Soldier Creek Sub-watershed

Coordinated Resource Management Plan

November 2004

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Developed under the leadership of the Timp-Nebo Soil Conservation District
with the full cooperation and support of the

SPANISH FORK RIVER WATERSHED
COORDINATED RESOURCE MANAGEMENT TEAM

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Executive Summary

Purpose of the Plan

The purpose of this coordinated resource management plan (CRMP) is to provide guidance for the effective treatment and management of all identified natural resources within the Soldier Creek sub-watershed of the Spanish Fork River watershed. If fully implemented, these recommendations are expected to reduce the amount of sediment entering Soldier Creek by 29,000 tons each year. This would result in improved water quality, enhanced aquatic, riparian and upland habitat, and increased agricultural productivity.

The building blocks of the CRMP are conservation plans. Conservation plans are developed with individual landowners to target specific natural resource problems identified in the CRMP and by the landowner. Conservation plans consist of projects, management strategies and implementation timetables that, when implemented, will conserve natural resources and improve land productivity.

Landowners and cooperators work voluntarily on their conservation plans, with the assistance of the Natural Resource Conservation Service (NRCS), Timp-Nebo Soil Conservation District (SCD), Division of Wildlife Resources (DWR), Utah County and other partners. When outside funding is available, it will be used to assist in plan implementation.

Existing Situation

Soldier Creek, a tributary to the Spanish Fork River, is on the State of Utah's 303(d) list of impaired water bodies for 2002 (Department of Environmental Quality, 2002). It was identified as a water body of concern due to excess sediment and phosphorous. The designated beneficial uses of Soldier Creek are recreation, cold water fisheries and agriculture.

Spanish Fork River and its tributaries, including Soldier Creek, flow into Utah Lake. The lake has also been identified by the State as an impaired water body and is on the 303(d) list due to water quality concerns associated with excess sediment and nutrients (Department of Environmental Quality, 2002). Utah Lake water quality is directly affected by the quality of the waters that flow into it, including the Spanish Fork River, Soldier Creek and other tributaries. The designated beneficial uses of Utah Lake are recreation, warm water fisheries, protected waterfowl and agriculture.

NRCS employees inventorying Soldier Creek stream and water quality parameters.

Within the Soldier Creek sub-watershed there is increasing interest in development, recreation and transportation. All of these uses can affect water quality.

Wildlife habitat within Spanish Fork Canyon is also affected, directly and indirectly, by water quality. Big game winter range, wetlands and at-risk species habitat are specific concerns. Ten threatened, endangered or sensitive species currently occupy or historically occupied habitat within the Soldier Creek sub-watershed. Eight species are exclusively dependent upon aquatic or riparian habitat, including three species of cold water fish.

Water Quality

Excess sediment and phosphorous in Soldier Creek are negatively affecting its beneficial

uses. This situation is also contributing to water quality problems in Utah Lake.

Water quality monitoring indicates that sediment and phosphorous are linked; excessive phosphorous is found only when excessive sediment is present. Although both sediment and phosphorous are identified as pollutants, reducing the amount of sediment reduces them both.

By far the largest source of sediment is upland soil erosion. The sub-watershed uplands contribute an estimated 142,300 tons of sediment to the Soldier Creek stream system annually. This is largely due to inadequate soil cover and highly erosive soils, particularly those soils formed from the Green River Formation, which is common in the upper watershed (Hintze, 1992).

Roads are another source of upland soil loss. With 568 miles of road within the sub-watershed, roads contribute an estimated 40,000 tons of sediment to the stream system each year.

Unstable streambanks are the second largest source of sediment to Soldier Creek. During high water events unstable streambanks erode, sloughing soil directly into the channel. This source contributes 60,800 tons of sediment annually into the Soldier Creek stream system.

Stream reaches that have been straightened, or otherwise altered by humans, tend to have unstable channels. This sediment source can be reduced by restoring the stream's natural sinuosity and function. Natural function is synonymous with stream channel stability, or the ability of the stream channel to develop a stable pattern, dimension, and profile without aggrading or degrading (Rosgen, 1996). Stable channels, or naturally functioning streams, are able to consistently transport their sediment load, and so will not excessively erode their own banks.

One significant source of streambank instability can be attributed to culverts installed to convey water under Highway 6. Several of these culverts concentrate storm run-off, creating a highly erosive stream of water that erodes new channels across the uplands until the water reaches Soldier Creek. To reduce the quantities of sediment delivered from this source, it is important to spread storm run-off across the uplands, allowing this water to soak into the soil, instead of concentrating run-off into man-made drainages, and funneling highly erosive water through culverts.

In the upper watershed, road culverts have created serious soil erosion problems.

OTHER ISSUES

Other natural resource issues are concerns within the sub-watershed including noxious weed infestations, increasing recreational use, and increasing interest in residential development. Each of these issues has an effect on Soldier Creek water quality.

OBJECTIVES

Ten natural resource objectives have been identified to assess the success of this CRMP. These objectives are:

1. To protect and stabilize at least 21 miles of eroding streambanks by applying best management practices (BMPs) that will result in a 11,000 ton/year reduction of soil loss within ten years of the CRMP implementation.
2. To restore the natural function (dimension, pattern and profile) to 14 miles of stream corridor within ten years of the CRMP implementation.

3. To improve fish habitat on at least 14 miles of stream by increasing protective habitat cover by 15% and reducing eroding banks by at least 10%, resulting in 118 pounds/ acre of trout biomass, within ten years of the CRM plan implementation.
4. To reduce sediment coming from the uplands by 5,000 tons/year by applying BMPs on 16,000 acres of rangelands within five years of complete plan implementation.
5. To reduce the influence of noxious weeds infestations within ten years of complete plan implementation.
6. To increase coordination with the various land owners and land management agencies to minimize potential conflicts and resource damage as transportation and recreation demands increase over the next 10 years.
7. To actively promote coordination between CRMP partners, including seeking team review of proposed actions that could affect Soldier Creek sub-watershed resources.
8. To provide recommendations regarding natural resources and development to the Utah and Wasatch County planning commissions, as needed, throughout the planning and implementation phases of this CRMP.
9. To organize local individuals and groups into action committees, provide guidance to keep committees functional, and provide technical assistance to plan and implement BMPs to resolve natural resource problems throughout the development and implementation of this plan.
10. To continue to seek outside funding to bring about the greatest improvement to the watershed through landowner, agency and public cooperation throughout the development and implementation of this plan.

EXPECTED RESULTS

When fully implemented, this CRMP is expected to have the following affects on the sub-watershed's natural resources:

1. Soldier Creek will meet Utah State Water Quality Standards for its designated beneficial uses,
2. Streambank and channel erosion will be reduced throughout the sub-watershed by at least 11,000 tons per year,
3. Excessive runoff from rainfall and snowmelt in the area will be greatly reduced which will subsequently reduce the amount of sediment entering the stream system,
4. Irrigation-related sediment will be reduced on 500 acres of private land,
5. Twenty-one miles of riparian area will regain its natural function, including the ability to filter runoff to reduce the amount of sediment entering the stream system,
6. Improved plant cover will increase water infiltration into upland and riparian soils, retard runoff events, recharge groundwater, and ultimately provide more available stream water during low flows,
7. Increased and better quality forage will be available for wildlife and livestock use,
8. A greater number and variety of wildlife including neo-tropical migratory birds, big game, and non-game species, will use the entire sub-watershed due to improved vegetation cover on uplands, riparian areas and agricultural fields,
9. Increased and better upland, riparian and aquatic habitat for threatened, endangered, and sensitive species, big game and other species,
10. Reduced number, size and influence of existing noxious weed populations, including white top, musk thistle, Scotch thistle, Canada thistle, and knapweeds, and the reduced incidents of new infestations,
11. Recreational use along Soldier Creek and its tributaries will provide a quality experience due to habitat improvement, landowner cooperation, improved public access and enhanced area aesthetics,
12. Resource-based recommendations to the Wasatch and Utah County planning commissioners will help local leaders to make better informed development decisions,
13. Cooperative working relationships based on a common interest to improve natural resource conditions among individuals, groups and agencies will increase, and
14. Competent network of funding opportunities and partnerships, and the consistent submission of grant proposals to adequately fund the prescribed projects.

In 2001 an intense summer thunderstorm incurred unexpected costs and reduced pasture production along Lake Fork.

COSTS

The estimated total cost of projects and management strategies recommended to fully implement this CRM plan is $4,998,200. This level of funding, coming from a variety of sources is needed to generate all of the benefits discussed in this plan.

PREFACE

Thanks to the many individuals representing private interests and federal, state and local government agencies which have cooperated to bring this document to completion. Under the leadership of the Timp-Nebo Soil Conservation District (SCD), the members of the Spanish Fork River Watershed steering committee have provided technical assistance, editorial support, data collection, data analysis, and report preparation in support of this plan.

The intent of this coordinated resource management plan (CRMP) is to provide a framework for watershed planning including the identification of resource problems, objectives and opportunities. The CRMP also provides direction and guidance for the development of individual cooperator conservation plans. Conservation plans identify problems specific to a cooperator's land and prescribe appropriate best management practices (BMPs) to achieve better water quality and agricultural results.

Treatment of this watershed will help the State of Utah to achieve its water quality improvement goals. Sponsors of this project expect Soldier Creek to meet State Water Quality Standards and support its beneficial uses. They also expect:

- More and improved fish habitat,
- Increased fish production,
- More and improved riparian and wetland habitat for game species and other species of concern,
- Reduced soil erosion rates,
- Decreased sediment and phosphorous loads,
- Healthier upland vegetation and more productive habitat,
- Increased forage availability for livestock and wildlife,
- Improved pasture production and management,
- Enhanced recreation opportunities,
- Improved aesthetic values,
- Viable agricultural enterprises,
- Increased and better quality upland habitat for species of concern, and
- More and improved habitat for threatened, endangered and sensitive species.

State and federal agencies, local units of government, landowners, special interest groups and donations will fund this work.

AUTHORITY

WATERSHED PLANNING

Utah State Law 17-83 (Utah State Code, 1999) authorizes SCDs to provide leadership for the planning and implementation of measures to prevent soil erosion, flood or sediment damage, and non-point source pollution, with landowner consent. The law specifies this process may be achieved by developing cooperative agreements, providing conservation planning assistance, implementing projects, distributing educational materials, developing demonstration projects, and by providing technical assistance.

In 1989, a memorandum of understanding was signed by 10 federal and state agencies with the State of Utah that set the stage for natural resource management coordination (Utah Coordinated Resource Management and Planning Executive Council and Task Group, 1989). This agreement established a foundation

Sponsored by the local work group, the 2002 tour of the sub-watershed looked at areas of concern and discussed possible solutions.

for cooperation between signatory agencies to share information for natural resource planning. It also provides guidelines for coordinated resource management planning within the state.

In 1997 the Timp-Nebo SCD, with the help of the Natural Resources Conservation Service (NRCS), agreed to establish a local working group for the Spanish Fork River Watershed. During the public meeting held to organize the Spanish Fork River Watershed team, it was decided to develop individual CRMP for each of the six sub-watersheds. Thistle Creek Sub-watershed CRMP encompassing 138,401 acres was the first developed, and a draft completed in 2001. Soldier Creek Sub-watershed CRMP, covering 150,751 acres, is the second plan to be developed, with completion slated for 2003. These CRMPs are just two of the many achievements of this local working group. Coordinated resource management in the Spanish Fork River watershed continues to progress under the Timp-Nebo SCD's leadership.

The inter-agency team planning the Dairy Fork channel inventory.

WATER QUALITY

In 1996 Soldier Creek was listed on the Division of Water Quality, Utah Department of Environmental Quality's 303(d) list of impaired waterbodies. It remains on the State's 303(d) list due to excessive sediment and phosphorous.

Section 319 of the Federal Clean Water Act of 1972 established provisions to control non-point sources of pollution. Non-point source pollution is usually associated with surface run-off from storms and snowmelt, where a definite point of entry into a stream system is not easily identified.

Through the Clean Water Act, Congress requires every state to prepare two reports on non-point source pollution impacts on all waterbodies. The first report is an assessment prepared by the Division of Water Quality in the Department of Environmental Quality. The second is prepared by the Utah Department of Agriculture and Food, and is a management plan for improving and maintaining water quality that may be affected by non-point sources of pollution. The Soldier Creek sub-watershed CRMP is written in support of these requirements of the Clean Water Act.

INTRODUCTION

BACKGROUND ON THE COORDINATED RESOURCE MANAGEMENT PLAN

In 1997 the Timp-Nebo Soil Conservation District (SCD) and Natural Resources Conservation Service (NRCS) organized a local working group to determine the most urgent natural resource concerns within Utah County. A diverse group of individuals, organizations and agencies worked together to pinpoint the top issues.

The group identified the Spanish Fork River watershed as its primary concern based upon water quality issues. Within months work began on the Spanish Fork River watershed coordinated resource management plan (CRMP).

They soon realized that the watershed's size and diversity made the development of one, all-encompassing CRMP a daunting task. By breaking the watershed into its six sub-watersheds and tackling each sub-watershed individually, the task became more manageable.

In spring 2001, a draft CRMP for Thistle Creek sub-watershed was completed. Under the direction of this plan, four miles of stream have been restored to their natural function, nearly 400 acres of uplands are slated for treatment, 68 acres of improved irrigation management were implemented and two animal feeding operations were brought into compliance with the Clean Water Act. These are only a handful of projects proposed under the Thistle Creek sub-watershed CRMP, and already changes in water quality are apparent.

Now the local working group is developing the Soldier Creek sub-watershed CRMP. Much like Thistle Creek, Soldier Creek is located at the headwaters of the Spanish Fork River watershed. Any improvements to this sub-watershed will directly affect the local and downstream water users as well as the water quality in Utah Lake.

CRITICAL ISSUE – WATER QUALITY

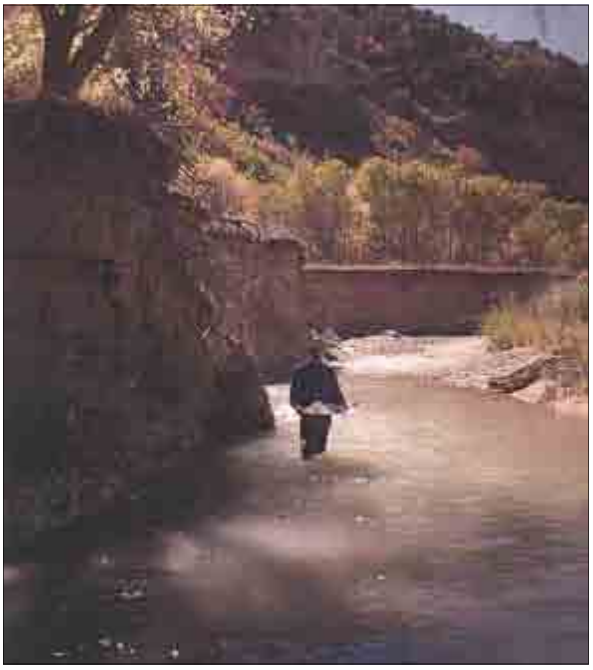
Water quality is the most critical natural resource concern in the Soldier Creek sub-watershed. Too much sediment and phosphorous are negatively affecting Soldier Creek's water quality and beneficial uses.

While some sediment and phosphorous in the water are natural, too much can degrade aquatic habitat, inhibit fish reproduction and even change the character of the stream channel. A heavy sediment load is also indicative of problems in riparian and upland habitats.

The number one source of sediment and phosphorous to Soldier Creek is upland soil erosion. Where poor condition vegetation exists, soil loss is accelerated, especially during snowmelt and summer thunderstorms.

Highly erosive soils are common in mid– and upper Soldier Creek. Derived from Green River formation parent material, these soils tend to be saline and are often located on steep slopes. These factors coupled with their highly erosive nature make vegetation establishment difficult and soil movement likely.

Upland condition was inventoried by an inter-agency team during the summer of 2001. Using the Pacific Southwest Inter-Agency



Unstable, vertical streambanks are one of the major sources of sediment in Soldier Creek.

Committee (PSIAC) method of estimating upland soil erosion along with existing soil surveys, sediment entering the stream system from this source was estimated at 142,300 tons annually. Erosion rates range from 161 tons per acre to .24 tons per acre, with one third of the sub-watershed with erosion rates over 1.5 tons per acre.

The second leading source of sediment is streambank instability. Sheer, poorly vegetated streambanks actively erode and perpetuate a continuum of unstable banks. The most unstable areas of the Soldier Creek channel are associated with culverts and bank armoring to protecting transportation right-of-ways. Along the tributary channels, unstable channels are associated with high flows of 1983 and concentrated flows due to roads.

In the summer of 2001, an inter-agency team inventoried Soldier Creek and its tributaries for streambank stability using the Ventura method (NRCS, 1983). It was found streambanks contribute 60,800 tons of sediment to the channel annually. Erosion rates ranged from over 4,000 tons per mile to 18 tons per mile.

Roads also affect water quality. Road cuts as well as paved and unpaved surfaces contribute to accelerated soil erosion. Whether by concentrating runoff or due to road cuts with inadequate vegetation protection, it is estimated that roads contribute 40,000 tons of sediment to the stream system annually.

Road crossings, such as this one on Tie Fork, contribute sediment to the stream system.

WATER QUALITY ISSUE RESOLUTION-TOTAL MAXIMUM DAILY LOAD

The State of Utah requires that total maximum daily loads (TMDLs) be prepared for all water quality impaired waterbodies. A TMDL is the acceptable limit of a pollutant in a waterbody, that does not interfere with that water's beneficial uses.

Soldier Creek was listed on the State's 303 (d) List of Water Quality Impaired Waters in 1996 and was scheduled for TMDL development. Because this CRMP has been developed with the specific purpose of improving Soldier Creek water quality, a TMDL will be developed to coincide with the completion of this plan. The TMDL will be written when the associated water quality data becomes available.

The primary pollutants of concern are sediment and phosphorous. Sediment is difficult to measure accurately because its delivery is highly erratic. Phosphorous tied to sediment is likewise highly erratic. High water events carry disproportionately more sediment and phosphorous than standard or low flows. Continuous in-stream monitoring is needed to capture the full array of sediment and phosphorous loads, but this intensity of data collection is generally too expensive and impractical.

In lieu of intensive in-stream data, estimates of sediment and phosphorous delivery to Soldier Creek were determined by sampling the major sources of sediment and phosphorous, including upland soil erosion and streambank instability. Sediment and phosphorous reduction can be measured by the effects of applying best management practices (BMP) to eroding areas.

The following objectives will be used to estimate sediment reduction and assess the resultant water quality improvements in Soldier Creek:

1. To protect and stabilize at least 21 miles of eroding streambanks by applying BMPs that will result in a 11,000 tons/year reduction of soil loss within ten years of the CRMP im-

plementation.

2. To restore the natural function (dimension, pattern and profile) to 14 miles of stream corridor within ten years of the CRMP implementation.
3. To improve fish habitat on at least 14 miles of stream by increasing protective habitat cover by 15% and reducing eroding banks by at least 10%, resulting in 118 pounds/ acre of trout biomass, within ten years of the CRM plan implementation.
4. To reduce sediment coming from the uplands by 5,000 tons/year by applying BMPs on 16,000 acres of rangelands within five years of complete plan implementation.
5. To reduce the influence of noxious weeds infestations within ten years of complete plan implementation.
6. To increase coordination with the various land owners and land management agencies to minimize potential conflicts and resource damage as transportation and recreation demands increase over the next 10 years.
7. To actively promote coordination between CRMP partners, including seeking team review of proposed actions that could affect Soldier Creek sub-watershed resources.
8. To provide recommendations regarding natural resources and development to the Utah and Wasatch County planning commissions, as needed, throughout the planning and implementation phases of this CRMP.
9. To organize local individuals and groups into action committees, provide guidance to keep committees functional, and provide technical assistance to plan and implement BMPs to resolve natural resource problems throughout the development and implementation of this plan.
10. To continue to seek outside funding to bring about the greatest improvement to the watershed through landowner, agency and public cooperation throughout the development and implementation of this plan.

This CRMP prescribes a voluntary course of

The CRMP depends upon voluntary projects, such as this one on Soldier Creek, to improve water quality.

DESCRIPTION OF THE SUB-WATERSHED

LOCATION

Soldier Creek sub-watershed is located 21 miles southeast of Provo, in eastern Utah County (see Appendix A, Map 1). Soldier Creek flows west through Spanish Fork Canyon, sharing the narrow valley floor with Highway 6 and the tracks of the Union Pacific Railroad and Utah Railway Company.

The sub-watershed lies within the Wasatch Mountains, comprising the eastern headwaters of the Spanish Fork River watershed. Soldier Creek sub-watershed spans from Soldier Summit at 7,440 feet in elevation to its confluence with Thistle Creek at 5,100 feet. The highest peak is , at 8,500 feet. The sub-watershed is about 24 miles long and 17 miles wide, encompassing 150,751 acres of mixed ownership lands.

PHYSICAL ENVIRONMENT

TERRAIN

Within the Spanish Fork River watershed, Soldier Creek sub-watershed boasts the steepest terrain. Only 6% of the sub-watershed has slopes of 10% or less. Slopes of 20% or greater are found on 74% of the area. Rock outcrops are common along the main canyon and tributary channels. See Table 1 below for a summary of slopes within the sub-watershed.

SOILS

Soil survey information is available for the Uinta and Manti-LaSal National Forests, which encompasses the upper elevations of the sub-watershed. These surveys indicate that highly erosive soils are common due to the pervasive presence of the Green River formation. As parent material Green River formation produces excessively erosive, saline soils making establishment difficult for most plants. As a result, these soils tend to be sparsely vegetated. The combination of steep slopes, poor vegetation cover and highly erosive soils makes soil erosion a serious concern for these sites.

Sheet and gully soil erosion are by far the largest sources of sediment to Soldier Creek. Soil erosion rates in the sub-watershed range from .24 tons per acre to 161 tons per acre. About one third of the sub-watershed soils have moderately high to very high erosion rates, ranging up from 1.6 tons per acre.

Steep slopes and rocky outcrops are common in the sub-watershed.

These estimates were derived from the soil surveys and an interagency Pacific Southwest Inter-Agency Committee (PSIAC, 1968) inventory completed in 2001. The highest potential for soil erosion occurs during snowmelt and isolated summer thunderstorms. Table 2 shows a summary of erosion rates and the affected acres for the sub-watershed.

DWR has 8 permanent vegetation monitoring sites where soil data is also collected in the Soldier Creek area (see Appendix A, Map 2). In 1997 the amount of bare ground at these sites ranged from 9 to 44%, indicating that some sites may lack adequate vegetative cover. Soil condition was generally acceptable, but on at least two sites, soil condition was identified

TABLE 1. Soldier Creek sub-watershed by % slope and acres

% Slope	Acres	% of Sub-watershed
0-10	9,325	6
10-20	30,379	20
20-40	66,190	44
40+	44,865	30

TABLE 2. Erosion rates by acre and percent of sub-watershed

Erosion Rate (tons/acre)	Acres	% of Sub-watershed
Low (.6 and below)	7,144	5
Moderate (.7 – 1.5)	92,806	62
Moderately high (1.6 — 2.97)	16,635	11
High (2.98 — 8.7)	29,165	19
Very high (8.8+)	5,001	3

WATER

From its headwaters to its confluence with the Spanish Fork River, Soldier Creek is 27 miles long (Unita National Forest, 1998). The Soldier Creek stream system includes nine perennial tributaries, including Lake Fork, Dairy Fork, Mill Fork, Clear Creek, Bennion Creek, Starvation Creek, Indian Creek, Tie Fork and Sheep Creek. The entire stream system is comprised of 133 miles of perennial and 349 miles of intermittent streams.

Division of Water Quality has nine permanent sampling stations within the Soldier Creek stream system(see Appendix A, Map 2). At these sites extensive water quality data is collected every 5 years. Through the use of this data two pollutants of concern have been identified for Soldier Creek; excessive sediment and excessive phosphorous.

The presence of phosphorous is directly tied to sediment load. Water quality data shows a direct relationship between the presence and quantity of phosphorous to that of sediment (Wham, D. 2002). Further, there are no known independent sources of phosphorous, such as sewage treatment outlets or animal feedlots, on the stream system.

Water quality data from Dairy Fork and Sheep Creek indicate that these two tributaries consistently carry excessive amounts of sediment and phosphorous into Soldier Creek. The widespread presence of Green River Shale in the area, results in the excessive sediment yield of these two tributaries.

Soldier Creek flows are not measured directly. There is a gaging station seven miles downstream at Castilla which provides an indicator of the relative volume of seasonal flows. Data has been collected at Castilla since 1920 for the Spanish Fork River, which includes Soldier Creek, Thistle Creek and Diamond Fork. Data from 1997 through 2001 provided the following information on flows (Jordan River Basin, Castilla Gaging Station, 1997-2001).

May is the month of highest runoff. Since 1997, the highest recorded runoff was 1,090 cubic feet per second in 1998. The lowest flow during that period was 193 cubic feet per second in 2001. The highest flow ever recorded was 5,000 cubic feet per second in May 1984.

December is the month of lowest flows. Since 1997, the lowest flow was 52 cubic feet per second recorded in 2001. The highest December flow during this time was 148 cubic feet per second in 1999. The lowest flow ever recorded was 20 cubic feet per second in 1951. Table 3 shows a summary of flow data for these two months for the years 1997 through 2001.

In addition to the normal seasonal fluctuations, intense, localized summer thunderstorms also affect stream flow. These events are unpredictable, but can have a major impact on the local stream channel and sediment load (Mendenhall, J., 2003).

TABLE 3. December and May flow data for years 1997 through 2001

Year	December ($ft.^2/sec.$)			May ($ft.^3/sec.$)		
	Max.	Min.	Mean	Max.	Min.	Mean
1997	146	74	106	1,060	544	839
1998	144	85	101	1,090	637	866
1999	148	95	131	691	211	458
2000	89	62	79	464	199	311
2001	71	52	64	446	193	298

CLIMATE

Long-term climate data, collected at nearby Birdseye and the Spanish Fork Power House indicate that the average precipitation is 15 to 21 inches annually. The majority of precipitation comes during the fall and winter months, with an average snowfall of 54 to 72 inches. One inch of snow on the ground usually last from 31 to 69 days. Isolated summer thunderstorms are common and can be fierce.

BIOLOGICAL ENVIRONMENT

THREATENED, ENDANGERED & SENSITIVE SPECIES

Ten threatened, endangered or sensitive plant or wildlife species currently occupy or historically occupied habitat within the Soldier Creek sub-watershed. Eight species are exclusively dependent upon aquatic or riparian habitat, including three species of cold water fish. See Table 4 for a summary of these species.

Ute ladies'-tresses is a federally listed threatened plant species found within the sub-watershed.

AQUATIC LIFE

The Division of Wildlife Resources (DWR) manages Soldier Creek and its tributaries for self-sustaining wild fish populations (Slater, 2003). The lower Soldier Creek is managed for intensive yields, which includes stocked, catchable fish. Native fish found in these waters include Bonneville cutthroat trout (*Oncorhynchus clarki utah*), mottled sculpin (*Cottus bairdi*), mountain sucker (*Catostomus platyrhynchus*), leatherside chub (*Gila copei*), and longnose dace (*Rhinichthys cataractae*). Non-natives found and managed for in Soldier Creek and its tributaries include an occasional rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*).

Class III waters are the highest stream class found within the sub-watershed and comprise 35 stream miles. Tie Fork, Clear Creek, Bennion Creek and lower Soldier Creek are Class III waters, providing important fisheries that can withstand most fishing pressure. Non-native fish are found in all of these waters, except Bennion Creek.

Class IV waters have limited fishery value, but may support native fish. In the sub-watershed 41 stream miles of Class IV waters exists. These waters include upper Soldier Creek, upper Lake Fork, Mill Fork, Mine Hollow and Indian Creek.

One mile of Class VI stream is located within Soldier Creek sub-watershed on lower Lake Fork. This segment of stream is de-watered for a significant part of the year.

Two State-listed sensitive fish species are known to inhabit the sub-watershed: Bonneville cutthroat trout and leatherside chub. In addition, the lower Spanish Fork River is believed to have once supported June sucker (*Chasmistes liorus*), a federally listed endangered species.

WILDLIFE

Within the sub-watershed, DWR manages over 14,000 acres, in three wildlife management units; Lake Fork, Dairy Fork and Starvation Canyon. Management objectives for these units are to provide big game winter range in adequate quantity and quality for manageable wildlife demands (Ogborn & Sakaguchi, 2001).

The sub-watershed provides important habitat for several managed wildlife species. Nearly

TABLE 3. Threatened, endangered and sensitive species in the sub-watershed

Common Name	Special Status	Aquatic/Riparian Dependent	Reason for Protection
— W I L D L I F E —			
Bald eagle	Threatened	YES	Likely to be de-listed
Bonneville cutthroat trout	Sensitive	YES	Declining populations & limited distribution
June sucker[1]	Endangered	YES	Declining populations
Leatherside chub	Sensitive	YES	Declining populations
Northern goshawk	Sensitive	YES	Declining populations
Osprey	Sensitive	YES	Limited distribution
Western boreal toad	Sensitive	YES	Declining populations
— P L A N T S —			
Clay phacelia	Endangered	NO	Extremely rare, vulnerable to extinction
Fireleaf beardtongue	Sensitive	NO	Rare, restricted range
Ute ladies'-tresses	Threatened	YES	Extremely rare, vulnerable to extinction

[1] June sucker is believed to have historically occupied habitat in the lower Spanish Fork River. The extent of its natural habitat is not known, however, existing barriers and poor habitat currently prohibit June sucker expansion into Soldier Creek.

75% of the sub-watershed is considered critical elk winter range, and 43% is critical mule deer winter range. At this time, populations of both elk and mule deer are considered stable (Ogborn & Sakaguchi, 2001).

Moose, black bear and mountain lion are found throughout the sub-watershed, with ranges extending beyond its boundaries. Bald eagle and osprey seasonally utilize habitat near the stream channels. Northern goshawk occupy habitat in the upper elevation expanses of coniferous forest. Turkeys have been introduced in the lower elevations and are successfully expanding their range.

The loss or modification of habitat is the most significant problem facing sub-watershed wildlife. Another significant problem is the human safety and wildlife casualty attributed to Highway 6 and the railroads, which create barriers for migrating animals.

VEGETATION

Vegetation data from Utah State's Automated Geographic Reference Center (AGRC) indicates that the sub-watershed dominant plant communities are 59% maple, 23% juniper, 17% aspen, and 1% mountain mahogany (Utah Department of Administrative Services, 1999).

Maple communities are found between the elevations of 5,100 to 9,000 feet. With a shrub component of 40% and perennial grass of 30%, the potential natural community can provide good to fair habitat for big game. The tree component is primarily juniper and maple, which averages 8 feet in height (NRCS Field Office Technical Guide, 1993).

The community dominated by aspen is located between 7,000 and 9,000 feet in elevation. Trees comprise 10% of the potential natural community and their average height is 30

Maple, juniper, aspen and mountain mahogany are the major plant communities in the sub-watershed.

feet. Perennial grasses make up 45% of this community (NRCS Field Office Technical Guide, 1993).

Mountain mahogany community comprises only 1% of the sub-watershed. This community is found between 5,200 to 8700 feet in elevation. The potential natural community has a shrub component of 60% and a perennial grass component of 35%. There are no trees in this community, but the average shrub height is 9 feet (NRCS Field Office Technical Guide, 1993).

Utah juniper communities are found between 5,500 to 7,000 feet in elevation. The potential natural community is comprised of 50% perennial grasses, 25% shrubs and 15% juniper (NRCS Field Office Technical Guide, 1993).

Within the last 150 years junipers have increased in number and density, as the presence of understory plants has declined. This vegetation trend is, in part, responsible for the high soil erosion rate associated with these communities. Studies done in upper Spanish Fork Canyon, within the Soldier Creek sub-watershed, found unchained juniper sites yield five (5) times more run-off than chained and reseeded juniper sites. Unchained sites yielded eight (8) times more sediment than did the chained sites (Farmer, M., 1995).

The riparian communities along Soldier Creek and its tributaries are generally lined with willows or cottonwoods. In areas of unstable banks, these communities have been lost or seriously depleted. Restoration of these sites with deep-rooted, soil-binding woody species is an important component of stabilizing streambanks (Hoag, J.C., et. al, 2001). In addition, although comprising a very small portion of the total vegetation in the sub-watershed, riparian communities are disproportionately important

TABLE 5. Land ownership by # of acres and % of sub-watershed

Land Owner or Manager	Total Acres	% of Sub-watershed
Private land	**30,749**	20
Division of Wildlife Resources	Starvation WMA_1 = 8,137 Dairy Fork WMA_1 = 5,319 Lake Fork WMA_1 = 1,280 TOTAL = **14,736**	10
Other State lands	**1,280**	1
Bureau of Land Management	**1,833**	1
Forest Service	Manti-LaSal National Forest = 58,757 Uinta National Forest = 43,396 TOTAL = **102,153**	68
TOTAL	**150,751**	100

$_1$ WMA = Wildlife Management Area

for the wildlife habitat they provide.

HUMAN ENVIRONMENT

LAND OWNERSHIP

The predominant landowner in this sub-watershed is the federal government. Almost 70% is under the management of the Manti-LaSal and Uinta National Forests. These lands are managed for multiple uses including water quality, aesthetic values, recreation, livestock grazing, and wildlife habitat.

DWR manages 10% of the lands within the sub-watershed. These lands consist of three wildlife management units; Starvation Creek, Dairy Fork, and Lake Fork. The management goals for these lands are to improve or maintain big game habitat for the appropriate number of animals.

The remaining 20% of the land is privately owned. The majority of these lands are found within a mile or two of Soldier Creek, with a large tract of private lands in the Starvation Creek area. Table 5 shows a summary of land-ownership for the sub-watershed.

LAND USE

Recreation, transportation, development, livestock grazing and wildlife habitat are the primary land uses in the area. The only known irrigated agricultural land is located up Lake Fork and comprises less than 1,000 acres.

With nearly 80% of the sub-watershed under federal or state land management, recreation is a widespread land use. Common recreation activities in the area include hunting, camping, fishing, ATV riding, horseback riding and sightseeing. Several privately owned campgrounds are scattered the length of the sub-watershed.

Transportation is another important land use in the sub-watershed. Spanish Fork Canyon has served as a major east to west artery through the state since pre-European settlement. In 1776, Fathers Silvestre Velez de Escalante and Francisco Antanasio de Dominguez led the first documented European expedition through the canyon. In search of a route from New Mexico to California, they traveled from Strawberry Valley down Diamond Fork and into Spanish Fork Canyon (USDA Uinta National Forest, 1997).

Highway 6 is an important transportation corridor through Spanish Fork Canyon.

Today there are 568 miles of road in Soldier Creek, including Highway 6, Ray's Valley Road and Skyline Drive. Utah Division of Transportation is working to improve safety on Highway 6 and to widen the road where practical. The vast majority of roads within the area are unpaved.

Utah Railway Company and Union Pacific Railroad continue to be an important presence in the canyon. Hauling materials along Soldier Creek since before 1912, Utah Railway Company now works with Union Pacific Railroad to transport goods through the canyon (Utah Railway Company, 2002). Today the railroad moves coal daily from Carbon County to the Delta power plant and Salt Lake City.

Residential development is not a major land use within the canyon at this time. A few summer homes are scattered along the stream corridor, the area's remoteness suppresses accelerated interest in development.

Elected officials have expressed concern about the effects of development on natural

resources, including water quality. To attempt to reduce these impacts Utah County Zoning Ordinances require residential lots to be at least 20 acres in size (Utah County, 2000).

Livestock grazing and wildlife habitat are uses that can and do occur on most of the sub-watershed acres.

Loading chutes and corrals facilitate livestock grazing in the sub-watershed.

List of Major Problems/Issues/Opportunities

Affected Environment

Water quality is the most important natural resource problem in the Soldier Creek sub-watershed. Excessive sediment and phosphorous entering the stream negatively affect water quality and its beneficial uses. Because water quality data indicates that phosphorous is directly linked to sediment, sediment is the pollutant of greatest concern.

Upland soil erosion and stream channel instability are the major contributors of sediment to Soldier Creek. These sources can come from natural or human-induced events, including landslides, certain agricultural practices, undesirable grazing management, roads, recreation activities and development.

This plan focuses on those sources of soil erosion that are the most economically feasible and practical to treat. These sources are:

- Upland range and wildlife habitat,
- Unstable stream banks, stream corridors and riparian areas,
- Roads,
- Agricultural lands, and
- Noxious weeds.

Secondary sediment sources were also identified as having potential to affect or be affected by water quality. These secondary sources include:

- Recreation,
- Housing and other development

In this chapter all of the sources of sediment identified above are briefly discussed.

Upland Range and Wildlife Habitat

In the summer of 2001 an interdisciplinary team inventoried the Soldier Creek sub-watershed uplands for soil erosion potential. Pacific Southwest Inter-Agency Committee (PSIAC) methodology was used to estimate soil erosion rates on selected sites (PSIAC, 1968). PSIAC data and Uinta and Manti-La Sal National Forest soil surveys were blended to estimate a total annual soil loss of 142,300 tons sediment, entering the stream channel from the uplands. Erosion rates range from .24 tons per acre to 161 tons per acre.

The majority of the sub-watershed falls into the category of upland. These lands are primarily used as habitat for big game and other wildlife, and as rangeland by domestic livestock. Historically improper grazing and other practices have caused a decline in the condition of upland vegetation. This decline is demonstrated by a loss of understory perennial grasses and broad-leafed plants and an increase in size and number of overstory shrubs and trees. Because understory plants perform the important role of holding soil in place, their decline in the plant community accelerates soil loss. Soil erosion potential increases with the characteristic steep slopes and highly erosive soils of this sub-watershed.

This upland soil erosion occurred during a summer thunderstorm on Clear Creek.

The Division of Wildlife Resources (DWR) has 8 permanent monitoring sites for vegetation and soil condition in the sub-watershed (DWR, 1999). Data from these sites show the existing plant communities tend to lack adequate peren-

nial grass and broad-leafed plants. Data further indicates the numbers of these plants are not significantly increasing or decreasing in the community.

Overall shrub or browse component trend was stable. There were some indicators of undesirable conditions in the plant communities, including the absence of adequate forage plants. This, coupled with too many mature shrubs and too few young shrubs could indicate a problem, including excessive soil exposure and possible erosion.

DWR monitoring found soil conditions were generally stable, but with less plant cover than is desirable. Bare soil ranged from 19 to 44 percent. Some sites show signs of past severe gully erosion, but this level of erosion is not occurring under the current conditions.

Much of the uplands are critical big game winter range for elk and mule deer. This habitat spans federal, state and private land boundaries, providing an opportunity for muliple land owners to work together to benefit wildlife.

Improvements to winter range also reduce upland soil erosion and sediment in the stream. By increasing understory forage plants, and the regeneration of shrubs and soil cover, upland production will improve, resulting in a decline of sediment transport into the stream system.

Unstable Streambanks and Riparian areas

In 2001, an inter-agency team completed an inventory of stream bank erosion using the Ventura method (Natural Resources Conservation Service, 1983) for Soldier Creek and its tributaries. The inventory identified unstable stream channel reaches, estimated the amount of sediment coming from those reaches and provided an estimate of total soil loss from the entire stream system. The estimated total annual loss of soil from streams in the Soldier Creek subwatershed is 60,800 tons.

Soil loss varied along the 133 miles of perennial stream channel sampled. Each sampled site had a unique erosion rate and potential for sediment reduction. These rates were averaged by stream or stream segment as shown in Table 6.

Upper Soldier Creek, from Tucker Rest Stop east to Soldier Summit, shows the worst erosion rate, with over 4,400 tons per mile per year. This 7-mile stretch contributes over ½ of the estimated total annual sediment per year for the creek. In these reaches, high sediment yield is largely due to gullies 20 to 30 feet deep associated with culverts. The culverts were installed to divert runoff away from the railroad tracks and Highway 6. However, when storm water collects in these culverts, the force of the water actively erodes at the outlet, forming gullies. The sediment contribution of these gullies is sporadic, but extreme.

A ½ mile reach of an ephemeral tributary to Sheep Creek is another area with an extremely high erosion rate. This short reach was estimated to contribute sediment exceeding 2,000 tons per mile per year to Sheep Creek. This short reach is characterized by 30-foot, highly erosive slopes, lacking vegetation cover. While the sediment contribution of this gully is sporadic, erosion is extreme when it is active.

Most of the remaining streams inventoried had erosion rates ranging from 100 to 475 tons per mile per year. Streambank loss is greatest in the early spring during highest run off during snowmelt. The runoff from summer thunderstorms can also overwhelm a stream system and increase the risk of bank loss.

The lowest stream bank erosion rates were also found along Soldier Creek. Approximately 6 ½ miles of the channel were extremely well armored with dense stands of coyote willow and appeared to be functioning well. Erosion rate

Highway 6 culverts have affected Soldier Creek channel stability.

for these stream reaches were estimated at 18 tons per mile per year.

Streams and their associated habitats are critical to wildlife, while providing a myriad of human values. Streams are the primary source of water for many wildlife species. They provide habitat for aquatic species including fish and their major food source, macro-invertebrates. In addition, the riparian corridor along the stream provides one of the richest, most diverse habitats available to wildlife in the area. There are opportunities for multiple land owners to work together to improve critical riparian and aquatic habitat. The benefits from these actions include cleaner water, more and better fish habitat, more and better riparian habitat, and overall better watershed health.

TRANSPORTATION

There are 568 miles of road within the sub-watershed, occupying at least 1,583 acres. The vast majority of these roads are not paved. Roads are areas of higher soil erosion potential in part due to the presence of denuded road cuts, and due to the concentration of runoff on road surfaces and through culverts.

Using the Uinta National Forest soil survey data it was estimated that nearly 40,000 tons of soil enters Solider Creek or its tributaries from roads (Uinta National Forest, 2001). Estimated

TABLE 6. Average stream erosion rate with miles applied and total annual sediment yield

Stream Name	Number of Miles Applied	Erosion Rate (Tons/Mile)	Total Sediment/Year (Tons/Year)
Clear Creek	14.7	156	2,293
Dairy Fork (lower)	2	97	194
Dairy Fork (upper)	3.2	375	1,200
Indian Creek[1]	2.5	108	270
Lake Fork (lower)	2.7	42	113
Lake Fork (upper)	29	225	6,525
Mill Creek[2]	10.3	375	3,862
Sheep Creek (main channel)	5.2	268	1,394
Sheep Creek (tributaries)	.5	2,079	1,040
Soldier Creek (upper w/culvert gullies)	7	4,400	30,800
Soldier Creek (upper)	1.6	298	477
Soldier Creek (middle)	6.4	18	115
Soldier Creek (lower)	11.6	369	4,280
Starvation Creek (upper)	15.8	309	4,882
Starvation Creek (lower)	3.4	475	1,615
Tie Fork	17.1	108	1,747
TOTAL	133	—	60,807

[1] Indian Creek was not surveyed. Erosion rates from nearby Tie Fork were applied for this estimate.
[2] Mill Fork was not surveyed. Erosion rates from nearby Dairy Fork were applied for this estimate.

Union Pacific Railroad transports coal daily from Carbon County to Delta and Salt Lake City, through Spanish Fork Canyon.

soil loss from roads averaged 9 tons per acre and could be as high as 32 tons per acre annually.

In some ways transportation systems have contributed to the stream channel instability concerns. Soldier Creek, Highway 6 and the railroad all occupy the narrow valley bottom of Spanish Fork Canyon. Conflicts arise because dynamic natural features are situated next to static human-made features.

In the past, when the highway or railroad was threatened by streambank erosion, those portions of the channel were armored. This tended to protect the newly armored bank, while moving the erosion problem downstream. There is a need to provide safe, well-maintained roads and railroads, while reducing overall streambank instability.

Other resource concerns are related to culverts. Culverts are intended to transport runoff under roads and railroads. Because they concentrate flows, if not properly installed culverts can create erosion problems at their outlet. Several such problems have been identified in the upper part of the sub-watershed on the south side of Highway 6. When active, the estimated sediment from these culverts can range from 300 to 4,300 tons per mile.

There is opportunity to work with Utah Department of Transportation, Utah Railway Company and Union Pacific Railroad and other landowners to improve watershed health. Areas of concern have been identified and tentative plans to work together to mend problem areas have been discussed. Expected outcomes will include cleaner water, more and better aquatic habitat, healthier upland plant communities, and more and better riparian habitat.

AGRICULTURAL LANDS

There are about 500 acres in irrigated pastures within the sub-watershed. Some agricultural practices can contribute excessively high soil erosion rates to stream, but no such practices have been identified in this area. Most of these lands have erosion rates that range from .6 to 2 tons per acre annually. Each year an estimated 950 tons per of soil moves off site.

There is opportunity to work with private landowners to implement conservation practices that would further reduce soil loss. Benefits of this would include increased pasture production, cleaner water and improved aquatic habitat.

NOXIOUS & INVASIVE WEEDS

Noxious & invasive weeds are aggressive, undesirable plants that can out-compete native species. These weeds tend to be less palatable than native plants, so infestations result a decline in available forage for wildlife and livestock. In addition, noxious weed infestations increase upland soil erosion as they overtake and decrease the productivity of natural plant communities.

The Spanish Fork River Watershed works with a coordinated weed management area (CWMA) that has aggressively been treating noxious weeds across different land ownership

TABLE 7. Noxious Weeds present, their treatment priority and status in the sub-watershed.

Treatment Priority	Noxious Weed	Sub-watershed Status
1	Dyer's woad	No change
2	Diffuse knapweed	No change
2	Squarrose knapweed	No change
3	Scotch thistle	Increasing
4	Musk thistle	Decreasing
5	Whitetop	No change
6	Canada thistle	No change

This privately-owned campground on Sheep Creek caters to a growing recreation demand in the canyon.

since 1998. This includes a program of integrated pest management, using herbicides, biological agents and mechanical treatment, as appropriate. Approximately 5,000 acres of weeds are treated annually across private, county, state, and federal lands.

Opportunities for the cooperative treatment of noxious weeds are many. In addition to cleaner water and healthier habitats, cooperative treatment also means applying the most effective and cost efficient means of treating weeds.

RECREATION

Recreation is a major activity in the subwatershed, including hunting, fishing, camping, all-terrain vehicle use, mountain biking, horseback riding and hiking. The primary destinations are the Uinta and Manti-LaSal National Forests, Utah Division of Wildlife Resources lands, and privately owned campgrounds. Wildlife, abundant throughout the are, are an attraction for people traveling to or through the area. Highway 6 provides easy access to open space and trails from nearby urban areas.

As the population of Utah and Carbon Counties grow, the demand for recreational opportunities will likewise escalate. Interest in every kind of recreational opportunity is expected to increase.

There is an opportunity to work with private landowners to allow access for the recreating public. Access onto private land can create problems for private landowners and recreation users. Problems are most prevalent when property rights are not respected. There is also an opportunity to educate the public about respecting private property rights and responsibilities for its use.

In addition, there is an opportunity to work with state and federal land mangers to improve recreation opportunities within the subwatershed. These opportunities will help to improve water quality, improve habitats, and overall watershed health as recreation planning becomes more comprehensive.

DEVELOPMENT

Only 20 percent of the land within the subwatershed is privately owned. Some private lands are currently being promoted for residential development. Utah County officials have expressed concerns about development in the canyon. Through zoning ordinances the county has put restrictions on residential lot development, but these restrictions do not address cumulative effects on the watershed.

Natural resource concerns regarding development include soil suitability for septic systems, soil suitability for road construction, conservation of critical wildlife and/or plant habitat, emergency vehicle access and reducing fire hazards on developed lands adjacent to native plant communities.

Other developments may occur with the subwatershed. At the mouth of Dairy Fork, there is an active gravel pit. Operators have a permit with Utah County that includes a plan to restore the site in about five years. Top soil has been stockpiled on site and measures have been taken to reduce soil movement into Soldier Creek during storm runoff. With these measures in place, it does not appear that this development will negatively impact water quality.

There is an opportunity to work with Utah and Wasatch Counties to develop recommendations for development. These recommendations will be based upon the soil survey and professional knowledge of the area resources. Use of these recommendations would maintain or improve water quality, retain or improve habitat and would contribute to the overall health of the watershed. As mountain communities grow, there is opportunity to work with developers and homeowners to reduce the threat of wildfire losses through fire wise planning, and prevention.

Planning Goals and Objectives

The comprehensive goal of this plan is to achieve water quality standards that meet the criteria set for the designated beneficial uses for Soldier Creek. This goal and the following objectives address the reduction in sediment input into streams and the many residual benefits.

Objectives

1. To protect and stabilize at least 21 miles of eroding streambanks by applying best management practices (BMPs) that will result in a 11,000 ton/year reduction of soil loss within ten years of the CRMP implementation.
2. To restore the natural function (dimension, pattern and profile) to 14 miles of stream corridor within ten years of the CRMP implementation.
3. To improve fish habitat on at least 14 miles of stream by increasing protective habitat cover by 15% and reducing eroding banks by at least 10%, resulting in 118 pounds/acre of trout biomass, within ten years of the CRMP implementation.
4. To reduce sediment coming from the uplands by 5,000 tons/year by applying BMPs on 16,000 acres of rangelands within five years of complete plan implementation.
5. To reduce the influence of noxious weeds infestations within ten years of complete plan implementation.
6. To increase coordination with the various land owners and land management agencies to minimize potential conflicts and resource damage as transportation and recreation demands increase over the next 10 years.
7. To actively promote coordination between CRMP partners, including seeking team review of proposed actions that could affect Soldier Creek sub-watershed resources.
8. To provide recommendations regarding natural resources and development to the Utah and Wasatch County planning commissions, as needed, throughout the planning and implementation phases of this CRMP.
9. To organize local individuals and groups into action committees, provide guidance to keep committees functional, and provide technical assistance to plan and implement BMPs to resolve natural resource problems throughout the development and implementation of this plan.
10. To continue to seek outside funding to bring about the greatest improvement to the watershed through landowner, agency and public cooperation throughout the development and implementation of this plan.

Upper Lake Fork on the Manti-LaSal National Forest.

Achieving Plan Objectives

Action items to achieve each planning objective will be implemented through voluntary participation by developing conservation plans with individuals or groups of landowners. These

plans will be tailored to address the specific resource problems and opportunities that pertain to each particular property. Implementation of the conservation plan will result in improved water quality, increased agricultural production and other resource benefits. When outside funding is available, it can be used to assist private landowners and agency personnel to implement the conservation plan.

ACTION PLAN AND MONITORING PLAN

OBJECTIVE 1

To protect and stabilize at least 21 miles of eroding streambanks by applying best management practices (BMPs) that will result in a 11,000 ton/year reduction of soil loss within ten years of the CRM P implementation.

ACTION ITEMS:

1. Work with 10 or more landowners to improve management of riparian areas along 21 miles of perennial stream,
2. Widen or increase the effectiveness of the vegetation buffer between uplands and riparian areas along 21 miles of perennial stream, and
3. Develop conservation plans with 10 landowners to reduce the impacts of land uses on Soldier Creek and its tributaries.

MONITORING:

NRCS, Timp-Nebo SCD and DWR will take the lead in monitoring and working with land owners to develop plans that include BMPs (see Appendix D). The landowner and DWR will assist in tracking the number of stream miles improved. Monitoring of this objective will be achieved by

1) tracking the number of miles of stream restored and/or with improved management,
2) inventory streambank stability before and after project implementation, and
3) photo-monitoring, showing the site before and after project implementation.

COST:

Total costs to fully implement this objective are estimated to be $341,360. These costs are summarized in Table 8 below.

Over time this beaver dam on Tie Fork will help to heal the damaged channel.

TABLE 8. Estimated costs to fully implement Objective 1 for 10 years

Expense	Description	10-Year Cost Estimate
Project	Fencing, brush management, water development, seeding for 10 Landowners @ $32,000 ea.	$320,000
Technical Assistance	Prepare 10 conservation plans @ $1,600 ea.	$16,000
Monitoring	5 hours or $200 per year	$2,000
	Follow-up stream stability monitoring for 21 miles @ 4 hours/mile	$3,360
TOTAL		$341,360

OBJECTIVE 2

To restore the natural function (dimension, pattern and profile) to 14 miles of stream corridor within ten years of the CRMP implementation.

OBJECTIVE 3

To improve fish habitat on at least 14 miles of stream by increasing protective habitat cover by 15% and reducing eroding banks by at least 10%, resulting in 118 pounds/acre of trout biomass, within ten years of the CRMP implementation.

ACTION ITEMS:

4. Implement stream realignment and/or restoration on 14 miles of perennial stream,
5. Implementation of BMPs including, but not limited to the installation of stream structures and re-establishment of native riparian woody species along 14 miles of perennial stream,
6. Increase the acres of vegetation buffer between uplands and riparian areas along 14 miles of perennial stream,
7. Reduce suspended solids and deposition of silts and clays in Soldier Creek to levels similar to those found in the headwaters,
8. Implement riparian and aquatic habitat improvement projects to improve habitat for sensitive species as well as game species, and
9. Restore the quality and quantity of native non-game fish and game fish habitat through the implementation of BMPs.

MONITORING:

DWR has the primary responsibility for monitoring the effectiveness of Objectives 2 and 3, with NRCS and Timp-Nebo SCD providing assistance, as needed.

DWR will use an existing monitoring strategy called Habitat Quality Index (HQI), which they have been using within the Spanish Fork River Watershed for over 10 years. HQI provides information on aquatic and riparian habitat quantity, quality and fish production. Collected about every five years, HQI data will provide before and after information on fish production, habitat changes, and macro-invertebrate populations.

Independent of HQI data collection, Utah Valley State College will collect more detailed information on macro-invertebrate diversity and density.

COST:

Total costs to fully implement this objective are estimated to be $3,416,640. These costs are summarized in Table 9 below.

TABLE 9. Estimated costs to fully implement Objectives 2 & 3 for 10 years

Expense	Description	10-Year Cost Estimate
Project	14 miles of stream restoration @ $237,600/mile	$3,326,400
Technical Assistance	Prepare 10 conservation plans @ $1,600 ea.	$16,000
Monitoring	5 hours or $200 per year	$2,000
	HQI monitoring @ $1,000 per site, with at least two visits per site over the next 10 years	$10,000
	Macro-invertebrate studies at 6 locations twice each year @ $500 per site visit	$60,000
	Follow-up stream stability monitoring for 14 miles @ 4 hours/mile	$2,240
TOTAL		$3,416,640

OBJECTIVE 4

To reduce sediment coming from the uplands by 5,000 tons/year by applying BMPs on 16,000 acres of rangelands within five years of complete plan implementation.

ACTION ITEMS:

9. Develop conservation plans with 15 landowners and work with public agencies to include BMPs, such as water spreading, gully plugs, culvert maintenance, brush management, seeding and grazing management,
10. Improve the vegetation condition on 2,000 acres of rangeland to reduce soil erosion and provide quality forage for livestock and wildlife, and
11. Develop habitat management plan for Dairy Fork Wildlife Management Unit.

MONITORING:

DWR, NRCS and Timp-Nebo SCD are responsible for monitoring the reduction of sediment as BMPs are applied. DWR will use its ongoing range condition monitoring strategy that revisits 8 sites within the sub-watershed every 5 years. NRCS and Timp-Nebo SCD will use PSIAC or the rangeland health evaluation to assess before and after site conditions. DWR will develop the Dairy Fork Wildlife Management Unit plan.

COST:

Total costs to fully implement this objective are estimated to be $531,240. These costs are

Soil eroded from the uplands accumulated at the mouth of this culvert.

TABLE 10. Estimated costs to fully implement Objective 4 for 10 years

Expense	Description	10-Year Cost Estimate
Project	Water spreading, gully plugs, culvert maintenance, brush management, seeding for 15 Landowners @ $32,000 ea.	$480,000
Technical Assistance	Prepare 10 conservation plans @ $1,600 ea.	$16,000
	Develop Dairy Fork Wildlife Management Unit plan	$15,000
Monitoring	5 hours or $200 per year	$2,000
	8 range sites every 5 years @ $5,120 per year	$10,240
TOTAL		$531,240

OBJECTIVE 5

To reduce the influence of noxious weeds infestations within ten years of complete plan implementation.

ACTION ITEMS:

12. Continue with the on-going treatment program with private landowners, Utah County, Sanpete County, Utah Department of Transportation, DWR, Forest Service and other cooperators,
13. Increase the number of cooperators with comprehensive weed plans,
14. Share information with landowners about noxious weeds in a timely manner using written materials, field days and demonstration projects through Utah County, Utah State University, Utah County Extension Service, coordinated weed management areas and other cooperators,
15. Use volunteers, as it is feasible, to treat noxious weed populations that would otherwise go untreated,
16. Develop sources of financial assistance to support the watershed-wide weed program, and
17. Promote and implement integrated pest management, including the continued use of biological controls when feasible on whitetop, musk thistle, Scotch thistle, Canada thistle, knapweed and other noxious weeds.

MONITORING:

The Utah County Weed Department will continue to take the lead on noxious weed treatment in the sub-watershed with the cooperation of private, federal, state and other county agencies. Through conservation plans with land owners, the trends of weed populations will be tracked and monitored by NRCS and the Timp-Nebo SCD.

COST:

Total costs to fully implement this objective are estimated to be $202,200. These costs are summarized in Table 11 below.

Whitetop is a common noxious weed found in the sub-watershed.

TABLE 11. Estimated costs to fully implement Objective 5 for 10 years

Expense	Description	10-Year Cost Estimate
Project	Cooperatively treat 5,000 acres annually @ $38/ acre	$190,000
Technical Assistance	Prepare 10 pest management plans @ $320 ea.	$3,200
Monitoring	Applicator site-assessment @ 20 hours per year	$8,000
	2.5 hours or $100 per year	$1,000
TOTAL		$202,200

OBJECTIVE 6

To increase coordination with the various land owners and land management agencies to minimize potential conflicts and resource damage as transportation and recreation demands increase over the next 10 years.

ACTION ITEMS:

18. Inventory sub-watershed roads to determine their contribution to soil loss, and develop a plan to reduce the losses,
19. Develop a list of proposed tasks that will improve resource conditions,
20. Seek funding to assist with the facilitation of road inventory, recreation opportunities and related resource conservation, and
21. Additional signage, information kiosks and other structures in support of trails and transportation may be warranted.

MONITORING:

A road inventory to provide baseline data will be completed as funding is made available or outside funding is secured. DWR, NRCS and Timp-Nebo SCD may provide personnel to perform the inventory, or volunteers may assist in the inventory. Any structures in support of trails or transportation will require outside funding.

COST:

Total costs to fully implement this objective are estimated to be $40,000. These costs are summarized in Table 12 below.

Increased coordination and cooperation is needed with all landowners to resolve resource issues and improve watershed health.

TABLE 12. Estimated costs to fully implement Objective 5 for 10 years

Expense	Description	10-Year Cost Estimate
Project	Install additional signage, information kiosks @ $20,000	$20,000
Monitoring	Initial road inventory @ $10,000	$10,000
	Follow-up inventory and assessment @ $5,000 to occur twice over next 10 years	$10,000
TOTAL		$40,000

OBJECTIVE 7

To actively promote coordination between CRMP partners, including seeking team review of proposed actions that could affect Soldier Creek sub-watershed resources.

ACTION ITEMS:

22. Maintain a current mailing and e-mail list of participants and interested parties,
23. Notify all interested parties of meetings, tours and other opportunities within the sub-watershed,
24. Maintain open communication with interested parties,
25. Retain a record of meeting notes and CRMP history, and
26. Promote watershed success stories.

Watershed tours are one way to bring diverse people together to discuss resource concerns and issues.

MONITORING:

Timp-Nebo SCD will maintain the current list of participants and interested parties and will notify interested parties of upcoming meetings, tours and other events. Timp-Nebo SCD will also retain the record of meeting notes and the sub-watershed history.

COST:

Total costs to fully implement this objective are estimated to be $12,800. These costs are summarized in Table 13 below.

TABLE 13. Estimated costs to fully implement Objective 7 for 10 years

Expense	Description	10-Year Cost Estimate
Technical Assistance	Maintain current mailing list, notify interested parties & maintain CRMP records @ $960 annually	$9,600
Monitoring	Administration and monitoring @ $320 per year	$3,200
TOTAL		$12,800

OBJECTIVE 8

To provide recommendations regarding natural resources and development to the Utah and Wasatch County planning commissions, as needed, throughout the planning and implementation phases of this CRMP.

ACTION ITEMS:

27. Complete soil survey on 119,854 acres of private land,
28. Provide periodic updates on soil survey findings,
29. Make recommendations to the county planning commissions as needed based upon soil survey or other natural resource findings, and
30. Develop fire-wise plans as communities develop in the canyon.

MONITORING:

NRCS soil scientists are in the process of completing the soil survey for this area. Their data will be reviewed and compiled into electronic format shortly after the field work is completed. As information is brought forward from the soil surveys or any other pertinent source, the CRMP steering committee may opt to bring this information to the attention of the county planning commissions. It is the responsibility of the steering committee to make suitable recommendations to the planning commissions in regards to natural resource and development issues.

Natural resource recommendations to the counties will help elected officials make better informed decisions regarding development.

COST:

Total costs to fully implement this objective are estimated to be $197,000. These costs are summarized in Table 14 below.

TABLE 14. Estimated costs to fully implement Objective 8 for 10 years

Expense	Description	10-Year Cost Estimate
Project	Spanish Fork Canyon soil survey @ $179,000	$179,000
Technical Assistance	Providing periodic updates @ $1,000 Fire-wise planning @ $12,000	$13,000
Monitoring	CRMP Steering Committee recommendations & oversight to County Commissioners on resource conflicts or issues @ $5,0000	$5,000
TOTAL		$197,000

OBJECTIVE 9

To organize local individuals and groups into action committees, provide guidance to keep committees functional, and provide technical assistance to plan and implement BMPs to resolve natural resource problems throughout the development and implementation of this plan.

ACTION ITEMS:

31. Provide CRMP leadership, direction and technical assistance to develop and implement BMPs and
32. Provide direction and assistance in the development of the Soldier Creek sub-watershed CRMP.

MONITORING:

Timp-Nebo SCD will provide leadership and direction in the development of the CRMP.

CRMP team members work together to complete the watershed inventory and planning.

Members of the steering committee will monitor project coordination, technical assistance and leadership for the Spanish Fork River watershed, including Soldier Creek sub-watershed.

COST:

Total costs to fully implement this objective are estimated to be $203,200. These costs are summarized in Table 15 below.

TABLE 15. Estimated costs to fully implement Objective 9 for 10 years

Expense	Description	10-Year Cost Estimate
Technical Assistance	CRMP coordination and guidance @ $20,000 per year	$200,000
Monitoring	8 hours per year @ $320 per year	$3,200
TOTAL		$203,200

OBJECTIVE 10

To continue to seek outside funding to bring about the greatest improvement to the watershed through landowner, agency and public cooperation throughout the development and implementation of this plan.

ACTION ITEMS:

33. Seek alternative sources of outside funding,
34. Develop and implement a fair and equitable ranking system for project development, and
35. Provide administration and tracking of 319 (Environmental Protection Agency) and other grant monies.

MONITORING:

NRCS, Timp-Nebo SCD and other CRMP steering committee members can pursue alternative funding sources as they become available. CRMP steering committee will rank projects to fairly allocate available funding. Timp-Nebo SCD will take the lead on 319 grant money administration and tracking. NRCS will take the lead on administration and tracking other sources of federal grant money.

COST:

Total costs to fully implement this objective are estimated to be $56,000. These costs are summarized in Table 16 below.

Cost share programs that help agricultural producers are just one of the many funding options the CRMP team can apply.

TABLE 16. Estimated costs to fully implement Objective 10 for 10 years

Expense	Description	10-Year Cost Estimate
Technical Assistance	Grant writing and development of ranking system @ $4,800 per year	$48,000
Monitoring	Grant administration and tracking @ $800 per year	$8,000
TOTAL		$56,000

COST ESTIMATES

Total cost estimates have been summarized in Table 1, with the assumption a ten year period is needed for full plan implementation.

TABLE 17. Estimate of ten-year CRMP implementation costs

Objective	Project	Technical Assistance	Monitoring	Total Cost
Objective 1 *Stabilize 21 miles of streambank*	320,000	16,000	5,360	341,360
Objectives 2 and 3 *Restore natural function on 14 miles of stream corridor & aquatic habitat*	3,326,400	16,000	72,000	3,414,400
Objective 4 *Improve 16,000 acres of rangeland*	480,000	39,000	12,240	531,240
Objective 5 *Reduce the influence of noxious weeds*	190,000	3,200	9,000	202,200
Objective 6 *Transportation & recreation coordination*	20,000	10,000	10,000	40,000
Objective 7 *Improve internal coordination & cooperation*	___	9,600	3,200	12,800
Objective 8 *Steering committee natural resource recommendations to County Commissioners*	179,000	13,000	5,000	197,000
Objective 9 *Provide CRM leadership*	___	200,000	3,200	203,200
Objective 10 *Seek funding*	___	48,000	8,000	56,000
TOTALS	**4,515,400**	**354,800**	**128,000**	**4,998,200**

EXPECTED RESULTS

EXPECTED RESULTS

When this CRMP is fully implemented the following changes in resources are expected:

1. Soldier Creek will meet Utah State Water Quality Standards for its designated beneficial uses,
2. Streambank and channel erosion will be reduced throughout the sub-watershed by at least 11,000 tons per year,
3. Excessive runoff from rainfall and snowmelt in the area will be greatly reduced which will subsequently reduce the amount of sediment entering the stream system,
4. Irrigation-related sediment will be reduced on 500 acres of private land,
5. Twenty-one miles of riparian area will regain its natural function, including the ability to filter runoff to reduce the amount of sediment entering the stream system,
6. Improved plant cover will increase water infiltration into upland and riparian soils, retard runoff events, recharge groundwater, and ultimately provide more available stream water during low flows,
7. Increased and better quality forage will be available for wildlife and livestock use,
8. A greater number and variety of wildlife including neo-tropical migratory birds, big game, and non-game species, will use the entire sub-watershed due to improved vegetation cover on uplands, riparian areas and agricultural fields,
9. Increased and better upland, riparian and aquatic habitat for threatened, endangered, and sensitive species, big game and other species,
10. Reduced number, size and influence of existing noxious weed populations, including white top, musk thistle, Scotch thistle, Canada thistle, and knapweeds, and the reduced incidents of new infestations,
11. Recreational use along Soldier Creek and its tributaries will provide a quality experience due to habitat improvement, landowner cooperation, improved public access and enhanced area aesthetics,
12. Resource-based recommendations to the Wasatch and Utah County planning commissioners will help local leaders to make better informed development decisions,
13. Cooperative working relationships based on a common interest to improve natural resource conditions among individuals, groups and agencies will increase, and
14. Competent network of funding opportunities and partnerships, and the consistent submission of grant proposals to adequately fund the prescribed projects.

This reach of Clear Creek illustrates our expected results once the CRM plan is implemented.

COSTS

The estimated total cost of projects and management strategies recommended to fully implement this CRMP is $4,998,200. This level of funding, coming from a variety of sources is needed to generate all of the benefits discussed in this plan.

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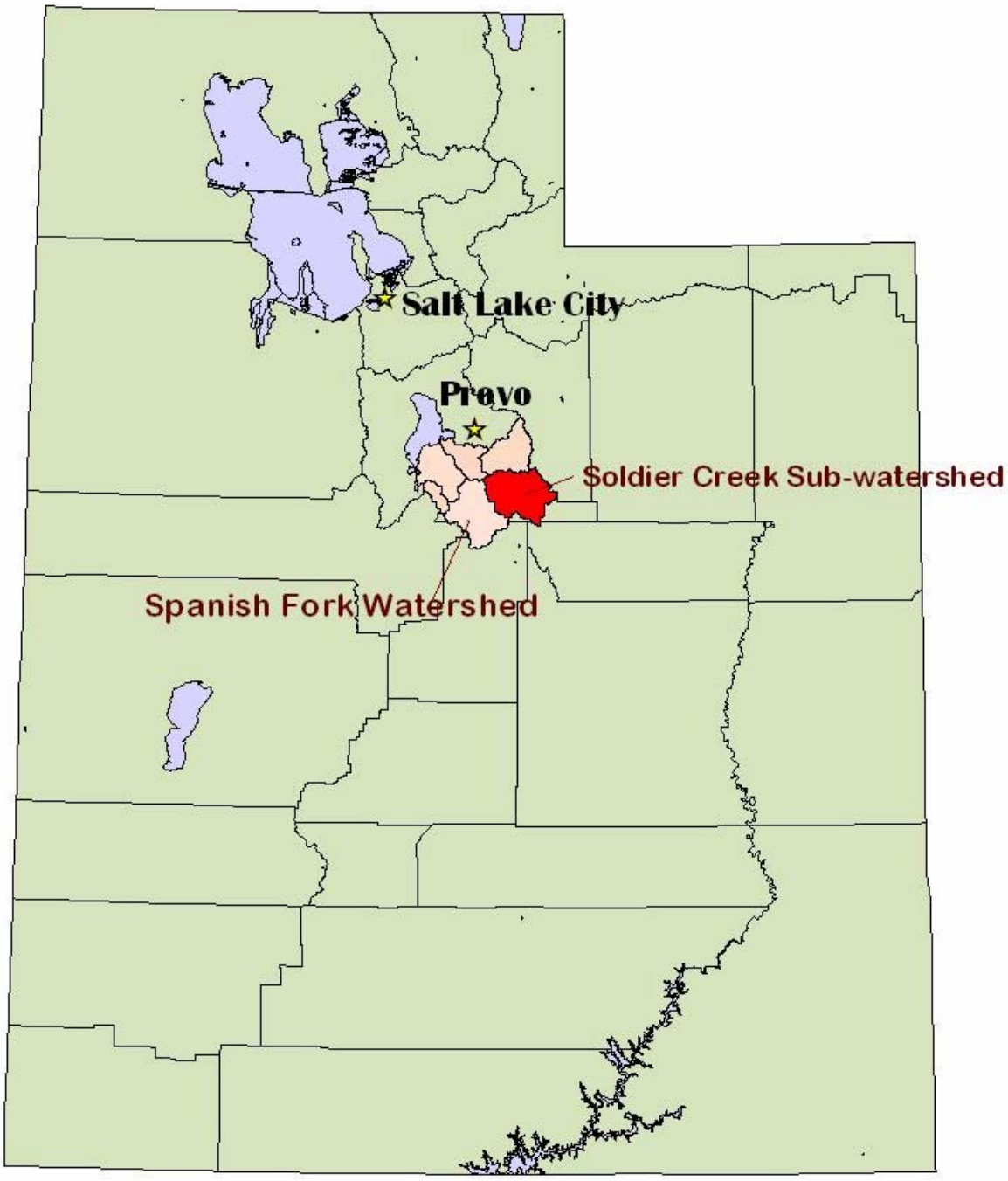
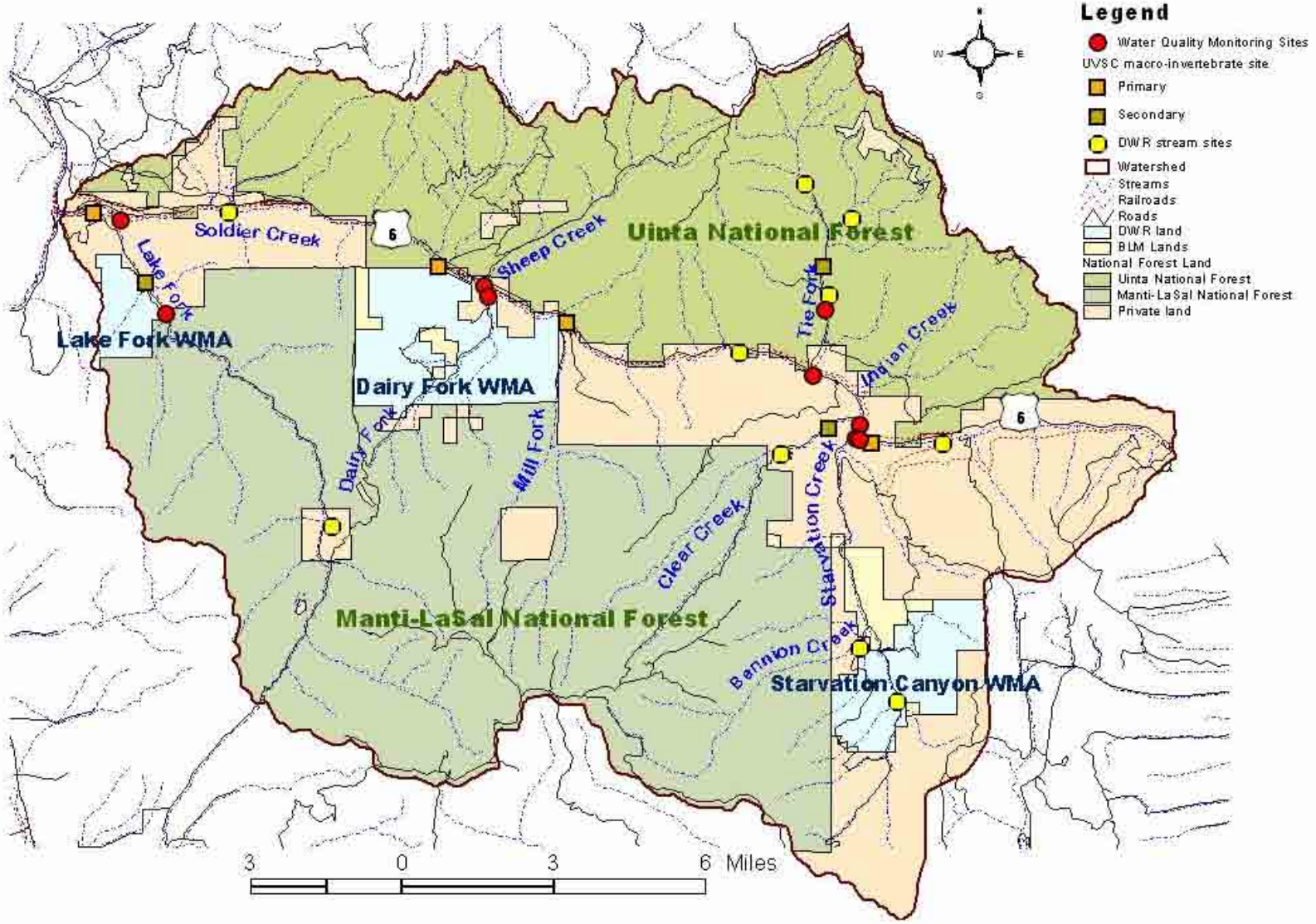
APPENDIX A

LIST OF MAPS

MAP 1. Soldier Creek Sub-watershed Location



MAP 2. Soldier Creek Sub-watershed Monitoring Sites & Landownership



APPENDIX B

LOCALLY LED WORK GROUP

In February 1997, under the leadership of the Timp-Nebo Soil Conservation District and Natural Resources Conservation Service, a local work group met to discuss local natural resource issues. Through this process they identified the Spanish Fork River watershed as the area of greatest resource concern. Within a year, the local work group had evolved into the Spanish Fork River watershed coordinated resource management group. The following is a list of those interested parties who have participated in the process:

PRIVATE INDIVIDUALS OR ORGANIZATIONS

Local Landowners

Irrigation Companies

Rocky Mountain Elk Foundation

Spanish Fork Grazing Company

Spanish Fork River Commission

Sportsmen for Fish & Wildlife

Timp-Nebo Soil Conservation District

Union Pacific Railroad

Utah Railway Company

ACADEMIC ORGANIZATIONS

Brigham Young University

Utah State University, Utah County Extension Service

Utah Valley State College

LOCAL GOVERNMENTS

Mountainland Association of Governments

Sanpete County

Spanish Fork City

Utah County

STATE AGENCIES

Utah Association of Conservation Districts

Utah Department of Transportation

Utah Department of Environmental Quality - Division of Water Resources

Utah Department of Natural Resources - Division of Water Rights

- Division of Water Quality

- Division of Wildlife Resources

FEDERAL AGENCIES

United State Department of the Interior	- Bureau of Reclamation
	- Central Utah Water Conservancy District
	- Fish and Wildlife Services
United States Department of Agriculture	- Farm Bureau
	- Farm Service Agency
	- Farm Service Agency County Committee
	- Forest Service Shrub Lab
	- Manti-LaSal National Forest
	- Natural Resources Conservation Service
	- Uinta Headwaters RC&D
	- Uinita National Forest

APPENDIX C

SOIL LOSS ESTIMATTIONS

Determination of actual soil loss in an area the size of this watershed is cost and time prohibitive. Instead several methods were used to estimate soil loss from known soil erosion sources; uplands, roads and streambank instability. These methods are listed in the References section, if further information is required.

Upland Soil Erosion

TABLE 18. Summary of soil loss estimates from streambank instability, roads and upland soil erosion.

Sediment Source	Miles or Acres	Total Annual Sediment Yield
Stream bank instability	130 miles	60,807
Upland w/o roads	149,236 acres	142,291
Roads	1,276 acres	39,868
TOTAL	_	242,966

The estimation of annual soil erosion rates were mostly derived from Pacific Southwest Inter-Agency Committee (PSIAC) inventory of characteristic sites in the watershed. Using this method a site can be classified according to physical, biological and management conditions, which then allows an erosion rate to be assigned to the area. Thirteen PSIAC assessments were made within the watershed, with erosion rates ranging from .6 to 19 tons to the acre. Based upon vegetation, soils, slope and aspect, a range of erosion rates were assigned throughout the watershed.

On the Uinta National Forest the existing soil survey was used to estimate soil loss. Erosion rates on undisturbed uplands ranged from .24 to 15 tons/acre. Although a soil survey exists for the Manti-La Sal National Forest, it did not provide erosion rates and therefore was not used for this exercise.

Roads

No actual road inventory was performed for the sub-watershed. However the Uinta National Forest soil survey does identify roads and attribute specific erosion rates to these land features. For roads the erosion rates tended to be much higher. These ranged from .49 to 40 ton/acre.

Streambank Instability

The Ventura method was used to estimate channel erosion and sediment yield. This method requires sampling an array of perceived bank stabilities, and collecting data on size of cutbank, rate of erosion and soil type. The length of total cutbanks are then figured into the length of stream inventoried for an estimated erosion rate in tons per mile.

In the sub-watershed, twenty samplings were made on Soldier Creek and its tributaries. Erosion rates ranged from 3 to 295 tons/mile. Erosion rates were then applied to similar stream reaches to arrive at the total annual estimated soil loss from streambank instability.

TABLE 19. Summary of streambank erosion by stream.

Stream Name	Number of Miles Applied	Erosion Rate (Tons/Mile)	Total Sediment/Year (Tons/Year)
Clear Creek	14.7	156	2,293
Dairy Fork (lower)	2	97	194
Dairy Fork (upper)	3.2	375	1,200
Indian Creek[1]	2.5	108	270
Lake Fork (lower)	2.7	42	113
Lake Fork (upper)	29	225	6,525
Mill Creek[2]	10.3	375	3,862
Sheep Creek (main channel)	5.2	268	1,394
Sheep Creek (tributaries)	.5	2,079	1,040
Soldier Creek (upper w/culvert gullies)	7	4,400	30,800
Soldier Creek (upper)	1.6	298	477
Soldier Creek (middle)	6.4	18	115
Soldier Creek (lower)	11.6	369	4,280
Starvation Creek (upper)	15.8	309	4,882
Starvation Creek (lower)	3.4	475	1,615
Tie Fork	17.1	108	1,747
TOTAL	133	—	60,807

[1] Indian Creek was not surveyed. Erosion rates from nearby Tie Fork were applied for this estimate.
[2] Mill Fork was not surveyed. Erosion rates from nearby Dairy Fork were applied for this estimate.

APPENDIX D

BEST MANAGEMENT PRACTICES (BMPS)

Best management practices are those projects and/or management to reduce water pollution, while improving soil and water conservation. These practices include structural and non-structural measures and are intended for federal, state or private lands within the state.

The following BMPs meet the minimum acceptable standards the Natural Resources Conservation Service Field Office Technical Guide and are most likely to be recommended within the Thistle Creek sub-watershed:

GRAZING LANDS

Grazing lands include all rangelands, grazeable woodland and upland wildlife habitat lands used for livestock grazing. Practices include upland and riparian grazing management, soil stabilization practices, and riparian area stabilization. BMPs for grazing lands include, but are not limited to:

Access roads – 560
Animal trails & walkways – 575
Brush management – 314
Channel vegetation – 322
Critical area planting – 342
Ditch & canal lining – 428
Fence – 382
Filter strip – 393
Firebreak – 394
Flood water diversion & floodway – 400, 404
Grazing land mechanical treatment – 548
Grade stabilization structures – 410
Grassed waterways – 412
Heavy use area protection – 561
Pipeline – 516
Prescribed burning – 338
Prescribed grazing – 556 & 528A
Proper woodland grazing - 530
Rangeland seeding - 550
Restoration & management of declining habitat - 643
Riparian herbaceous cover - 390
Sediment basins - 350
Spring development - 574
Stream channel stabilization - 584
Streambank protection - 580
Tree/shrub establishment - 612
Troughs or tanks - 614
Use exclusion - 412
Water & sediment containment basins - 638
Waterspreading – 64?
Wildlife water facility - 648
Diversion – 362

PASTURE MANAGEMENT

Pastures include lands where forage crops are grown. Practices for pastures include measures to increase water infiltration and reduce runoff, soil stabilization and drainage modification measures. BMPs for pastures include, but are not limited to:

Bedding – 310
Chiseling and subsoiling – 324
Conservation cover – 327
Conservation crop rotation – 328
Contour farming – 330
Cover and green manure crop – 340
Residue management use – 329A, 329B
Diversions – 362
Field border – 386
Filter strip – 393
Grassed waterway – 412
Heavy use area protection – 561
Irrigation water management – 499
Mulching - 484
Nutrient management - 590
Pasture and hayland planting - 512
Pest management – 595A
Pipeline - 430
Critical area planting – 342
Irrigation system – 442, 443, 444
Strip cropping contour - 585
Strip cropping field - 586
Subsurface drain - 606
Subsurface drainage – 607, 608
Terraces - 600
Windbreak/shelterbelt - 380

AGRICULTURAL PESTICIDE MANAGEMENT

Agricultural pesticide management is the judicious use of chemical, biological and physical treatment of weeds and other pests on crop and rangelands. These BMPs prescribe applications or management strategies to minimize the transport of chemicals and chemical residue to surface or groundwater. BMPs for agricultural pesticide management include, but are not limited to the following practices:

- Application rate adjustment
- Pest management – 595A
- Planting time organization
- Soil testing
- Timing of applications
- Timing of field tillage operations
- Use of alternative methods of pest control
- Use of alternative pesticides
- Use of insect & disease-resistant crop varieties

IRRIGATION WATER MANAGEMENT

Irrigation water management is the efficient and effective use of irrigation water on agricultural lands. Proper irrigation water management plans the application timing and rate to promote desired crop response, minimize soil erosion, reduce the transport of chemicals, control water loss and protect water quality. Irrigation water management includes, but is not limited to, the following practices:

- Application rate
- Drainage water re-use
- Irrigation & sediment removal
- Irrigation scheduling
- Site-specific guidelines
- Optimal integration of water & chemical application
- Recycling irrigation runoff
- Salinity control
- Tailwater control

WETLAND & WATER QUALITY MANAGEMENT FOR DEVELOPED AREAS

Developed areas require special wetland management to control and trap pollutants from storm water runoff, and minimize the potential for those pollutants to reach surface or groundwater. BMPs for wetland management for developed areas includes, but is not limited to, the following practices:

- Altering time of runoff
- Community pride/involvement
- Garbage and trash collection
- Good housekeeping practices
- Grade stabilization structure – 410
- Grassed waterways – 412
- Heavy use area protection – 561
- Infiltration fields
- Local ordinance
- Lined waterway or outlet – 468
- Mulching – 484
- Pet ordinances
- Runoff management system – 570
- Sediment basin – 350
- Septic tanks
- Sewage system
- Streambank & shoreline protection - 580
- Street cleaning
- Street de-icing
- Street paving
- Storm water collection system
- Storage basin
- Structures for water control – 587
- Tree planting – 612
- Water and sediment containment basin - 638
- Water spreading – 640
- Water table control – 641
- Wetland creation – 658
- Wetland enhancement - 659
- Wetland restoration – 657
- Wetland wildlife habitat management – 644

APPENDIX E

SOLDIER CREEK SUB-WATERSHED
COORDINATED RESOURCE MANAGEMENT PLAN
UT-CPA-53 & ENVIRONMENTAL EVALUATION

U.S. Department of Agriculture	UT-CPA-52	**A. Client:**	Soldier Creek Subwatershed landowners
Natural Resources Conservation Service	Sept. 2004	**B. Plan ID No:**	
		C. CMU/Fields:	
Environmental Evaluation Worksheet		**D. Client's Objective**	**E. Purpose & need for action**
		to reduce soil erosion & improve upland & aquatic wildlife habitat	303(d) listed stream due to sediment/phosphorous loads

F. Resource Considerations (Quality Criteria)	**H. Alternatives and Effects (Attach additional pages as necessary)**		
	Benchmark/No Action	Proposed Action	Alternative Action
	No plan to reduce soil erosion or improve	Plan covers 150,751 acres Reduce soil erosion by 34,000+ tons/year & restore 21 miles of stream habitat	Target 46,765 acres Reduce soil erosion by 26,000+ tons/year & restore 19 miles of stream habitat
SOIL			
Erosion			
Streambank	no effect/change	significant decrease	moderate decrease
Condition			
Compaction	no effect/change	slight decrease	slight decrease
WATER			
Quantity			
Inefficient Water Flows in Water Courses	no effect/change	slight decrease	slight decrease
Quality			
Excess Suspended Sediment & Turbidity in Surface Water	no effect/change	significant decrease	moderate decrease
AIR			
Quality			
Reduced Visibility	no effect/change	slight decrease	slight decrease

PLANT			
Productivity, Health and Vigor	no effect/change	significant increase	slight increase
Noxious and Invasive Plants	no effect/change	slight decrease	slight decrease
Threatened or Endangered Plant Species	no effect/change	slight increase	slight increase
ANIMAL			
Fish and Wildlife			
Inadequate Food	no effect/change	moderate increase	slight increase
Inadequate Cover/Shelter	no effect/change	significant increase	moderate increase
Inadequate Water	no effect/change	slight increase	slight increase
Domestic Animals			
Inadequate Quantities and Quality of Feed and Forage	no effect/change	moderate increase	slight increase

G. Economic and Social Considerations	**I. Effects**		
	Benchmark/No Action	Proposed Action	Alternative Action
Land Use	no effect/change in land use	no effect/change in land use	no effect/change in land use
Capital	no effect/change in capital needs	significant capital needs	significant capital needs
Labor	slight increase in labor requirements	moderate increase in labor requirements	moderate increase in labor requirements
Management Level	no effect/change in management skills needed	slight increase in management skills required	slight increase in management skills required
Profitability	no effect/change in profitability	slight increase in profitability	slight increase in profitability
Risk	no effect/risk	slight increase in risk	slight increase in risk

J. Special Environmental Concerns	**K. Effects**		
	Benchmark/No Action	Proposed Action	Alternative Action
Clean Water Act/U.S. Waters	Present (see attachment)	Present (see attachment)	Present (see attachment)
*T&E or Sensitive Species	Present (see attachment)	Present (see attachment)	Present (see attachment)
*Cultural Resources	No effect (see attachment)	No effect (see attachment)	No effect (see attachment)
Environmental Justice	Not applicable	Not applicable	Not applicable
*Fish & Wildlife Coordination	Present (see attachment)	Present (see attachment)	Present (see attachment)
Floodplain Management	Not applicable	Not applicable	Not applicable
Invasive Species	Present (see attachment)	Present (see attachment)	Present (see attachment)
Migratory Birds	Present (see attachment)	Present (see attachment)	Present (see attachment)
Natural Areas	No effect	No effect	No effect
Prime & Unique Farmlands	Not applicable	Not applicable	Not applicable
Riparian Area	Present (see attachment)	Present (see attachment)	Present (see attachment)
Scenic Beauty	No effect	No effect	No effect
Wetlands	Present (see attachment)	Present (see attachment)	Present (see attachment)
*Wild & Scenic Rivers	Not applicable	Not applicable	Not applicable

* These items may require consultation/coordination between the lead agency/RFO and another governmental unit

L. Easements, permissions, or permits:	Permits will be aquired by landowner/manager as needed
M. Mitigation:	

N. The information recorded above is based on the best available information:

Cindy Burton	Rangeland Management Specialist	10/18/2004
Signature	**Title**	**Date**

O. Agencies, persons, and references consulted:

P. Findings: The preferred alternative from Section H is the: Proposed Action

I have considered the effects of this action on the Resource, Economic, and Social Considereations; the Special Environmental Concerns; and the extraordinary circumstances criteria in the instructions for form UT-CPA-52. I find, for the reasons stated in (Q) below, that the selected alternative:

- (●) **is not a federal action. No further analysis is required.**
- ( ) **is categorically excluded from further environmental analysis and there are no extraordinary circumstances. No additional analysis is required.**
- ( ) **has been sufficiently analyzed in an existing NRCS environmental document. No additional analysis is required. National environmental documents can be obtained at the following hyperlink:** (National NRCS documents)
- ( ) **may require preparation of an EA or EIS. The action will be referred to the State Office.**

Q. Rationale supporting the finding:

Check the appropriate categorical exclusion:

- ( ) a. Soil Survey - 7 CFR Part 611;
- ( ) b. Snow Survey and Water Supply Forecasts - 7 CFR Part 612;
- ( ) c. Plant Materials for Conservation - 7 CFR Part 613;
- ( ) d. Inventory and Monitoring - Catalog of Federal Domestic Assistance - 10.908
- ( ) e. River Basin Studies under Section 6 of Public Law (PL) 83-566 as amended 0 7 CFR Part 621.

Provide information on the current NEPA documentation, if applicable to the plan:

Name/project: Soldier Creek Subwatershed
Prepared by: Cindy Burton
Date of FONSI or ROD: 18-Oct-04

R.

David M. Hanson	District Conservationist	19-Oct-04
Signature	**Title**	**Date**

Soldier Creek Sub-Watershed
Coordinated Resource Management Plan
Environmental Evaluation

Introduction:

The Timp-Nebo Soil Conservation District, with assistance from Natural Resources Conservation Service (NRCS) and its partners Spanish Fork Grazing Association, Spanish Fork River Commission, Utah Department of Transportation, Mountainland Association of Governments, Utah Division of Water Quality, Utah Division of Wildlife Resources, Utah Division of Water Resources, USDA Forest Service, Fish and Wildlife Service, Utah County, Spanish Fork City, Utah Valley State College, Utah State University Extension Service, and Uinta Headwaters Resource and Development Council have written a coordinated resource management plan (CRMP) for Soldier Creek Sub-watershed. Soldier Creek is located within Utah County, Utah and is one of six sub-watersheds in the Spanish Fork River watershed. The sub-watershed begins 7,477 feet above sea level at Soldier Summit and spans an area 24 miles to the west, terminating at the confluence with Thistle Creek, at 5,080 feet in elevation (see Map 1).

The purpose of the CRMP is to provide a comprehensive plan for improving the water quality of Soldier Creek, which is currently on the State's 303 (d) list as an impaired waterbody. The plan meshes the natural resource goals and objectives for over 9 private individuals/organizations, 2 academic organizations, 4 local governments, 4 state agencies and 6 federal agencies.

The CRMP establishes a proposed course of action to work with private landowners to improve water quality through the voluntarily installation of conservation practices on their property. In conjunction, state and federal land managers will apply conservation practices on public lands.

Need for Proposed Action:

Soldier Creek has been identified by the State of Utah as a 303(d) listed waterbody, indicating there are water quality concerns. State-sponsored monitoring has consistently found excessive sediment and phosphorous in the water.

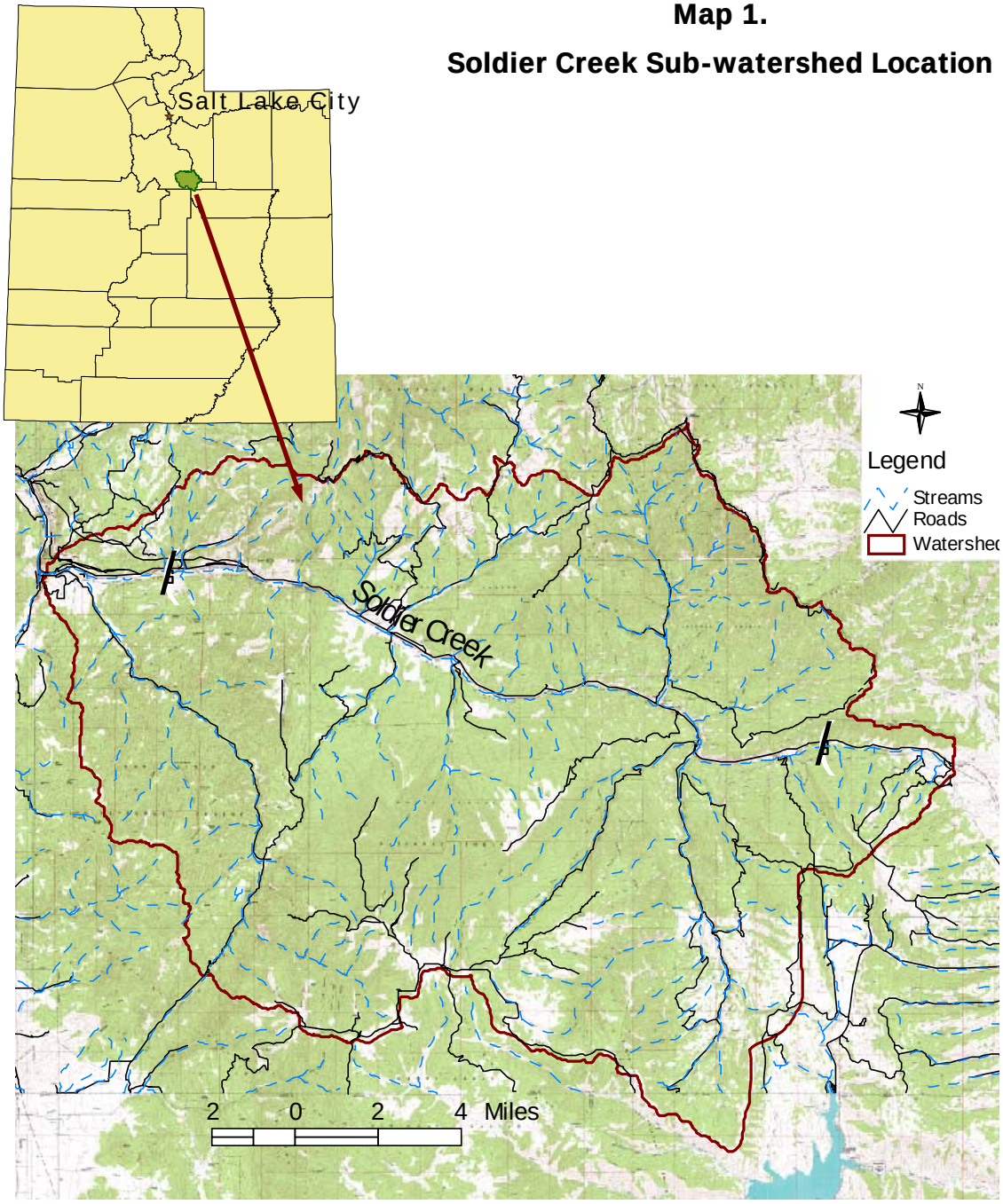
Soldier Creek is on the State's 303(d) list due to excessive sediment in the water.

The source of these pollutants is soil from upland erosion, and streambank and channel instability.

Excessive sediment and phosphorous directly affects the beneficial uses of agriculture, recreation, and cold water fisheries, including the aquatic organisms that support fish survival. Specifically excessive sediment degrades the aquatic habitat of Soldier Creek by an overall loss of habitat quality and quantity; spawning and nesting habitats are lacking because they are buried in sediment, aquatic organisms are generally low in numbers and represented by those tolerant of poor water quality, instream cover is lacking due to extensive eroding, vertical banks, and inadequate riparian vegetation lining the banks, and pool habitat is generally lacking due to channel

Map 1.

Soldier Creek Sub-watershed Location



Soil erosion from the uplands is the major source of sediment in the stream water.

widening and extreme high flows.

An inventory was completed on the watershed in 2001. It found the two major causes of degraded water quality were upland soil erosion and unstable streambanks. Upland soil erosion, including road-related erosion, was found to contribute 182,200 tons of sediment each year. Unstable streambanks contribute 60,500 tons of sediment annually. State water quality monitoring data shows Soldier Creek consistently exceeds state standards for sediment, or total suspended solids.

The Soldier Creek Sub-watershed CRMP is an inter-agency, interdisciplinary effort to address the water quality issues. The CRMP identifies areas where the erosion problems can be substantially reduced by applying specific conservation practices. On private lands, landowners will voluntarily work with state and federal agencies to apply these site specific conservation practices to prevent upland soil erosion and stabilize streambanks. State and federal land managers will implement similar measures to improve water quality.

The CRMP provides a coordinated assessment of the resource problem and solution, pulling its wisdom from many agencies, organizations and individuals (see page 16 for full list of plan contributors). This coordination promotes multiple-agency approach paving the way for a concerted effort to resolve resource issues. Without the CRMP, each land management agency, individual landowner would work independent, and possibly contrary to the improvement of resource concerns.

Unstable, vertical banks are the other major source of sediment in the stream water.

Severe erosion can be found even in the headwaters of Soldier Creek tributaries.

Alternatives:

In developing the CRMP, several alternatives were identified. Based upon likelihood of landowners or land managers to implement the CRMP, four alternatives were reviewed; Alternative 1 is the no action alternative, Alternative 2 targets just private lands within the sub-watershed, Alternative 3 includes both private and state lands within the sub-watershed, and Alternative 4 includes all lands, private, state and federal, within the sub-watershed. These alternatives are as follows:

Table 1. Alternative development

Elements	Alternative 1[1]	Alternative 2	Alternative 3	Alternative 4
LANDOWNER & ACRES	None 0 acres	Private land only 30,749 acres 20 private landowners	Private & State land 46,765 acres 20 private landowners DWR	Private, State & Federal lands 150,751 acres 20 private landowners DWR, Forest Service
STREAM RESTORATION	0 miles	14 miles	19 miles	21 miles
STREAM RESTORATION Estimated sediment reduction	0 tons/year	7,243 tons/year	8,624 tons/year	10,709 tons/year
UPLAND IMPROVEMENT	0 acres	2,730 acres	5,180 acres	16,000 acres
UPLAND IMPROVEMENT Estimated sediment reduction	0 tons/year	11,453 tons/year	17,412 tons/year	23,335 tons/year
NOXIOUS WEED TREATMENT	No change	No change	Increased level	Increased amount & coordination
RECREATION	No change	No change	Moderate	Moderate
FLORA & FAUNA Plus threatened, endangered & sensitive species	Little to no improved habitat	Improved habitat on private land	Improved habitat on private & state lands	Improved habitat on private, state & federal lands
MONITORING	None	Current level	More sites, more acres	More sites, most acres

[1] Alternative 1 represents what would happen without implementing the CRMP.

Impacts and Effects:

ALTERNATIVE 1	
Issue	**Expected impacts and effects**
Water Quality (also see comments under Aquatic Habitat)	
Direct	Water quality will continue to degrade
Indirect	Soldier Creek to remain on 303(d) list; degradation to aquatic habitat continues
Cumulative	Postponement or delay of a clean water plan for Soldier Creek, could put the State of Utah out of compliance with federal Clean Water Act; contribute to the decline of Utah Lake, habitat for federally listed endangered June sucker
Soil Erosion	
Direct	Expect current soil loss of 243,100 tons/year to increase
Indirect	Loss of property as streambanks erode, loss of site production as soils erode off upland sites; decline in aquatic and upland habitats
Cumulative	Long-term productivity loss due to erosion of topsoil off upland sites, change site potential for vegetation it can support; loss of riparian vegetation as stream banks erode, reduced filtering function so expect higher rates of sediment & other pollutants to enter stream channel
Aquatic Habitat (also see comments under Water Quality)	
Direct	Beneficial users: cold water fish & their food source will decline as habitat continues to degrade, due to increased sediment levels
Indirect	Decline in habitat use by the 8 threatened, endangered or sensitive aquatic-dependent spp.[2]; possibly decline in spp. populations; reduced use by all wildlife spp.; loss in recreation and aesthetic value to humans
Cumulative	Possible listing of a spp. due to loss of habitat or habitat quality; potential for increased pollution into Utah Lake, habitat for federally listed endangered June sucker[3]
Terrestrial Habitat	
Direct	142,300 tons/year upland soil that enters the stream
Indirect	Loss of upland vegetation production, leading to decline in habitat for 1 federally listed endangered and 1 state listed sensitve spp. of plants[4]; also loss of forage, cover habitat for big game and other wildlife spp.; decline in diversity of plant spp., increase in invasive plant spp.
Cumulative	Potential extinction of federally listed endangered clay phacelia & potential threatened listing for fireleaf beardtongue; loss of forage for big game, affecting increased predation on nearby pastures & croplands, resulting in a loss of income for landowner; lack of adequate feed for big game herds & could lead to starvation in extreme weather

[2] Federally listed endangered species include June sucker (which historically may have occupied this habitat), federally listed threatened species include bald eagle, Ute's ladies tresses, & state sensitive species include Bonneville cutthroat trout, leatherside chub, northern goshawk, osprey, & Western boreal toad.

[3] Awaiting response from Fish & Wildlife Service

[4] Federally listed endangered species clay phacelia & state listed sensitive fireleaf beardtongue.

ALTERNATIVE 1 (continued)	
Issue	**Expected impacts and effects**
Noxious Weeds	
Direct	No change in the level of pest management
Indirect	New infestations are expected to go untreated; spread of weeds will accelerate; loss of available forage for livestock and big game; increased soil loss as desirable plants are replaced by noxious weeds with less soil binding capabilities
Cumulative	Weed infestations will expand more readily; greater loss of forage and plant production, resulting in increased soil erosion; loss of habitat for big game and possibly threatened, endangered or sensitive spp; population spread into new locations within and outside of the watershed
Recreation Opportunities	
Direct	Decline in level of recreation opportunities available to the public due to continued habitat loss, demand for wildlife and fish-related recreation is expected to increase
Indirect	Access areas will see increased use, with associated impacts at these sites
Cumulative	Increase in recreation demand will not be met for Utah County, anticipate increased unauthorized use and damage to existing resources, resulting in increased loss of soil, vegetation, wildlife and water resources
Coordination	
Direct	Little to no coordination/cooperation between private landowners, local, state or federal agencies
Indirect	Additional cost to landowners & tax payers for poor planning; lack of resource continuity between properties; potential to have one project override another or cause resource degradation another project was attempting to prevent
Cumulative	Higher costs of projects; little outside support for implemented projects; lack of interest in clean water goal
Economics	
Direct	Loss of property & potential revenue as streambanks slough & uplands erode
Indirect	Loss of revenue as forage production declines due to upland soil loss, poor plant productivity, & erosion of streambank vegetation
Cumulative	Decrease in property value & increased cost of restoration as erosion problems go unchecked; expect greater damage as subsequent big storm events occur; water quality will continue to be of concern; aquatic & upland habitats will continue to decline
Monitoring	
Direct	Resource monitoring would be intermittent, inconsistent; little to no sharing of resource data
Indirect	No clear understanding of resources baseline; without this information projects could be costly and ineffective
Cumulative	Lacking a clear understanding of the condition of the resources; unable to assess resource response when project installed; lack data to tie water quality to other resource issues; questionable compliance with Clean Water Act

ALTERNATIVE 2	
Issue	**Expected impacts and effects**
Water Quality (also see comments under Aquatic Habitat)	
Direct	Reduce overall instream sediment load by 19,000 tons/year
Indirect	Anticipate improved fish reproductive success, more numbers & kinds of macro-invertebrate spp. populating streams; improved streambank stability, wider & more effective riparian vegetation, & more diverse vegetation
Cumulative	State of Utah in compliance with federal Clean Water Act; less sediment downstream to Utah Lake where it affects habitat for federally listed endangered June sucker
Soil Erosion	
Direct	Reduce total soil erosion loss by 8% (19,000 tons/yr) by improving resource conditions on 14 miles of streambank & 3,000 acres of private land
Indirect	Upland & streambank erosion will be reduced: treated areas will see marked increase in plant health & diversity; aquatic & upland habitats will improve in quantity & quality; fish & other aquatic-dependent spp. will occupy improved habitat in increased numbers; more available forage for wildlife & livestock
Cumulative	Long-term productivity will increase on 3,000+ acres & 14 miles of treated stream reaches & adjacent lands; due to increased upland & riparian vegetation production filtering function will be more effective & further reduce the amount of sediment & other pollutants entering the stream channel; livestock & wildlife management improvement target 30,000 acres of private land
Aquatic Habitat (also see comments under Water Quality)	
Direct	14 miles of restored aquatic habitat for beneficial users, cold water fish & their food source; reduce sediment from unstable streambanks by 7,300 tons/year
Indirect	Threatened, endangered or sensitive spp[5]. habitat will improve in quantity & quality; possible increase in spp. populations; increased use by all wildlife spp; better channel function will reduce streambank instability in non-treated reaches; increase recreation & aesthetic values; water temperature will be reduced by increased overbank shading from improved riparian zone vegetation establishment
Cumulative	Possible de-listing of one or more threatened, endangered or sensitive spp. due to improved habitat or habitat quality; decreased pollution into Utah Lake, will slightly improve habitat for federally listed endangered June sucker
Terrestrial Habitat	
Direct	Reduce upland soil erosion by 11,500 tons/year on 3,000 acres of uplands
Indirect	Increase upland vegetation production on 2,730+ acres, protect & improve threatened, endangered or sensitive spp.[6] habitat, increased forage, cover habitat for big game & other wildlife spp.; increase in diversity of plant spp.
Cumulative	Potential de-listing of state listed sensitive spp., fireleaf beardtongue; more & better forage availability for big game, likely reducing predation on nearby pastures & cropland, reducing erosion on adjacent, down slope lands

[5] Federally listed endangered species include June sucker (which historically may have occupied this habitat), federally listed threatened species include bald eagle, Ute's ladies tresses, & state sensitive species include Bonneville cutthroat trout, leatherside chub, northern goshawk, osprey, & Western boreal toad.

[6] Federally listed endangered species clay phacelia & state listed sensitive fireleaf beardtongue.

ALTERNATIVE 2 (continued)	
Issue	**Expected impacts and effects**
Noxious Weeds	
Direct	Pest management will expand onto 2,730 acres of private land through conservation planning
Indirect	Better job of containment on 2,730 acres, increase available forage for livestock & wildlife; improve habitat for big game & threatened, endangered & sensitive spp.; reduce soil erosion on previously infested sites
Cumulative	Retard the rate of infestation & spread due to a more knowledgeable landowners; more forage available for livestock & wildlife as weed numbers are reduced, resulting in reduced soil erosion; improved big game habitat & possibly increase threatened, endangered & sensitsive spp. habitat
Recreation Opportunities	
Direct	14 miles of restored aquatic habitat & an increase in fish populations; increased public access to private lands due to Division of Wildlife Resources agreements with cooperating landowners
Indirect	Improved upland & aquatic habitat yields better opportunities for wider variety of consumptive and non-consumptive outdoor recreational activities
Cumulative	Agency assisted stream restorations are expected to accelerate natural healing process in-stream, increasing the effects of aquatic habitat projects beyond landownership boundaries, resulting in increased fish populations outside of project areas; increased wildlife-related opportunities on adjacent lands as wildlife migrate to & from area of improved habitat
Coordination	
Direct	Coordination/cooperation with private landowners will assure clean water goals & objectives are met
Indirect	Better planning means less cost to landowner & taxpayer; opportunities for resource continuity between properties; good projects generate interest from neighbors so coordination grows
Cumulative	Lower project costs; multi-layered outside support for project implementation & clean water goals; landowner's resource objectives more likely to be met; all share & support objectives with Clean Water Act
Economics	
Direct	20 private landowners and public land managers will spend more on conservation practices than will be returned to them for agricultural land uses of their lands
Indirect	Land value will increase as conservation practices are installed & habitat improves, forage increases, soil erosion decreases, increased recreational opportunities & higher valued aesthetics
Cumulative	Landowner/manager's investment may be offset by overall benefit to public as water quality & habitat improves; improved health of upper watershed will reduce likelihood of damage in subsequent big storm events & therefore cost less to repair
Monitoring	
Direct	Coordinated resource monitoring is available to all cooperators & interested parties
Indirect	Clear understanding of resources baseline; projects cost-effective & resources responsive
Cumulative	Clear understanding of the condition of the resources & trend; assess resource response when project installed added to cumulative knowledge base; several kinds of data to tie water quality to other resource issues; compliance with Clean Water Act

ALTERNATIVE 3	
Issue	**Expected impacts and effects**
Water Quality (also see comments under Aquatic Habitat)	
Direct	Reduce overall instream sediment load by 26,000 tons/year
Indirect	Anticipate increased fish reproduction success, more numbers and kinds of macro-invertebrate spp. populating streams; improved streambank stability, wider and more effective riparian vegetation; more diverse vegetation
Cumulative	State of Utah in compliance with federal Clean Water Act; less sediment downstream to Utah Lake where it affects habitat for federally listed endangered June Sucker
Soil Erosion	
Direct	Reduce soil erosion loss by 11% (26,000 tons/yr) by improving resource conditions on 19 miles of streambank & 5,200 acres of private and state land
Indirect	Upland and streambank erosion will be reduced; treated areas will see marked increase in plant health and diversity; aquatic and upland habitats will recover; fish and other aquatic-dependent spp. will occupy improved habitat in increased numbers
Cumulative	Long-term productivity will increase on 5,200 acres and 19 miles of treated stream reaches; due to increased upland and riparian vegetation production filtering function will be more effective and further act to reduce the amount of sediment and other pollutants entering the stream channel; livestock and wildlife management improvement targets 47,000 acres of private land
Aquatic Habitat (also see comments under Water Quality)	
Direct	19 miles of restored aquatic habitat for beneficial users, cold water fish and their food source, reduce sediment from unstable streambanks by 8,600 tons/year
Indirect	Threatened, endangered and sensitive spp.[8] habitat will improve in quantity and quality; possible increase in spp. populations; increased use by all wildlife spp; better channel function will reduce streambank instability in non-treated reaches; increase recreation and aesthetic values; water temperature will be reduced by increased overbank shading from improved riparian zone vegetation establishment
Cumulative	Possible de-listing of one or more threatened, endangered and sensitive spp.[8] due to improved habitat or habitat quality; decreased pollution into Utah Lake, will slightly improve habitat for federally listed endangered June sucker
Terrestrial Habitat	
Direct	Reduce upland soil erosion by 17,400 tons/year on 5,200 acres of uplands
Indirect	Increase upland vegetation production on 5,200+ acres, protect and improve threatened, endangered and sensitive spp.[9] habitat, increased forage, cover habitat for big game and other wildlife spp.; increase diverisity of plant spp.
Cumulative	Potential de-listing of state listed sensitive spp., fireleaf beardtongue; more and better forage availability for big game, likely reducing predation on nearby pastures and cropland, reducing erosion on adjacent, downslope lands

[8] Federally listed endangered species include June sucker (which historically may have occupied this habitat), federally listed threatened species include bald eagle, Ute's ladies tresses, and state sensitive species include Bonneville cutthroat trout, leatherside chub, northern goshawk, osprey, and Western boreal toad.

[9] Federally listed endangered species clay phacelia and state listed sensitive fireleaf beardtongue.

ALTERNATIVE 3 (continued)	
Issue	**Expected impacts and effects**
Noxious Weeds	
Direct	Pest management expands to 5,200 acres of private & state land through conservation planning
Indirect	Better job of containment on 5,200 acres, increase available forage for livestock and wildlife; improve habitat for big game and threatened, endangered and sensitive spp.; reduce soil erosion on previously infested sites; increased cooperation/coordination between private landowners, state land managers and the county to comprehensively treat weed problems
Cumulative	Retard the rate of infestation and spread due to a more knowledgeable landowners; more forage available for livestock and wildlife as weed numbers decline, resulting in reduced soil erosion; improved big game habitat and possibly increase threatened, endangered and sensitive spp. habitat
Recreation Opportunities	
Direct	19 miles of restored aquatic habitat & an increase in fish populations; increased public access to private lands due to Division of Wildlife Resources agreements with cooperating landowners
Indirect	Improved upland and aquatic habitat yields better opportunities for wider variety of consumptive and non-consumptive outdoor recreational activities
Cumulative	Agency assisted stream restorations are expected to accelerate natural healing process in-stream, increasing the effects of aquatic habitat projects beyond landownership boundaries, resulting in increased fish populations outside of project areas; increased wildlife-related opportunities on adjacent lands as wildlife migrate to and from area of improved habitat
Coordination	
Direct	Coordination/cooperation with private landowners & state land mangers will assure clean water goals and objectives are met
Indirect	Better planning, so less cost to landowner and taxpayer; opportunities for resource continuity between properties; good projects generate interest from neighbors so coordination grows
Cumulative	Lower project costs; multi-layered outside support for project implementation and clean water goals; landowner's resource objectives more likely to be met; all share and support objectives with Clean Water Act
Economics	
Direct	20 private landowners and public land managers will spend more on conservation practices than will be returned to them for agricultural land uses of their lands
Indirect	Value of the land will increase as conservation practices are installed and habitat improves, forage increases, soil erosion decreases, increased recreational opportunities and higher valued aesthetics
Cumulative	Landowner/manager's investment will be offset by overall benefit to public as water quality & habitat improves; improved health of upper watershed will reduce likelihood of damage in subsequent big storm events and therefore cost less to repair
Monitoring	
Direct	Coordinated resource monitoring available to all landowners, cooperators & interested parties
Indirect	Clear understanding of resources baseline; projects cost-effective and resource responsive
Cumulative	Clear understanding of the condition of the resources and trend; assess resource response when project installed added to cumulative knowledge base; several kinds of data to tie water quality to other resource issues; in compliance with Clean Water Act

ALTERNATIVE 4	
Issue	**Expected impacts and effects**
Water Quality (also see comments under Aquatic Habitat)	
Direct	Reduce overall instream sediment load by 34,000 tons/year
Indirect	Anticipate improved fish reproduction success, more numbers & kinds of macro-invertebrate spp. populating streams; improved streambank stability, wider & more effective riparian vegetation; more diverse vegetation
Cumulative	State of Utah in compliance with federal Clean Water Act; less sediment downstream to Utah Lake where it affects habitat for federally listed endangered June sucker
Soil Erosion	
Direct	Reduce soil erosion loss by 14% (34,000 tons/yr) by improving resource conditions on 16,000 acres of private, state & federal land
Indirect	Upland & streambank erosion will be reduced; treated areas will see marked increase in plant health & diversity; aquatic, riparian & upland habitat recovery; aquatic & upland habitats will improve in quantity & quality; fish & other aquatic-dependent spp. will successfully occupy improved habitat in increased numbers; more forage availability for livestock & wildlife
Cumulative	Long-term productivity will increase on 16,000 acres & 21 miles of treated stream reaches; due to increased upland & riparian vegetation production filtering function will be more effective & further act to reduce the amount of sediment & other pollutants entering the stream channel: livestock & wildlife management improvement targeting 150,700 acres of entire sub-watershed
Aquatic Habitat (also see comments under Water Quality)	
Direct	21 miles of restored aquatic habitat for beneficial users, cold water fish & food source; reduce sediment from unstable streambanks by 10,700 tons/year
Indirect	Threatened, endangered & sensitive spp.[10] habitat will improve in quantity & quality; possible increase in spp. populations; increased use by all wildlife spp; better channel function will reduce streambank instability in non-treated reaches; increase recreation & aesthetic values; water temperature will be reduced by increased overbank shading from improved riparian zone vegetation establishment
Cumulative	Possible de-listing of threatened, endangered & sensitive spp.[10]; due to improved habitat or habitat quality; decreased pollution into Utah Lake, will slightly improve habitat for federally listed endangered June sucker
Terrestrial Habitat	
Direct	Reduce upland soil erosion by 23,300 tons/year on 16,000 acres of uplands
Indirect	Increase upland vegetation production on 16,000+ acres, protect & improve threatened, endangered & sensitive spp. habitat[11], increased forage, cover habitat for big game & other wildlife spp.; increased diversity of plant spp.
Cumulative	Potential de-listing of state listed sensitive spp., fireleaf beardtongue; more & better forage availability for big game, likely reducing predation on nearby pastures & cropland, reducing erosion on adjacent, down slope lands

[10] Federally listed endangered species include June sucker (which historically may have occupied this habitat), federally listed threatened species include bald eagle, Ute's ladies tresses, & state sensitive species include Bonneville cutthroat trout, leatherside chub, northern goshawk, osprey, & Western boreal toad.

[11] Federally listed endangered species clay phacelia & state listed sensitive fireleaf beardtongue.

ALTERNATIVE 4 (continued)	
Issue	**Expected impacts and effects**
Noxious Weeds	
Direct	Pest management expands to 16,000 acres of private & state land with conservation planning
Indirect	Better job of containment on 16,000 acres, increase available forage for livestock & wildlife; improve habitat for big game & threatened, endangered & sensitive spp.; reduce soil erosion on previously infested sites; increased cooperation/coordination between private landowners, state & federal land managers, & the county
Cumulative	Retard the rate of infestation & spread due to a more knowledgeable landowners; more forage available for livestock & wildlife as weed numbers are reduced, resulting in reduced soil erosion; improved big game habitat & possibly threatened, endangered & sensitive spp. habitat
Recreation Opportunities	
Direct	21 miles of restored aquatic habitat & an increase in fish populations; increased public access to private lands due to Division of Wildlife Resources agreements with cooperating landowners
Indirect	Improved upland and aquatic habitat yields better opportunities for wider variety of consumptive and non-consumptive outdoor recreational activities
Cumulative	Agency assisted stream restorations are expected to accelerate natural healing process in-stream, increasing the effects of aquatic habitat projects beyond landownership boundaries, resulting in increased fish populations outside of project areas; increased wildlife-related opportunities on adjacent lands as wildlife migrate to & from area of improved habitat
Coordination	
Direct	Coordination/cooperation with private landowners, state & federal land mangers will assure clean water goals & objectives are met
Indirect	Better planning, so less cost to landowner and taxpayer; opportunities for resource continuity between properties; good projects generate interest from neighbors so coordination grows
Cumulative	Lower project costs; multi-layered outside support for project implementation & clean water goals; landowner's resource objectives more likely to be met; all share & support objectives with Clean Water Act
Economics	
Direct	20 private landowners & public land managers will spend more on conservation practices than will be returned to them for agricultural land uses of their lands
Indirect	Land value will increase as conservation practices are installed & habitat improves, forage increases, soil erosion decreases, increased recreational opportunities & higher valued aesthetics
Cumulative	Landowner/manager's investment may be offset by overall benefit to public as water quality & habitat improves; improved health of upper watershed will reduce likelihood of damage in subsequent big storm events & therefore cost less to repair
Monitoring	
Direct	Coordinated resource monitoring is available to all cooperators & interested parties
Indirect	Clear understanding of resources baseline; projects cost-effective & resource responsive
Cumulative	Clear understanding of the condition of the resources & trend; assess resource response when project installed added to cumulative knowledge base; several kinds of data to tie water quality to other resource issues; compliance with Clean Water Act

Comparison of Alternatives

Issue	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Water Quality	**-** (increase in sediment because no treatments)	**+** (reduced sediment by 19,000 t/yr)	**+** (reduced Sediment by 26,000 t/yr)	**++** (reduced Sediment by 34,000 t/yr)
Soil Erosion	**-** (243,000 ton/yr sediment load to stream)	**+** (224,000 ton/yr sediment load to stream	**+** (217,000 ton/yr sedi-ment load to stream	**+** (209,000 ton/yr sedi-ment load to stream
Aquatic Habitat	**-** (0 miles of stream restored, decline as sediment increases)	**+** (14 miles of stream restored)	**+** (19 miles of stream restored)	**+** (21 miles of stream restored)
Terrestrial Habitat	**-** (no acres treated)	**+** (3,000 acres treated)	**+** (5,200 acres treated)	**++** (16,000 acres treated)
Noxious Weeds	0 (no change)	**+** (pest mgmt on 3,000 acres more)	**+** (pest mgmt on 5,200 acres more)	**++** (pest mgmt on 16,000 acres more)
Recreation Opportunities	**0** (no change)	**+** (increased public access)	**+** (increased public access)	**+** (increased public access)
Coordination	**-** (no coordination)	**+** (increased coordination)	**+** (increased coordination)	**+** (increased coordination)
Economics	**-** (loss of resources & revenue)	**+** (improve resources & values)	**+** (improve resources & values	**+** (improve resources & values
Monitoring	**-** (inconsistent, no sharing)	**+** (inter-agency monitoring & sharing)	**+** (inter-agency monitoring & sharing))	**+** (inter-agency monitoring & sharing)

The following symbols will be used in issue comparison:

"0" = neutral effect on resources,
"+" = resource improvement,
"++" = greater resource improvement,
"-" = resource decline, and
"- -" = greater resource decline

Preferred Alternative

Our sponsors have selected Alternative 4 without any changes or modifications. This alternative proposes conservation practices across private, state and federally managed lands, including 21 miles of stream restoration and 16,000 acres of upland improvements. These practices are cumulatively expected to reduce sediment by 34,000 tons annually.

Alternative 4 was selected because it meets all of the resource concerns, maximizes resource improvement and maintains inter-agency coordination. This alternative will provide the most rapid water quality recovery for Soldier Creek, &, therefore, compliance with the Clean Water Act.

To expedite project installation, several sources of federal funding may be available to qualified cooperators, including Environmental Quality Incentives program (EQIP), Wildlife Habitat Incentives Program (WHIP), Wetland Reserve Program (WRP), Grazing land Reserve Program (GRP), and Continuous Conservation Reserve Program (CCRP). In addition, at times the State provides funding for habitat improvement projects. Private organizations, such as Rocky Mountain Elk Foundation and Sportsmen for Fish and Wildlife, may also voluntarily provide assistance on specific projects.

Other Resources of Concern

Clean Air Act

Most of the proposed conservation practices will not affect air quality. For those few that may, it is the responsibility of the cooperator to secure all the necessary permits & plans prior to installing these practices.

Clean Water Act

The purpose of the CRMP is to bring Soldier Creek into compliance with the Clean Water Act. Water quality is covered in the alternatives discussions.

Coastal Zone Management Area

There is no Coastal Zone Management Area within the sub-watershed.

Cultural Resources

It is NRCS policy to comply with the National Historic Preservation Act, by identifying & protecting cultural resources early in the planning process. Consultation with NRCS State Archeologist & the State Historic Preservation Office will occur on all projects prior to installation. Project sites will be surveyed for cultural or historic resources &, if found, avoidance of culturally significant sites is the preferred course of action. When disturbance is unavoidable, recommendations from the NRCS State Archeologist and the State Historic Preservation Office will be sought.

Threatened and Endangered Species

Threatened & endangered species habitat is covered in the alternative discussions. For addition information, see the biological assessment in the Appendix.

Environmental Justice

The planning process has been open to all interested parties, regardless of income level, ethnic affiliation or minority status. The benefits of implementing the CRMP will affect all down stream users equally.

Essential Fish Habitat

This refers to critical habitat for sustaining marine or anadromous fish populations, of which there is none within the sub-watershed.

Fish & Wildlife Coordination

Federal Fish & Wildlife Service & Utah State Division of Wildlife Resources have continuously contributed vital information on wildlife habitat needs throughout the planning process. Both agencies will continue to be consulted in the implementation stages.

Floodplain Management

It is the intent of the CRMP to prescribe conservation practices that will enhance floodplain function, & thereby reduce potential hazards to life & property.

Migratory Birds

Migratory birds will benefit from the implementation of the CRMP because it will improve aquatic & upland habitats. For additional informa-

tion on migratory birds see the Biological Assessment in the Appendix.

Natural Areas

Natural areas are expected to benefit from adjacent improved upland & aquatic habitats, as a result of implementing the CRMP.

Prime and Unique Farmland

There are no Prime or Unique Farmlands designated within the sub-watershed.

Riparian Areas

Riparian areas will benefit from the implementation of the CRMP. The Preferred Alternative (Alternative 4) proposes the restoration of 21 miles of stream channel, which includes the associated riparian areas.

Scenic Beauty

Scenic beauty will be enhanced as aquatic & upland habitats improve, & plant diversity & production increase.

Wetland

NRCS policy is to protect & promote wetland functions & values. Recommended conservation practices are expected to support this policy. For those instances where wetlands may be affected, it is the cooperator's responsibility to secure all the necessary permits prior to ground disturbing activities.

Wild and Scenic Rivers

There are no Wild & Scenic Rivers designated within the sub-watershed.

Irreversible and Irretrievable Resources

During the implementation phase of stream restoration, increased soil loss is expected which may cause the loss of individual fish & or macro-invertebrates.

Consultation & Public Participation

In 1998, Timp-Nebo Soil Conservation District and NRCS brought together a diverse working group to identify the biggest natural resource concern in Utah County. The biggest concern was Spanish Fork River water quality. The Spanish Fork River Watershed CRMP group quickly evolved out of the working group and took charge in planning for water quality improvements. In 2001, they completed the CRMP for Thistle Creek sub-watershed. In 2003, Soldier Creek sub-watershed CRMP was completed.

Public participation has been encouraged throughout all stages of the planning process. Notes from CRMP meetings are kept on file at the Provo Field Office, 302 East 1860 South, Provo, Utah 84606. The following is a list of those persons involved in the development of Soldier Creek CRMP:

Private Individuals/Organizations

Steve Bearnson, Spanish Fork Grazing Assoc.	Bryce Clayton, Landowner
Paul Dremann, Stonefly Association	Bruce Hall, Landowner
Shawn Thomas, Strawberry Water Users Assoc.	Boyd Park, Landowner
John Mendenhall, Spanish Fork River Comr.	Blaine Evans, Landowner
Lloyd Jackson, Asst. to Spanish Fork River Comr	Alan Ellis, Landowner
Laynee Jones, HDR Consulting	Mill Fork LLC, Landowner
Lance Houser, HDR Consulting	Jared Brown, Landowner
Vince Izzo, HDR Consulting	Debbie Lasson (Hymas), Landowner
Bill Callor, Utah Railway Company	Edith Lasson, Landowner
Jim Marshall, Union Pacific Railroad	Hal Johnson, Landowner
Robert Uzelac, Off Highway Vehicle Council	Renae Swenson, Landowner
Gary Hubbs, Landowner	Richard Daybell, Landowner
Karl Ritchie, Landowner	David Olsen, Landowner

Educational Institutions

Larry Gray, Utah Valley State College	Dean Miner, Utah State Univ., UT County Extension Service

Local Agencies/Organizations

Craig Searle, Utah County	Dick Saunders, Timp-Nebo Soil Conservation District
Terri McMurtrey, Utah County	Nate Daugs, Timp-Nebo Soil Conservation District
Russ Eagar, Utah County	Carl Adams, Timp-Nebo Soil Conservation District
Commissioner Jerry Grover, Utah County	Rex Larsen, Farm Service Agency County Committee
Bert Miller, Utah County	Ray Loveless, Mountainland Association of Governments
Dwight Hill, Utah County	Jack Herring, Sanpete County
Keith Neubert, Utah County	Dale Barney, mayor of Spanish Fork City

Federal Agencies

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Mark Sensibaugh, Uinta National Forest

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Jeanine Cook, Farm Service Agency

Lori Jones, Farm Service Agency

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Russell Hillman, Congressional Aide to Chris Cannon

Donna Sackett, Congressional Aide to Bob Bennett

Ron Dean, Congressional Aide to Orrin Hatch

Steve Noyes, Bureau of Reclamation

Janice Richardson, Bureau of Reclamation

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