90	6.0	2,194	70,896	38,776
	4/1/90	2.0	4,580	49,332	12,925
	5/1/90	1.0	2,760	14,864	6,463
	6/1/90	1.0	2,300	12,387	6,463
	7/1/90	0.2	3,400	4,212	1,486
	8/1/90	0.4	2,530	4,905	2,327
	9/1/90	1.3	2,070	14,047	8,143
	10/1/90	4.0	1,820	39,207	25,851
	11/1/90	10.0	1,560	84,015	64,627
	12/1/90	10.0	1,560	84,015	64,627
	1/1/91	10.0	1,690	91,017	64,627
	2/1/91	10.0	1,750	94,248	64,627
	3/1/91	10.0	1,810	97,479	64,627
	4/1/91	2.0	2,162	23,287	12,925
	5/1/91	1.0	3,102	16,706	6,463
	6/1/91	9.0	1,290	62,527	58,164
	7/1/91	1.0	2,958	15,931	6,463
	8/1/91	1.0	2,046	11,019	6,463
	9/1/91	3.0	2,446	39,520	19,388
	10/1/91	2.0	2,316	24,946	12,925
	11/1/91	5.0	1,942	52,294	32,314
	12/1/91	3.0	1,714	27,693	19,388
	1/1/92	3.0	1,634	26,400	19,388
	2/1/92	3.0	1,870	30,213	19,388
	3/1/92	6.0	1,722	55,644	38,776
	4/1/92	25.0	1,280	172,339	161,568
	5/1/92	7.0	2,808	105,859	45,239
	6/1/92	3.0	2,186	35,319	19,388
	7/1/92	1.0	3,190	17,180	6,463
	8/1/92	2.0	2,592	27,919	12,925
	9/1/92	2.0	2,550	27,467	12,925
	10/1/92	2.0	2,130	22,943	12,925
	11/1/92	4.0	1,630	35,114	25,851
	12/1/92	4.0	2,130	45,885	25,851
	1/1/93	4.0	1,608	34,640	25,851
	2/1/93	4.0	1,920	41,361	25,851
	3/1/93	29.0	1,050	163,992	187,419
	4/1/93	18.0	1,470	142,503	116,329
	5/1/93	48.0	638	164,929	310,211
	6/1/93	38.0	576	117,880	245,583
	7/1/93	2.0	1,850	19,927	12,925
	8/1/93	1.0	2,340	12,602	6,463
	9/1/93	1.0	2,240	12,064	6,463
	10/1/93	9.0	1,970	95,487	58,164
	11/1/93	9.0	1,520	73,675	58,164
	12/1/93	9.0	1,650	79,976	58,164
	1/1/94	9.0	1,570	76,099	58,164
	2/1/94	13.0	1,710	119,722	84,015
	3/1/94	16.0	1,080	93,063	103,404
	4/1/94	3.0	3,580	57,841	19,388
	5/1/94	4.0	2,010	43,300	25,851
	6/1/94	0.9	2,300	11,024	5,752
	8/1/94	1.0	2,210	11,902	6,463
	9/1/94	1.0	2,580	13,895	6,463
	10/1/94	3.0	2,480	40,069	19,388

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-14 (cont)	11/1/94	6.0	2,230	72,059	38,776
	12/1/94	6.0	1,470	47,501	38,776
	1/1/95	6.0	1,380	44,593	38,776
	2/1/95	10.0	1,160	62,473	64,627
	3/1/95	12.0	938	60,620	77,553
	4/1/95	3.8	3,190	65,284	24,558
	5/1/95	2.8	2,270	34,231	18,096
	6/1/95	170.0	468	428,478	1,098,662
	7/1/95	45.0	728	176,432	290,822
	8/1/95	33.5	1,150	207,480	216,501
	9/1/95	4.4	1,650	39,099	28,436
	10/1/95	5.4	1,700	49,440	34,899
	11/1/95	9.1	1,180	57,831	58,811
	12/1/95	9.1	2,000	98,018	58,811
	1/1/96	9.1	1,160	56,850	58,811
	2/1/96	9.1	1,320	64,692	58,811
	3/1/96	10.3	1,140	63,238	66,566
	4/1/96	4.7	2,200	55,687	30,375
	5/1/96	83.9	800	361,481	542,222
	6/1/96	27.0	595	86,520	174,493
	7/1/96	1.9	2,330	23,842	12,279
	8/1/96	1.0	892	4,804	6,463
	9/1/96	10.0	1,930	103,942	64,627
	10/1/96	5.9	1,860	59,302	38,259
	11/1/96	13.9	887	66,401	89,832
	12/1/96	13.9	1,770	132,502	89,832
	1/1/97	13.9	1,500	112,290	89,832
	2/1/97	13.7	1,620	119,528	88,539
	3/1/97	31.6	1,110	188,905	204,222
	4/1/97	20.9	1,100	123,815	135,071
	5/1/97	147.8	416	331,133	955,190
	6/1/97	120.0	508	328,306	775,526
	7/1/97	2.7	2,010	29,228	17,449
	8/1/97	38.5	1,190	246,741	248,815
	9/1/97	40.0	1,720	370,529	258,509
	10/1/97	14.8	1,510	120,357	95,648
	11/1/97	7.8	2,180	91,577	50,409
	12/1/97	7.8	1,380	57,971	50,409
	1/1/98	7.8	1,640	68,893	50,409
	2/1/98	7.8	1,470	61,751	50,409
	3/1/98	24.5	1,240	163,615	158,337
	4/1/98	27.9	1,200	180,310	180,310
	5/1/98	49.7	940	251,604	321,197
	6/1/98	80.0	544	234,381	517,018
	7/1/98	30.3	1,020	166,447	195,820
	8/1/98	11.3	1,160	70,594	73,029
	9/1/98	28.3	1,100	167,654	182,895
	10/1/98	49.9	1,320	354,739	322,490
	11/1/98	27.9	1,440	216,372	180,310
	12/1/98	27.9	1,530	229,895	180,310
	1/1/99	27.9	1,520	228,393	180,310
	2/1/99	27.9	1,240	186,320	180,310
	3/1/99	19.3	1,480	153,834	124,730
	4/1/99	9.5	2,020	103,350	61,396
	5/1/99	50.6	792	215,829	327,014
	6/1/99	81.3	664	290,732	525,419
	7/1/99	104.0	1,480	828,952	672,123
	8/1/99	18.1	1,100	107,227	116,975
	9/1/99	9.7	1,620	84,629	62,688
	10/1/99	9.7	2,150	112,317	62,688
	11/1/99	11.8	2,070	131,549	76,260
	12/1/99	11.8	1,450	92,148	76,260
	1/1/00	11.8	1,560	99,138	76,260

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
EWCD-14 (cont)	2/1/00	24.1	2,450	317,993	155,752
	3/1/00	12.2	1,640	107,755	78,845
	4/1/00	13.9	1,500	112,290	89,832
	5/1/00	9.4	2,180	110,362	60,750
	6/1/00	1.8	2,230	21,618	11,633
	7/1/00	5.7	1,920	58,940	36,838
	9/1/00	3.7	1,600	31,883	23,912
	10/1/00	9.2	1,400	69,367	59,457
	11/1/00	9.2	1,300	64,412	59,457
	12/1/00	9.2	1,300	64,412	59,457
	1/1/01	9.2	1,300	64,412	59,457
	2/1/01	9.2	1,600	79,276	59,457
	3/1/01	21.4	1,500	172,878	138,302
	4/1/01	11.3	1,600	97,372	73,029
	5/1/01	37.8	690	140,467	244,291
	6/1/01	9.2	990	49,052	59,457
	7/1/01	3.2	2,400	41,361	20,681
	8/1/01	1.6	1,600	13,787	10,340
	9/1/01	2.1	1,800	20,358	13,572
	10/1/01	1.3	3,100	21,704	8,402
	11/1/01	4.4	2,400	56,872	28,436
	12/1/01	4.4	1,600	37,915	28,436
STORET 495500	4/18/90	4.8	6,444	83	16
	5/9/90	0.1	7,494	2	0
	5/22/90	0.0	8,746	0	0
	10/10/90	0.9	6,130	15	3
	2/20/91	14.4	4,078	158	47
	9/11/91	48.9	3,434	452	158
	10/23/91	1.5	6,354	26	5
	12/11/91	10.0	4,520	122	32
	2/12/92	17.0	2,310	106	55
	4/1/92	64.9	1,912	334	210
	8/18/92	0.2	4,678	3	1
	12/1/92	6.2	5,818	97	20
	3/30/93	41.9	3,056	345	135
	4/27/93	46.2	2,196	273	149
	6/22/93	47.0	1,672	212	152
	8/12/93	6.0	4,532	73	19
	10/6/93	0.8	6,080	13	3
	11/30/93	25.0	4,266	287	81
	1/19/94	4.0	4,036	43	13
	3/23/94	6.0	3,828	62	19
	5/4/94	2.3	5,070	31	7
	8/9/94	12.0	4,662	151	39
	9/21/94	7.0	5,544	105	23
	11/1/94	1.5	5,644	23	5
	12/13/94	4.0	4,994	54	13
	2/14/95	7.5	3,556	72	24
	3/28/95	4.5	3,672	44	15
	5/11/95	6.0	4,428	72	19
	9/20/95	2.0	5,132	28	6
	11/14/95	6.0	2,894	47	19
	1/17/96	20.0	2,870	155	65
	2/28/96	18.0	2,508	122	58
	4/10/96	8.0	3,040	65	26
	5/14/96	22.0	2,382	141	71
	10/15/96	0.8	4,782	10	3
	12/18/96	2.0	5,070	27	6
	2/13/97	9.0	2,932	71	29
	4/2/97	21.0	1,962	111	68
	5/14/97	35.0	910	86	113
	6/25/97	30.0	1,114	90	97
	7/30/97	150.0	3,386	1368	485

Station	Date	Flow (cfs)	TDS (mg/L)	Existing Load (tons/day)	Load Capacity (tons/day)
STORET 495500 (cont)	8/26/97	50.0	2,120	285	162
	9/16/97	150.0	2,516	1016	485
	11/18/97	13.9	2,928	110	45
	1/13/98	25.0	2,584	174	81
	2/17/98	25.0	2,960	199	81
	3/30/98	35.0	1,508	142	113
	5/19/98	35.0	2,456	231	113
	6/23/98	40.0	806	87	129
	9/16/98	19.0	3,014	154	61
	10/29/98	30.0	2,290	185	97
	12/16/98	120.0	3,464	1119	388
	2/10/99	55.0	2,416	358	178
	4/14/99	12.0	3,536	114	39
	6/23/99	40.0	1,458	157	129
	8/4/99	30.0	3,380	273	97
	9/29/99	4.1	4,616	51	13
	12/8/99	10.5	3,760	106	34
	2/2/00	15.0	3,092	125	48
	3/22/00	18.9	2,726	139	61
	5/24/00	5.0	4,956	67	16
	11/8/00	17.9	2,712	131	58
	4/25/01	5.4	3,170	46	17
	6/27/01	74.0	2,340	466	239
	8/22/01	500.0	3,826	5151	1616
	10/31/01	25.0	972	65	81
	12/12/01	4.0	4,634	50	13
	1/30/02	4.2	4,378	50	14
	4/24/02	25.0	4,492	302	81
	9/17/02	22.6	4,060	247	73

APPENDIX C

COMMENTS ON DRAFT DOCUMENT AND RESPONSES:

Formal comments were received from five individuals. For each of these individuals, the comments provided are listed followed by a response in bold italicized text.

Comment Letter 1: Mark Page, Utah Division of Water Rights

Just a couple of comments after reviewing the final report. First, I think a really good job was done on the report.

On page 2, Table 1-1 it refers to Lower Grassy Trail Creek being the area from Grassy Trail Reservoir to the headwaters. This area might be more appropriately named the upper Grassy Trail Creek area.

Comment noted and change made.

In appendix A, page A-7, Table A-2, the description of the site refers to the Price River near Wellington at US 6 Crossing. Highway 6 never crosses the Price River at or near Wellington.

Comment noted and change made.

Do we have enough data collected on the Price River to set the proper targets?

As is typical for most TMDLs, more data would refine our understanding of the targets. However, there is sufficient data to determine annual TDS loading and to estimate what effect BMPs may have on loadings in the Price River.

The monitoring system that will need to be established to monitor progress was addressed very briefly. Maybe more detail would be helpful. Who will collect the samples, how often and at what sites? At what point will reconsideration of the targets be reviewed if we are not meeting the established figures?

Details of the State-wide water quality monitoring program are available from the Division of Water Quality.

Thanks for your good work on this project. If you have any questions please feel free to contact me. Thanks again.

Comment Letter 2: Roger Barton, Chairman Price-San Rafael River Watershed Committee

March 2, 2004

Utah Division of Water Quality
Attn: Kent Montague
288 North 1460 West
P O Box 144870
Salt Lake City, Utah 84114-4870

RE: Comment on TMDL

The follow comments and questions are offered to you for the Price River, San Rafael River, and Muddy Creek TMDL for Total Dissolved Solids, West Colorado Watershed Management Unit, Utah (January 2004).

1. Section 3.4, Data Use and Limitations: Reference is made to the lack of available data. Do we have enough data to make the determinations and conclusions in the TMDL? Data, especially on the Price River, is lacking in several areas as mentioned in the TMDL.

As noted in the earlier response, additional data would refine the understanding of TDS loadings in the Price. However, as indicated in the report, there is sufficient flow and chemistry data to calculate TDS loading to the watershed at certain locations.

2. The biggest concern that I have is the TDS calculations for the Muddy River. Natural Resources Conservation Service and the Bureau of Reclamation are writing an Environmental Assessment (EA) for the Muddy Creek drainage and are claiming 15,000 tons of "salts" are coming from agricultural non-point sources. This TMDL is showing 50,767 tons (Table 6-9). Table A-9, page A-9, shows 64,335 tons with 25,600+ tons attributed to agriculture. The concern is if these documents, TMDL and EA, are to be recognized by the Federal Government and the calculations are to be used in watershed improvements a consensus on the salt loading should be reached. Both documents should reflect basically the same figures.

   The community of Emery is willing to make irrigation improvements and the tons of salt attributed to agriculture can make a big difference in whether they can afford to install those systems. If the figure is 15,000 tons, the cost per ton of salt removed is very high. If the figure is 25,000 – 50,000 tons, the cost drops considerably. It is stated (page A-10) that, on the Muddy Creek, 45%-93% of the salt loading comes from ambient sources, yet the TMDL shows a wide range of tons attributed to agricultural practices. Is there some way to come to agreement on these calculations?
   The non-point load listed in Table 6-9 was derived using the available flow and water quality data available. The 50,767 tons/year is for all non-point sources, including natural background and irrigation. The value for irrigation return flow, winter water replacement, and canal seepage of 26,200 tons/year listed in Table A-9 was based on allocating the total non-point load in the Muddy Creek watershed to the different segments in the watershed and estimating what portion of the load is attributable to the different sources, as based on land use and available loading values. The 45%-93% values listed as ambient loadings was incorrect. The report has been modified to reflect that 34-49% of the annual non-point load is estimated to be a result of ambient TDS loading.

Roger Barton, Chairman
Price-San Rafael River Watershed Committee
P O Box 263
Ferron, Utah 84523

Comment Letter 3: Steve Gerner, USGS-Salt Lake City

Mr. Judd,

I was delighted to find the draft TMDL document for TDS in West Colorado River Watershed streams posted on the Utah DEQ web site. My particular interest is in the interpretation of existing data relative to dissolved solids in Muddy Creek. I thought the sections describing data limitations particularly inciteful given the lack of flow data for Muddy Creek. I'm familiar with the samples collected by UTDEQ at the U24 Muddy Creek site and appreciate the value inherent in this data set, however, I'm a little concerned about the number of 'estimated' flow values associated with TDS concentrations. Estimated flow values (which comprise about half the data) are notoriously inaccurate and load calculations or streamflow statistics based on these values have a high degree of uncertainty. I think the sections relative to the need for additional data acquisition and monitoring, followed by re-evaluation of the TMDL document can't be overstated.

The USGS Utah District will be initiating a project in the near future to quantify the dissolved-solids load in Muddy Creek. As I'm sure you're aware, a lack of continuous flow and concentration data has resulted in a high degree of uncertainty associated with estimates of the dissolved-solids load in the middle and lower segments of Muddy Creek. The data that is generated by this project should result in improved estimates of average monthly stream flow, dissolved-solids concentrations, and dissolved-solids loads for Muddy Creek. Continuous monitoring of specific conductance and subsequent dissolved solids concentration calculations should enable you to evaluate the site-specific TDS concentration criteria (5,600 mg/L) proposed for Muddy Creek as well. I've attached a copy of the USGS Muddy Creek project proposal if you're interested in learning more about this project. Thank you for the opportunity to review the draft TMDL for the West Colorado Watershed Management Unit.

Regards,
- Steve Gerner

U.S. Geological Survey
2329 Orton Circle
SLC, Utah 84119

(801) 908-5031

(See attached file: Muddy_Regional_Proposal.pdf)

Comment noted and results from the proposed work will be incorporated into the TMDL as it becomes available.

Comment Letter 4: Kathy Hernandez, USEPA Region 8

EPA REGION VII TMDL REVIEW FORM

Document Name:	**West Colorado Watershed – Water Quality Management Plan**
Submitted by:	**Harry Judd – Kent Montague**
Date Received:	**02/06/2004**
Review Date:	**02/14/2004**
Reviewer:	**K. Hernandez**
Draft or Final Review?	**Draft**

This document provides a standard format for the EPA Region 8 to provide comments to the Utah Department of Environmental Quality on TMDL documents provided to the EPA for either official formal, or informal review. All TMDL documents are measured against the following 12 review criteria:

1. Water Quality Impairment Status
2. Water Quality Standards
3. Water Quality Targets
4. Significant Sources
5. Total Maximum Daily Load
6. Allocation
7. Margin of Safety and Seasonality
8. Monitoring Strategy
9. Restoration Strategy
10. Public Participation
11. Endangered Species Act Compliance
12. Technical Analysis

Each of the 12 review criteria are described below to provide the rational for the review, followed by EPA's comments. This review is intended to ensure compliance with the Clean Water Act and also to ensure that the reviewed documents are technically sound and the conclusions are technically defensible. This document review form incorporates, by reference, the summary of TMDL elements presented in Table 1 (attached).

1. Water Quality Impairment Status

1.1 Criterion Description – Water Quality Impairment Status

TMDL documents must include a description of the listed water quality impairments. While the 303(d) list identifies probable causes and sources of water quality impairments, the information contained in the 303(d) list is generally not sufficiently detailed to provide the reader with an adequate understanding of the impairments. TMDL documents should include a thorough description/summary of all available water quality data such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and/or appropriate water quality

☐ Satisfies Criterion
☐ Satisfies Criterion. Questions or comments provided below should be considered.
☑ Partially satisfies criterion. Questions or comments provided below need to be addressed.
☐ Criterion not satisfied. Questions or comments provided below need to be addressed.
☐ Not a required element in this case. Comments or questions provided for informational purposes.

The following segments are addressed in the TMDL Watershed Management Unit Plan for the West Colorado Watershed: Price River Watershed, San Rafael River Watershed and Muddy Creek Watershed. Utah DEQ 2000 and 2002 303(d) List identifies the following streams segments as impaired:

Listed Stream Segment	Pollutant	Related Beneficial Use
Price River Watershed		
Gordon Creek and tribs.*	Total dissolved solids (TDS)	Agriculture, water supply, cold water aquatic species
Pinnacle Creek	TDS	***Agriculture, water supply, cold water aquatic species***
Price River and tribs from Green River to near Woodside*	TDS, DO, Iron	Agriculture, non game fish
Price River and tribs from Woodside to Soldier Creek*	TDS	Agriculture, water supply, cold water aquatic species
Lower Grassy Trail Creek*	pH, TDS	Agriculture
Price River and tribs from Coal Creek to Carbon Canal*	TDS	***Agriculture, water supply, cold water aquatic species***
San Rafael River Watershed		
Huntington Creek tribs from Cottonwood Creek to Hwy 10*	TDS	Agriculture
Huntington Creek and tribs from Hwy 10 to USFS boundary	TDS	Agriculture, water supply, cold water aquatic species
Cottonwood Creek from Huntington Creek to Hwy 57*	TDS	Agriculture
Rock Canyon Creek from Cottonwood Cr. to headwaters	TDS TDS	***Agriculture, non game fish***
San Rafael River from Buckhorn to Huntington Creek	TDS	Agriculture
San Rafael River from Green River to Buckhorn Crossing	TDS	Agriculture
Muddy Creek Watershed		
Muddy Creek and tribs from Quitchupah to Hwy 10*	TDS	Agriculture
Quitchupah Cr. from Muddy Cr. to Hwy 10*	TDS	Agriculture
Ivie Creek and trivs from Muddy Cr. to Hwy 10*	TDS	Agriculture

Muddy Creek from Fremont River to Quitchupah*	TDS	Agriculture

There is a good description of the watersheds including the land use, geology, vegetation and climate. The review of STORET data for Lower Grassy Creek from 1997-2002 found only one exceedance of pH , therefore this segment will be delisted for pH. The Lower Price River has not had any exceedance of DO in the past 3 years, therefore this segment will be delisted. Because of the limited exceedances of the dissolved iron concentrations and the lack of any identified sources, Price River has been delisted for iron from the 2004 303 (d) list.

What is the watersheds priority on the 2002 list? If these segments are not high priority, explain how their development affects the high priority TMDL schedule.

Please identify the applicable beneficial use for Pinnacle Creek, Rock Canyon, Cottonwood Creek and the segment of Price Creek near Coal Creek.

2. Water Quality Standards

1.1.1 Criterion Description – Water Quality Standards

The TMDL document must include a description of all applicable water quality standards for all affected jurisdictions. TMDLs result in maintaining and attaining water quality standards. Water quality standards are the basis from which TMDL's are established and the TMDL targets are derived, including the numeric, narrative, use classification, and antidegradation components of

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☐ Partially satisfies criterion. Questions or comments provided below need to be addressed.
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☐ Not a required element in this case. Comments or questions provided for informational purposes.

The chronic numeric water quality standard for TDS for the West Colorado River Watershed is 1200 mg/l to support the agricultural use. The dissolved oxygen standard to support non game fish is 5.0 mg/l as a daily minimum, and a dissolved iron concentration of 1.0 mg/l. The State's antidegradation policy dictating that "existing water quality shall be maintained and protected" applies to waters designated as 'High Quality – Category 1". Portions of Gordon Creek, Huntington Creek, Cottonwood Creek, Muddy Creek, and Quitchupah Creek are designated as Category 1 – High Quality Waters.

3. Water Quality Targets

Criterion Description – Water Quality Targets

Quantified targets or endpoints must be provided to address each listed pollutant/water body combination. Target values must represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the TMDL target. For pollutants with narrative standards, the narrative standard must be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of

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☐ **Not a required element in this case.**

The water quality targets/ initial endpoint selected for these TMDLs to achieve chronic numeric water quality standard for TDS is 1200 mg/l . Additionally this watershed is addressed under the Colorado River Basin Salinity Control Forum, which addresses salinity in the Colorado River System. The

standards required a plan that would maintain the flow-weighted average annual salinity at or below 1972 levels.

There are two target sites in the Price River watershed, five target sites in the San Rafael River watershed, and two target sites in the Muddy River watershed which are shown on Map 2 in the TMDL document. The endpoint was modified at selected target sites to reflect an adjustment to TDS criterion based on site-specific conditions as allowed for under Utah water quality standards.

These segments that have site specific targets cannot be approved as TMDLs until the standard is changed by UTDEQ.

4. Significant Sources

1.1.1.1 Criterion Description – Significant Sources

TMDLs must consider all significant sources of the stressor of concern. All sources or causes of the stressor must be identified or accounted for in some manner. The detail provided in the source assessment step drives the rigor of the allocation step. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source when the relative load contribution from each source has been estimated. Ideally, therefore, the pollutant load from each significant source should be quantified. This can be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach

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The primary factors in increased TDS loads in the middle and lower reaches of the Price, San Rafael and Muddy Creek watersheds are from agricultural irrigation practices, surface runoff, grazing, recreational activities and natural geological loadings. Increased surface run-off, and loadings of TDS are associated with current irrigation practices.

Elevated TDS concentrations in Rock Canyon Creek are attributed to agricultural use, with irrigation and urban activities, the Hunter Power Plant and the presence of Mancos Shale. Wastewater Treatment facilities located in Price (UT0021814), Huntington (UT00212960) and Castle Dale (UT0023663), contribute TDS loads to Price River, Huntington Creek and Cottonwood Creeks, respectively. Permitted industrial source discharges are associated with coal mine operations and power plants contribute load, as do runoff rates and flows from urban areas.

5. TMDL

Criterion Description – Total Maximum Daily Load

TMDLs include a quantified pollutant reduction target. According to EPA reg (see 40 C.F.R. 130.2(i)) TMDLs can be expressed as mass per unit of time, toxicity, % load reduction, or other measure. TMDLs must address, either singly or in combination, each listed pollutant/water body combination.

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The TMDL is expressed in average annual loading capacity/TMDL in tons/year TDS and in % reduction in existing load to achieve allocation.

Stream Segment – Price River Watershed	**TMDL** **tons/yr TDS**	**% Reduction**
Pinnacle Creek and tribs	31,755	**43%**
Gordon Creek and tribs		
Price River and tribs from Coal Creek to Carbon Canal Diversion		

6. Allocation

Criterion Description – Allocation

TMDLs apportion responsibility for taking actions or allocate the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or dividing of responsibility. A performance based allocation approach, where a detailed strategy is articulated for the application of BMPs, may also be appropriate for non point sources.

In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive

☑ Satisfies Criterion

S 2

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☐ Satisfies Criterion

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Summary of Average Annual TDS Load and TMDL Allocation for the Price River Watershed from Coal Creek to Carbon Canal Diversion

Source	Current Load Tons/year	WLA Tons/year	LA Tons/year	% increase/reduction
NPDES UTGO40019	258	1,035		+300%
NPDES UT0023094	146	941		+644%
NPDES UT0000094	146	552		+278%
NPDES UT0025453	8	30		+275%
NPDES UT0021814	2,190	7,304		+234%
Non-Point Source Load	52,732		20,305	61%
Margin of Safety	1,558			
Total Existing Load	55,480			43%

There are 17,000 acres under consideration for irrigation improvements for the Price River watershed. The Resource Protection plan is projected to decrease the salt load in the Price River watershed by 69,975 tons per year. Replacing 100% of the 69 miles of open laterals and canals could potentially reduce nearly 4,000 tons per year. Dewatering of the Price River area canal systems in winter and lining stock ponds could result in a load reduction of 18,356 tons of salt per year. It is estimated that Price River watershed contributes 279 tons of salt per year due to unstable stream banks that are impacted by livestock and wildlife, which could be reduced through fencing and restoration. Urban areas in the Price River watershed contribute 95 tons of salt annually, 29 tons removed application of vegetative filter strips and detention ponds.

Price River Watershed – Price River near Wellington at US 6

Source	Loading (tons/year)	Reduction (tons/year)
Irrigation return flows	65,470	55,980

Canal seepage	4,677	3,692
Winter water replacement	18,706	14,685
Surface erosion	3,555	1,997
Streambank erosion	112	84
Urban areas	90	28
Forest	204	64
Totals	92,814	76,530
Ambient loading	2,030	0
TOTAL LOADING	94,844	18,314 (post BMP)

Is the allocation in Table A-2 applicable to the Target Site #493239?

The allocation in Table A-2 was based on looking at the total non-point source loading in the Price River Watershed (Site 493165) and allocating the load to the different segments based on percent of watershed. From there, information on land use and TDS loading by source were used to estimate the allocations listed.

It appears that the tons/year attributed to the point source is actually increasing, since it is based on design flow rather than actual effluent flow. It is not clear if the effluent limit for all NPDES dischargers will be at or below 1200 mg/l. Additionally, are any of the permittees being allowed to backslide to effluent quality greater that their past performance? If so, that would be considered a violoation of the "anti backsliding". Additionally most of these segments are requesting site specific criteria because of their inability to meet the existing WQS, as in Muddy Creek where 1/3 of the load is attributable to point source discharge, which is 3 time greater that the existing point source load and the site specific standard requested ranges from 2600 to 5800 mg/l.

7. Margin of Safety and Seasonality

1.1.1.1.1.1 Criterion Description – Margin of Safety/Seasonality

1.1.1.1.1.2

A margin of safety (MOS) is a required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (303(d)(1)(c)). The MOS can be implicitly expressed by incorporating a margin of safety into conservative assumptions used to develop the TMDL. In other cases, the MOS can be built in as a separate component of the TMDL (in this case, quantitatively, a TMDL = WLA + LA + MOS). In all cases, specific documentation describing the rational for the MOS is required.

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There is an explicit margin of safety of 5%.

8. Monitoring Strategy

1.1.1.1.1.3 Criterion Description – Monitoring Strategy

Many TMDL's are likely to have significant uncertainty associated with selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL documents to articulate the means by which the TMDL will be evaluated in the field, and to provide supplemental data in the future to address any uncertainties that may exist when the document is prepared.

At a minimum, the monitoring strategy should:

- *Articulate the monitoring hypothesis and explain how the monitoring plan will test it.*
- *Address the relationships between the monitoring plan and the various components of the TMDL (targets, sources, allocations, etc.).*
- *Explain any assumptions used.*
- *Describe monitoring methods.*
- *Define monitoring locations and frequencies, and list the responsible parties.*

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9. Restoration Strategy

1.1.1.1.1.4 Criterion Description – Restoration Strategy

At a minimum, sufficient information should be provided in the TMDL document to demonstrate that if the TMDL were implemented, water quality standards would be attained or maintained. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document.

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Adequate information is provided to demonstrate the water quality standards will be attained with the suggested BMPs and effluent limits.

10. Public Participation

1.1.1.1.1.5 Criterion Description – Public Participation

The fundamental requirement for public participation is that all stakeholders have an opportunity to be part of the process. Public participation should fit the needs of the particular

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Information regarding the public meeting and notification and publications of the TMDL was identified.

A watershed committee was formed and there was two public meetings. The draft and final TMDL are posted on the UTDEQ website for review.

11. Technical Analysis

1.1.1.1.1.6 Criterion Description – Technical Analysis

*TMDLs must be supported by an appropriate level of technical analysis. It applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader. Of particular importance, the cause and effect relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and allocations needs to be supported by an*

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The TMDL and load allocations were developed based on flow and water quality data over an 11 year period of record from 1990 to 2001. The average annual loading capacity/TMDL at each target site were calculated as the product of the average annual flow at the target site, the TDS standard criterion of 1,200 mg/l and a conversion factor to express the average annual loading capacity/TMDL in tons/year TDS.

12. Endangered Species Act Compliance

1.1.1.1.1.7 Criterion Description – Endangered Species Act Compliance

EPA's approval of a TMDL may constitute an action subject to the provisions of Section 7 of the Endangered Species Act ("ESA"). EPA will consult, as appropriate, with the US Fish and Wildlife Service (USFWS) to determine if there is an effect on listed endangered and threatened species pertaining to EPA's approval of the TMDL. The responsibility to consult with the USFWS lies with EPA and is not a requirement under the Clean Water Act for approving TMDLs. States are encouraged, however, to participate with FWS and EPA in the consultation process and, most importantly, to document in its TMDLs the potential effects

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The USFWS has been involved with the development of this TMDL and is currently reviewing the draft document.

13. Miscellaneous Comments/Questions

Comment Letter 5: Kerry Flood, BLM-Price

Comment Narrative for Price River, San Rafael River, and Muddy Creek TMDL
Primary Sources of Sediment Loading from BLM Managed Lands
K. Flood – Hydrologist

There are 3 major sources of sediment from excessive erosion coming from BLM land in PFO. This is the most relevant consideration of impacts because all five major basins are 303(d) listed for non-attainment of water quality standards. The sources are:

A. sheet erosion - major causes in decending order of contribution:

1) grazing wind erodible soils – any level of surface disturbance on these soils, which are naturally protected from wind erosion by cryptobiotic soil crusts, increases soil movement and loss dramatically over natural levels. This changes site productivity, which is degrading. Eventually the use will not be sustainable. This increases sediment loading to streams, the source of 303(d) target parameters in the PFO area. Grazing is the one uncontrollable activity, it is either graze or no-graze on these soils. There is one alternative which proposes to close an allotment (the Iron Wash Allotment) from grazing due to this impact. Very desirable. The allotment boundary doesn't coincide with the soils types, so some of the closure area is not necessary to close, and some erodible soils will be missed in the closure, but, better than not doing it.

We agree that grazing of erodible soils is a source of TDS loading in the watersheds. Identification of locations, based on soil type, where grazing is problematic and modifying the landuse could be an effective BMP for this source.

2) Roads, trails, and other development on wind erodible soils – where roads aren't built to standards, the surface continually erodes downward, resulting in significant soil loss/sediment loading. Anywhere vegetation is removed and the soil crust destroyed on these soils, sheet erosion accelerates.

As noted in Appendix A, roads and recreational use are identified as sources of TDS. We agree that BMPs that focus on identifying and improving roads that are not built to best standards would help limit loading.

3) Grazing erodible soils – primarily only a problem where overgrazed, and where livestock distribution is poor. Standards and guidelines are going a long way to mitigating this. The critical soil loss threshold plays a role in this also.

We agree that proper grazing techniques are an important BMP for limiting TDS loading to the watersheds. These recommendations are included in Appendix A.

4) Vegetative reduction on erodible soils by surface occupancy increases sheet erosion and reduces infiltration.

We agree that increased vegetative cover on erodible soils can limit TDS loading from sheet erosion.

B. Stream channel erosion (difficult to quantify, but possibly as large a contributer as sheet erosion). Consequences have and can include degradation of stream potential and type (Rosgen class). Results in non-sustainable uses.

Causes:

- Improperly functioning riparian due to channel bank defoliating (grazing)
- Improperly functioning riparian due to changes in flow regime, i.e. 100% diversion practice.
- Hydrologic instability due to changes in flow regime, such as interbasin transfers (even by road drainages) and diversions. Results in degraded stream type (i.e. from perennial flow to intermittent flow, lowering of water table, changes in use imminent.
- Bank trampling, usually grazing related.
- Poorly designed stream channel alterations.

Stream channel erosion is identified in Appendix A as an identified source of TDS loading in the evaluated watersheds. Appropriate BMPs are provided that are in agreement with the identified sources of stream erosion listed above.

C. Gully erosion – Probably equivalent total quantity as stream channel erosion
More easily prevented than restored. Caused primarily by transportation routes, which berm sheet flow, convert to channel flow, and discharge with accelerated velocity to create gullies. Also caused by headcutting from improperly installed culverts at drains and crossings. Prevented and sometimes reversed by PFO hydromods and BMP's. Otherwise, gullying can be a domino problem, which does not stop when cause is removed.
Gullies also are created when soil is compacted and vegetation removed. The effects are severe, both in soil loss and changes in infiltration rate and area. Changes in land use due to

unsustainable yield, and elimination of access to land are potential consequences, as well as the soil loss and sediment loading

Comments noted and text added to Appendix A to incorporate information provided.

General comment summation: Almost all of the above are mitigatable, or manageble within targets. Grazing wind erodible soils is the one impact we can't mitigate, only no-graze can prevent that. It would be possible to determine whether we could "sacrifice" certain areas and remain within sediment loading limits for a particular watershed, if we had completed soils analysis by watershed.

End.