APPENDIX E

Other Supporting Information

E-1 Biological Opinion (USFWS)
E-2 Biological Assessment (NRCS)
E-3 Scoping Information
E-4 Emergency Action Plan
E-5 Environmental Evaluation/CPA-52 Form
E-6 Ferron Watershed Work Plan - 1965

Millsite Dam Rehabilitation
Final Plan-Environmental Assessment (EA)

Ferron Watershed
Emery County, Utah

February 2017
Appendix E-1

BIOLOGICAL OPINION

Millsite Dam Rehabilitation
Emery County, Utah

U.S. Fish and Wildlife Service
In Reply Refer To:
FWS/R6 ES/UT
06E23000-2013-F-0146

Mr. David Brown
Natural Resources Conservation Service
Utah State Office
125 South State Street, Room 4010
Salt Lake City, Utah 84138

Subject: Conclusion of formal consultation for the proposed Millsite Dam Rehabilitation in Emery County, Utah

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this transmits our final biological opinion (BO) for impacts to federally listed species and designated critical habitat for the Natural Resources Conservation Service’s (NRCS) proposed Millsite Dam Rehabilitation project (Project) in Emery County, Utah and its effects on the endangered San Rafael cactus (Pediocactus despainii). We received your request for consultation on October 4, 2016 and final biological assessment (BA) on November 3, 2016.

You also determined and we concur that the Project may affect and is not likely to adversely affect the California condor (Gymnogyps californianus). We base this conclusion on the fact that condors are rare migrants to the area, the Project is not near known nesting locations, it will not negatively impact suitable habitat for the species, and the construction time frame is relatively short-term (1-year maximum). We acknowledge your no effect determination for all other listed species and their critical habitat within Emery County.

Consultation History

This section summarizes significant steps in the consultation process.

August 13, 2010 – We provided migratory bird guidance, listed bird determination recommendations, and listed fish determination considerations by email.

May 23, 2013 – We met with your staff to discuss the Project scope, schedule, and Section 7 consultation.
February 27, 2014 – We received your letter requesting cooperating agency participation during the preparation of an Environmental Assessment for the proposed project.

September 15, 2014 – We met with your staff to discuss plant survey findings, Project design updates, and geotechnical investigations, project schedule, and the section 7 consultation.

April 21, 2015 – We met with your staff to discuss final survey needs, design updates, schedule, and the section 7 consultation.

February 22, 2016 – We received the draft BA for the Project.

March 18, 2016 – We met with your staff to discuss the draft BA.

May 31, 2016 – We received a revised draft BA for the Project.

July 22, 2016 – We met with your staff to discuss the revised draft BA.

August 11, 2016 – We met with your staff to discuss mitigation opportunities for San Rafael cactus.

September 9, 2016 – We met with your staff, Bureau of Land Management (BLM) staff, and the Ferron Canal and Reservoir Company staff at the Project area to discuss deed restriction details and long-term management of private property for San Rafael cactus on private Ferron Canal and Reservoir Company lands.

**BIOLOGICAL OPINION**

**1.0 Description of the Project**

The project analyzed in this consultation is the rehabilitation of the existing Millsite Dam in Emery County, Utah. The Project would restore capacity to the existing reservoir and implement measures so that the structure meets or exceeds NRCS safety and performance standards. Due to changes in engineering safety and performance criteria since construction, Millsite Dam no longer meets the current criteria for a High Hazard Class structure. The primary objectives of the Project are to reduce the risk of loss-of-life and damage from flooding associated with a catastrophic dam failure and to extend the functional timeframe of the dam to support irrigation, municipal, industrial, and recreational water storage.

The Project would remove and replace the downstream embankment sediments, raise the dam crest, extend the principal spillway outlet, and replace the auxiliary spillway. Construction areas will be restored to grade level and revegetated using appropriate plant species. Borrow areas for the Project are located on adjacent private and BLM lands. Specific locations and engineering drawings are detailed in the BA. A new high water level for the reservoir would be established after construction that is expected to inundate approximately 28.8 acres of upland habitat.
1.1 Action Area

For the purpose of our evaluation, we define the action area to include the area directly disturbed by the action within the BA (e.g., construction areas, staging areas, borrow areas, ingress and egress areas, spoils areas, and the entire reservoir shoreline; see Appendix A, map 5) plus a 3,281 foot (ft) (1000 meter [m]) distance from proposed borrow areas where fugitive dust resulting from project activities may land on San Rafael cactus individuals and invasive weeds may spread into San Rafael cactus habitat along dirt road corridors used by the project. This distance is supported by our literature evaluation of road effects to plants (see USFWS 2014) and studies that document dust dispersal from dirt roads out to 2,297 (700 m) (Lewis 2013) and 3,281 ft (1000 m) (Walker and Everett 1987). While not based on site specific information, we consider the 3,281 ft (1000 m) distance to be a reasonable “upper bound” distance for plant impacts from the Project. Our action area is larger than the NRCS action area as described on pages 4 – 5 of the BA.

1.2 Agency Committed Conservation Measures

1.2.1. General Conservation Measures

1. A pre-construction meeting will be held to discuss all conservation measures. This meeting will be attended by the NRCS on-site inspector, NRCS biologist/botanist, and a representative from the contractor. A handout of the conservation measures will be given to all construction staff.

2. Staging areas (equipment and materials) and refueling areas will be located at least 100 ft from Ferron Creek, Millsite Reservoir, and wetland areas.

3. Construction activities will be confined to designated work areas that are identified by stakes and flagging.

4. The contractor will minimize the potential for accidental spills of hazardous materials by implementing Best Management Practices (BMPs) and measures specified in the Storm Water Pollution Prevention Plan (SWPPP) for the project. The contractor will develop a Spill Prevention, Control, and Countermeasures (SPCC) plan and will follow it during construction.

5. The contractor will provide watertight tanks or barrels to dispose of chemical pollutants that are produced as by-products of construction activities, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer wash water, or asphalt. At the completion of construction work, these containers will be removed and the area restored to its original condition.

6. The contractor will keep a hazardous materials spill kit on-site that is appropriate for fluids associated with construction equipment.

7. Sanitary facilities, such as chemical toilets, will be located at a distance sufficient to prevent contamination of any water source and will be disposed of at an off-site, approved facility following construction.

8. Excavated material and construction debris (including grease, oil, or other possible pollutants) will not be placed in Ferron Creek, Millsite Reservoir, or wetlands.

1.2.2. San Rafael cactus Conservation Measures

1. Construction equipment will be cleaned to remove invasive weeds/seeds and petroleum.
products prior to moving on-site.

2. Fill materials will be free of waste, pollutants, and invasive weeds/seeds.

3. Ingress and egress of construction equipment will be kept to a minimum.

4. Areas disturbed during construction will be revegetated using a seed-mix developed in coordination with our office and BLM. The areas will be restored in a manner consistent with current BLM Reclamation Guidelines and will be monitored for invasive plant species for five years. Corrective actions for invasive plants species (if necessary) will be implemented in coordination with our office and BLM.

5. Construction traffic will not exceed 25 miles-per-hour in designated work areas to minimize fugitive dust and the potential for collisions with wildlife.

6. A pre-construction survey targeting the San Rafael cactus will be completed by a qualified botanist in all areas containing suitable habitat. San Rafael cactus occupied habitat (current and historic) will be flagged and construction activities will be prohibited in these areas.

7. Excavation activities will not occur within 300 feet of San Rafael cactus occupied habitat during the species flowering period (April-May).

8. San Rafael cactus individuals that would be directly affected by the proposed action (i.e., inundated by the new high water level) will be moved, in accordance with our office’s translocation protocol, to suitable habitat on BLM lands. Pre-construction surveys and translocation will occur prior to filling the reservoir to its new high water level. All translocation planning and implementation activities will be completed in coordination with our office and BLM.

9. NRCS will complete San Rafael cactus surveys within 50 feet of the reservoir’s high water level for five years in order to monitor the species’ abundance and distribution. A report with survey findings will be submitted to our office and BLM.

1.2.3. Mitigation

The Project has committed to compensate for impacts to San Rafael cactus. These mitigation measures include:

- The Ferron Canal and Reservoir Company will forfeit development rights on approximately 12.4 acres of private lands contained within two parcels to preserve San Rafael cactus occupied habitat and manage the lands for San Rafael cactus recovery (see BA, Appendix A, Map 6). The Ferron Canal and Reservoir Company will forfeit development rights in perpetuity by placing a deed restriction on the two parcels with the Emery County Recorder’s Office. This deed restriction is anticipated to be in place by December 31, 2016 and documentation will be sent to our office once recorded.

- The two private parcels contain 262 San Rafael cactus individuals and are directly adjacent to BLM lands. Both parcels are currently experiencing high levels of disturbance from unauthorized off-highway vehicle (OHV) use and other recreational activities.

- The BLM will provide long-term management of the two private parcels and the BLM will manage the lands in conjunction with their current efforts to reduce recreation impacts to the species. The Ferron Canal and Reservoir Company will enter into a Memorandum of Understanding (MOU) with the BLM to provide the framework for the in-perpetuity management of San Rafael cactus. Land management actions in the MOU
will include, but are not limited to: 1) trespass barricades; 2) trail reclamation/realignment; 3) parking areas; 4) fencing and signage; and 5) weed suppression.

- The MOU has an initial term of 20 years; however, both parties at this time intend to renew the MOU prior to expiration. A copy of the draft MOU will be submitted to our office for comment and approval. It is anticipated that the MOU will be finalized by March 31, 2017. A copy of the final MOU will be sent to our office once signed by all parties.
- The Project will install barricades, fencing, and signage during construction of the proposed action in order to provide immediate protection on easement lands.

2. Status of the Species

2.1 Regulatory Status

The San Rafael cactus (Pedio cactus despainii) is a perennial small globose cactus in the cactus family. The species occurs in Emery County, Utah. This narrowly distributed perennial was proposed for federally listing as endangered in 1986 (51 FR 10560, March 27) following a final rulemaking published on September 16, 1987 (52 FR 34914). No critical habitat was designated for this species.

2.2 Species Description and Taxonomy

San Rafael cactus is described as a separate species in all taxonomic treatments involving the species in regional floras (eFloras 2014; Neese 1981; Welsh et al. 1987; Welsh et al. 2003) and in monographs of the genus (Heil et al. 1981). At one point, the species was proposed as subspecies of Pedio cactus bradyi, a federally listed species from northern Arizona (Arp 1972; Hochstätter 1995). However, it was later demonstrated through conclusive genetic analysis that San Rafael cactus is more closely related to P. simpsonii, but distinct from that species as well as from Winkler cactus (P. winkleri) (Porter et al. 1999). Populations identified as San Rafael cactus have distinct haplotypes (sets of DNA variations that tend to be inherited together) from other Pedio cactus species (Porter et al. 1999). Thus, we support the designation of San Rafael cactus as a separate Pedio cactus species. Demarcation of the range of the species is based largely on plant morphological characteristics and geographic location.

San Rafael cactus was first discovered by Kim Despain in 1978 in the San Rafael Swell in Emery County, Utah (Welsh and Goodrich 1980). San Rafael cactus is a small sub-globose cactus. The species is usually solitary stemmed, 3.8-6.0 centimeters (cm) (1.5-2.4 inches (in)) tall and 3.0-9.5 cm (1.2-3.7 in) in diameter. The stem apex extends from the ground level to 5 cm (2 in) above. Stems are ribbed with tubercles 0.6-1.0 cm (0.2-0.4 in) long. Spine bearing areoles are borne at the apex of the tubercle. The areoles are elliptic with moderate spines partially obscuring the stem. Central spines are lacking. Radial spines commonly number 9-13, are white, and range from 2-6 millimeters (0.08-0.24 in) long. Flowers are borne on the upper end of the tubercle near the apex of the stem. Flowers are 1.5-2.5 cm (0.9-1.0 in) long and colored yellow bronze, peach bronze, or pink with a purple mid-stripe. Stamens are yellow and stigmas are green. Fruit is 0.9-1.1 cm (0.3-0.4 in) long with a smooth surface, initially green, turning reddish-brown with age and...
dehiscing with a vertical slit along the ovary wall. Seeds are shiny black and kidney shaped with papillate mounds that coalesce into large irregular ridges (Heil et al. 1981; Welsh et al. 2003; Welsh and Goodrich 1980).

2.3 Distribution and Status

At the time of listing, the species was known only from two populations, approximately 25 miles apart and were estimated to contain 2,000-3,000 individuals each (52 FR 34914, September 16, 1987). In 1995, an additional population was discovered and the total population of the species was estimated to comprise 20,000 individuals (USFWS 1995). Since that time, many additional occurrences of San Rafael cactus have been documented.

Based on re-inventory efforts over the past five years, and recent discoveries of additional populations and occurrences, we now know of 21 populations of San Rafael cactus consisting of a total of 8,553 documented individuals (BLM 2012, 2012a, 2013; Ivory 2016; Robinson 2011; Truman 2014, 2015; USFWS 2016).

Two populations (the Wedge and Millsite/Clawson) contain over 1,000 individuals and are considered large in size; the remaining populations are small and more than half of the populations are under 100 recorded individuals. There is the potential to locate new populations; one new population was discovered in 2014 (Dripping Spring, the farthest north of the range) and another new population was discovered in 2016, over 6 km (3.7 mi) distant from the nearest other population. Long-term monitoring has not been performed for this species, and it is not possible to determine an accurate population trend for this species with the available data.

2.4 Life History and Population Dynamics

The species is considered to be a long-lived perennial, although there are no long term demography studies on San Rafael cactus. We infer much of our life-history information for the species from data collected on the threatened Winkler cactus that is similar in size and its range is located just south of San Rafael cactus. It is likely that both species behaves similarly in terms of growth, reproduction, recruitment, and pollination. Winkler cacti lived at least 20 years (Clark et al. 2015). Based on recorded growth rates, Winkler cactus individuals of 2 cm (0.8 in) in diameter are likely to be at least 15 years old, while those reaching 5 cm (2.0 in) in diameter may be closer to 40 years old (Clark et al. 2015).

Overall fecundity is low, with 20 percent of demographic monitored cacti never flowering at all, and a very low flowering rate (10 percent) for small individuals. Size and age are positively correlated with reproductive effort, and the majority of reproduction is from a small cohort of larger (over 2.1 cm (0.8 in) in diameter) individuals. Ten cacti in the study (out of 108 total monitored cacti) produced 31 percent of the total flowers (Clark et al. 2015). Large individuals tend to be sheltered under rocks or shrubs that provided protection from disturbance from cattle or other large ungulates and were not recorded to experience trampling events or damage during the study. This indicates that a lack of disturbance may be vital for the development of the large, reproductively active individuals necessary to maintain the population (Clark et al. 2015).
Recruitment is low and sporadic, and may be positively correlated with warmer temperatures in February and March; however, there may be a delay of several years between a recruitment event and the first time seedlings are visible aboveground. This makes determining the factors that lead to successful recruitment difficult (Clark et al. 2015).

The species reproduces sexually, is self-incompatible and cross pollination is needed to produce viable seeds (Tepedino 2000). Pollinators visiting San Rafael cactus include many species of bees, from multiple families (Tepedino 2000). Pollinator visitation to plants is positively affected by plant population size (Goverde et al. 2002). Therefore, small population size may limit pollinator visits and reproductive success.

Flowering occurs from March to May with fruiting from May to June (Heil 1984). The specific timing of flowering and fruiting varies from year to year apparently due to temperature and moisture conditions of late winter and early spring (Clark et al. 2015; Truman 2014). The lower elevation occurrences usually flower at least 5 to 15 days earlier than the upper elevations (Heil 1984).

Much of the year individual cacti shrink underground or retract down to ground surface as a defense against an annual cycle of extreme heat, drought and cold (Clark 1999). The time of year when the cacti retract underground and whether they retract fully under the surface of the soil or remain partially visible appears to vary by individual population and weather conditions for that year. However, retraction generally occurs during the summer and winter with stems resurfacing in spring and fall. Resurfacing in the spring appears to be dependent on winter and spring moisture (Clark et al. 2015). Some populations of San Rafael cactus do not fully retract underground at any time of year while others remain above the surface for only a brief period each year (Truman 2014).

2.5 Habitat

San Rafael cactus grows in fine textured, mildly alkaline soils rich in calcium derived from limestone substrates of the Carmel Formation and the Sinbad member of the Moenkopi formation (Heil 1984; Kass 1990). The species also has been located growing on shale barrens of the Brushy Basin member of the Morrison, Carmel, Mancos and Dakota geologic formations (Clark 1999; Kass 1990) and in soils characterized as mainly alluvium and colluvium (Truman 2014). San Rafael cactus most commonly occurs on benches, hill tops and gentle slopes, most abundantly on sites with a south exposure and elevations of 1,450-2,080 m (4,760-6,830 ft). San Rafael cactus populations are a component of the vegetative community occurring at the lower elevations of a piñon-juniper woodland plant community and the upper elevations of a galleta-three awn shrub-steppe community of the Canyonlands section of the Colorado Plateau Floristic Division (Cronquist et al. 1972; Kuchler 1964). The vegetative community is characterized by open woodlands of scattered Utah juniper and piñon pine with an understory of shrubs and grasses (Heil 1984).

Most of the associated vegetation is xerophytic and often only a small percent of the ground has vegetative cover (Heil 1984). There is no evidence of competition between these taxa and any
other cactus or perennial plant for space, light or nutrients (Heil 1984). Elevation, geologic formation/soil type, and plant community appear to be the primary defining habitat characteristics for the species.

2.6 Threats to the Species

We consider recreation and OHV-related activities, livestock grazing, energy and mineral development, and climate change to be the primary stressors to San Rafael cactus (USFWS 2016). The small populations, specialized habitat requirements, and slow growth habit of San Rafael cactus make this species highly vulnerable to human-caused habitat disturbances from OHV-related activities, livestock grazing, and energy and mineral development (Clark and Clark 2008; Heil 1984, 1987, 1994; Neese 1987; BLM 2013; USFWS 1995, 2009, 2010; 52 FR 32914, September 16, 1987; 63 FR 44587, August 20, 1998). The species is especially vulnerable and susceptible to damage and mortality from surface disturbance of the habitat during the spring flowering period when individuals are actively growing and reproducing at or above ground in seasonally moist soils. The species also forms flower buds in the autumn that persist over winter (Heil et al. 1981); these flowering buds are at the ground surface level and vulnerable to surface disturbance year-round (Clark 2015).

The negative effects of OHV on cactus and cactus habitat are well documented. There is extremely high recreation pressure on the two largest San Rafael cactus populations and there is a high concentration of OHV use and poor adherence to designated routes in and around these populations. Overall, the majority of documented plants and three populations (including the two largest populations) occur in areas known to have high recreation levels, high OHV use, and unauthorized off-trail uses (particularly in the absence of clearly signed and designated trails). The BLM has taken measures to reduce OHV impacts at these populations.

Livestock grazing and trampling by livestock has been recognized as a threat to San Rafael cactus since at least 1981, with impacts to cacti documented regularly since that time (Heil et al. 1981). Grazing is occurs throughout the known range of San Rafael cactus and evidence of livestock has been recorded in every population, although grazing pressure is not equal at every population or every surveyed site within a population. As of 2013 the populations with the most documented disturbance from grazing were: the Millsite/Clawson population (primarily the portion near Clawson Reservoir and Eli Hollow); the Wedge population (in areas less used for recreation that have watering sites for cattle); and the Mesa Butte population (which receives heavy trailing from livestock at sites near the road and is located near reservoirs) (BLM 2012; Truman 2014). Two of the populations (Millsite/Clawson and the Wedge) with high levels of documented disturbance contain the majority of the recorded individuals and both face high pressures from recreation and native ungulates. The Ferron Mills allotment in the Millsite/Clawson population has not been permitted for livestock since 2013, although livestock trailing along the road through that population still occurs heavily (Bauer 2016). A livestock disturbance rate of 24 percent was documented at sites where the Millsite/Clawson population occurs around the West Clawson Reservoir in 2011, although this number decreased to almost nothing in revisits in 2012 and 2016 as the reservoir has been dry since 2012 (Ivory 2016). While no detailed trampling and mortality study has been conducted on San Rafael cactus, it is likely that the species behaves similarly to Winkler cactus in terms of impacts to survival and reproduction (Clark et al. 2015).
The habitat of San Rafael cactus is underlain by potential oil and gas reserves and gypsum deposits (52 FR 32914, September 16, 1987; 63 FR 44587, August 20, 1998). Surveying and development of these deposits has the potential for adversely impacting the species and its habitat. Mining activities, including oil and gas exploration and development, can impact cactus by destroying habitat, increasing erosion potential and dust deposition, fragmenting habitat through access road construction, degrading suitable habitat, and increasing invasive plant species (Brock and Green 2003). Impacts to individual cacti include crushing and removing plants, reducing plant vigor, and reducing reproductive potential in damaged plants and through increased dust deposits. This reduces seedbank quantity and quality, and decreased pollinator availability and habitat (Brock and Green 2003).

Approximately 86 percent of the total population San Rafael cactus occurs on BLM land that is open to oil and gas leasing in the future either with no additional constraints or subject to minor constraints, including the entirety of the two largest populations (The Wedge and Millsite/Clawson). Twenty percent of the Millsite/Clawson population and 80 percent of the Humbug population occur on active oil and gas leasing parcels (parcels that have been leased by the BLM for fluid mineral development (Switek2016)). No current impacts to either population are known. However, previous energy development activity in the Millsite area has destroyed individual plants and occupied habitat (BLM 2008a). In 2012 and 2013, there was a request for lease sales that would have overlapped 80 percent of known occupied habitat for the species (Truman 2014). However the requests for these parcels were deferred due to time constraints for proper analysis and concerns about impacts to rare plants, including San Rafael cactus. There continues to be a high amount of interest in oil and gas leasing in known San Rafael cactus habitat, some parcels with known occupied habitat were nominated in 2015, although they were again deferred at the time due to concerns about impacts to rare plants (including San Rafael cactus) (Truman 2015).

Climate change is likely to negatively impact San Rafael cactus. A draft suitable habitat ensemble model developed by U.S. Geological Survey predicts that San Rafael cactus will lose almost all high to moderate probability habitat by the 2050’s with the exception of the highest elevation population, the Millsite/Clawson population (Kelly 2016). By the 2090’s what little moderate probability habitat is left would shift to the northwest, into higher elevations areas not currently occupied (Kelly 2016). The Millsite/Clawson population is the only extant population with access to higher elevations of suitable habitat that allow for migration (Kelly 2016). Another model evaluated the potential impact of climate change to suitable habitat for San Rafael cactus under two probably climate scenarios provided by the IPCC (Krause et al 2015; Krause 2016). Both scenarios predicted that San Rafael cactus would lose all of its current range by 2099 and suffer a complete range loss within the next 53 years. Between them, these models suggest that any increase in average temperatures could have significant consequences for San Rafael cactus in the near future.

3. Environmental Baseline

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, state, or private actions and other human activities in the action
area. The environmental baseline also includes the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations and the impacts of state and private actions that are contemporaneous with the consultations in progress.

3.1 Status of the Species within the Action Area

The action area occurs within the second largest San Rafael cactus population, the Millsite/Clawson population. The Millsite/Clawson population contains approximately 2,095 individuals based on count data from past surveys and represents 25 percent of the total population of San Rafael cactus (USFWS 2016).

In 2009, 2011, 2012, 2013, 2014, and 2015, NRCS conducted project-level surveys in areas of suitable habitat for San Rafael cactus. The protocol level surveys were performed within 300 feet (91 meters (m)) of construction areas and borrow areas, and within 50 ft (15 m) of the new high water level around Millsite reservoir. Overall, the scope of BLM’s survey did not include the entirety of our action area. A total of 829 San Rafael cactus individuals were located during the NRCS protocol-level surveys within 300 ft (91 m) of construction areas and borrow areas, and within 50 ft (15 m) of the new high water level around Millsite reservoir. The majority of known San Rafael cactus plants occur around the reservoir on BLM and private lands while the remaining individuals are on BLM lands adjacent to Project construction and borrow areas (see Error! Reference source not found.; BA Appendix A, map 5). This represents 40 percent of the Millsite/Clawson population and 10 percent of the total population of San Rafael cactus. The NRCS surveys also identified approximately 320 acres of suitable and 36 acres of occupied San Rafael cactus habitat.

We conducted our own analysis of the species abundance relative to our defined action area. We estimate 959 plants occur within the NRCS survey area and within 3,281 ft (1,000 m) of the proposed borrow areas. Our action area includes all San Rafael cactus identified in the BA plus an additional 130 plants north of borrow areas 6A and 4 on BLM lands. This represents 46 percent of the Millsite/Clawson population and 11 percent of the total population of San Rafael cactus. Our analysis identified a total of 89 acres of occupied habitat for the species. As we mentioned above, we used a 1,000 foot buffer because this is the distance where fugitive dust resulting from project activities may impact the growth and reproduction of San Rafael cactus individuals and invasive weeds may spread into San Rafael cactus along dirt road corridors used by the project. This distance is supported by our literature evaluation of road effects to plants (see USFWS 2014) and studies that document dust dispersal from dirt roads out to 2,297 (700 m) (Lewis 2013) and 3,281 ft (1000 m) (Walker and Everett 1987). While not based on site specific information, we consider the 3,281 ft (1000 m) distance to be a reasonable “upper bound” distance for plant impacts from the Project.

As mentioned above, we have never been confident of a population trend for the species. There is also difficulty in estimating population size because of the dormancy characteristics of San Rafael cactus. We have higher confidence in the number of San Rafael cactus within the NRCS protocol-level survey area based on the multiple years of surveys that have occurred for this project. We have less confidence in the total number of San Rafael cactus within the remainder of the Millsite/Clawson population.
As mentioned above, the Millsite/Clawson population is an important population for the species in terms of population size and connectivity to higher elevations of suitable habitat that allow for migration and possible persistence under future climate conditions. Therefore, it is imperative to support the resiliency of this population and connectivity to higher elevation habitat.

3.2 Factors Affecting the Species within the Action Area

Specific threats identified for the Millsite/Clawson population of San Rafael cactus include OHV-related activities, livestock grazing, energy and mineral development, and native ungulate disturbance.

There is high recreation pressure in the Millsite/Clawson population along the southern shoreline of the Millsite reservoir on BLM and private lands. Recreational use appears to be associated with the developed Millsite State Park and accessible shoreline areas near the State Park. High recreation use areas overlap with approximately 216 San Rafael cactus in the BLM Access Area (see BA Appendix A, map 5, Group H and I). The moderate recreation use area overlaps with approximately 61 San Rafael cactus on private land (see BA Appendix A, map 5, Group J). The BLM has taken some measures to reduce OHV impacts at these locations by partnering with OHV user groups to install signs and block unauthorized roads and trails with boulders (USFWS 2016). Additional measures such as fencing, additional boulder placement, and redirecting existing trails should be incorporated at these three locations to reduce impacts to San Rafael cactus.

Energy development has impacted the Millsite/Clawson population but impacts have occurred outside of the action area. Twenty percent of the Millsite/Clawson population occurs on active oil and gas leasing parcels (parcels that have been leased by the BLM for fluid mineral development) (Switek 2016). No current activities within the population are known (USFWS 2016).

Livestock grazing occurs within the Millsite/Clawson population and the action area. The population is within three livestock allotments managed by the BLM: the Clawson Dairy, Ferron Mills, and Northwest Ferron allotments. The action area is entirely within the Ferron Mills allotment. Livestock use within the allotment has declined recently; the Ferron Mills allotment has not been permitted for livestock use since 2013, although livestock trailing continues to occur along a road through the allotment (Bauer 2016; USFWS 2016). We view the continued non-use of the allotment by livestock as a beneficial action for the species by the BLM that addresses the threat of livestock grazing and supports the resiliency of this important population.

Ungulate disturbance, specifically deer trampling, has been documented to impact the Millsite/Clawson population (BLM 2011, 2012, 2012a). Deer over-winter in the general area and spring use by deer can be high in some parts of the population and impact approximately 5 percent of the individuals in the population. Within the action area, ungulate disturbance appears to be concentrated near the Millsite reservoir (a water source) and public golf course (a food source).

Other ongoing activities in the action area include periodic use of existing borrow areas on private lands, seasonal use for hunting, dispersed camping, and light recreational use along the northern
portion of Millsite Reservoir.

3.3 Effects of the Action

Regulations pursuant to section 7 of the ESA define effects of the action as “the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline” (50 CFR § 402.02). Direct effects are defined as the direct or immediate effects of the action on the species or its habitat. Indirect effects are defined as those effects that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur.

Effects of the action to San Rafael cactus include the loss of plants, and the loss of occupied and suitable habitat from the water level rise of Millsite Reservoir; the loss of suitable habitat from borrow area excavation; suitable habitat soil compaction and habitat degradation from construction activities; potential impacts to plant growth and reproduction from fugitive dust generation; and potential for encroachment of non-native weeds in disturbance areas along access roads and within occupied habitat. There is the potential for these effects to occur during all three phases of the proposed action, including the pre-construction, construction, and post-construction maintenance phases.

Ground-disturbing activities associated with construction staging and work areas, borrow area excavation, and ingress and egress areas have the potential to adversely affect San Rafael cactus in the short and long term. Ground-disturbing activities may result in the loss of suitable habitat, compaction of soil and vegetation, soil disturbance, destruction of associated vegetation to support pollinators, and herbicide use. These activities may reduce the vigor and fecundity of individual San Rafael cactus plants and reduce the expansion potential of the population in the future. An upper bound estimate of approximately 86.8 acres of San Rafael cactus suitable habitat may be lost as a result of borrow material excavation. No San Rafael cactus individuals are located within the borrow areas based on multiple years of surveys.

Effects to San Rafael cactus from the higher water level of Millsite Reservoir as a result of the Project include the loss of individual plants, and occupied and suitable habitat from water inundation. There were likely past precipitation events that resulted in water levels that reached the planned reservoir level rise; however, these events were likely of short duration compared to the long-term, permanent effect of the Project. We do not have information about past effects to the species from water inundation or from the creation of Millsite Reservoir. Recreational use within San Rafael cactus habitat may change based on the higher water level; however, we do not have information to evaluate this potential impact. For this Project, an estimated 44 San Rafael cactus individuals are anticipated to be inundated by the Millsite Reservoir water level rise and will be relocated to nearby suitable habitat prior to Project completion. The loss of 24.5 acres of suitable habitat and 3.66 acres of occupied habitat is also anticipated.

Effects to San Rafael cactus from the use of borrow areas and ingress/egress areas that are adjacent to the Millsite/Clawson population may result from fugitive dust generation that has the potential to impact San Rafael cactus growth and reproduction during the active growing and flowering season. Dust accumulation on plants can negatively affect plant growth and physiology.
Dust deposition during the active growing and flowering season from increased traffic can impact San Rafael cactus individuals. Dust can clog plant pores, increase leaf temperature, alter photosynthesis, and affect gas and water exchange (Sharifi et al. 1997; Ferguson et al. 1999; Lewis 2013), thereby negatively affecting plant growth and reproduction. Since dust accumulation attenuates with distance from roads and other sources of dust, we expect dust impacts to be greatest to plants within 300 ft (91 m) of dirt access roads (Etyemezian et al. 2004; Vernath et al. 2003; Lewis 2013; Silver 2007) and other surface disturbances that generate dust. We anticipate dust deposition from the proposed action will be low during the pre-construction and post-construction phases of the project, and will be high but of short duration during the construction phase of the Project without additional conservation measures.

Seeds from invasive species are often carried and spread by vehicles (Forman and Alexander 1998) and invade areas in response to surface disturbances (Hobbs 1989; Rejmanek 1989; Hobbs and Huenneke 1992; Evans et al. 2001). The spread of invasive nonnative species is considered the second largest threat to imperiled plants in the United States (Wilcove et al. 1998), and is second only to habitat loss as factors responsible for biodiversity declines (Randall 1996). Invasive nonnative plants alter ecosystem attributes including geomorphology, fire regime, hydrology, microclimate, nutrient cycling, and productivity (Dukes and Mooney 2004). Invasive nonnative plants also can detrimentally affect native plants through competitive exclusion, alteration of pollinator behaviors, niche displacement, hybridization, and changes in insect predation. Examples are widespread and involve numerous taxa, locations, and ecosystems (Aguirre and Johnson 1991; D’Antonio and Vitousek 1992; DiTomaso 2000; Melgoza et al. 1990; Mooney and Cleland 2001; Levine et al. 2003; Traveset and Richardson 2006). We anticipate invasive species invasions will be a concern post-construction in areas with significant soil disturbance without additional conservation measures.

Impacts primarily associated with dust deposition and possibly weed encroachment may affect all of the 959 individuals in the action areas because they are located within the 3,281 ft (1000 m) distance from proposed borrow areas. However, impacts will likely be greatest within 300 ft (91 m) of proposed borrow areas where 162 plants occur (see BA, Appendix A, map 4, Group F and J). Dust and weed impacts may affect growth and reproduction of individual plants during the periods of active growth in the spring and fall when project activities occur; however, these impacts are not likely to result in a population level impact to San Rafael cactus because of the short time-frame of borrow material excavation and the applicant committed conservation measures for dust and weed control. Our evaluation is supported by the current status of San Rafael cactus near the existing borrow areas despite ongoing borrow material excavation.
To avoid and minimize impacts to San Rafael cactus to the greatest extent possible, the NRCS will implement conservation measures (see the list of conservation measures in section 1.2), including: (1) minimize San Rafael cactus plant mortality by relocating 44 San Rafael cactus prior to reservoir level rise to higher elevation habitat and implementation of survival monitoring for 5 years; (2) minimize impacts to San Rafael cactus plants from dust in the action area by avoiding borrow area excavation activities within 300 ft (91m) of plants during the flowering period and implementing traffic speed restrictions to reduce fugitive dust generation; (3) minimize impacts to San Rafael cactus from weeds in the action area by cleaning construction vehicles prior to entering the Project area and revegetating disturbed areas with plants and methods consistent with current BLM reclamation guidelines; (4) implement census monitoring for San Rafael cactus within 50 ft (15 m) of the reservoir’s new high water level for 5 years; and (5) compensate for Project impacts to San Rafael cactus by applying a deed restriction and implementing long-term management to protect San Rafael cactus on 12.4 acres of private land in the action area.

4. Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area. Future federal actions that are unrelated to the proposed action are not considered under this section because they require separate consultation pursuant to section 7 of the ESA.

Unrelated state or private actions that are most likely to occur in the future within the action area is the continuation of ongoing baseline activities described above (see Factors Affecting the Species in the Action Area). We have no information that indicates an increase in recreational use, residential development, highway projects, or other activities will occur in the action area. Currently, there are no plans to expand Millsite State Park or the nearby Millsite Golf Course. There are no known projects planned that will require borrow material from the existing gravel pits in the action area. Based on this information, we do not anticipate cumulative effects to increase in the action area in the future.

5. Conclusion

The conclusions of this biological opinion are based on full implementation of the Project as described in the BA. After reviewing the current status of the San Rafael cactus; the environmental baseline for the action area; the effects of the proposed action; and the cumulative effects; it is our biological opinion that this Project, as proposed, is not likely to jeopardize the continued existence of the San Rafael cactus. Critical habitat has not been designated for this species. We base our conclusion on the following:

1. The Project may result in loss of 44 San Rafael cactus plants that represent less than 1 percent of the total population. Potential growth and reproduction impacts associated with dust deposition and invasive weeds may affect the estimated 959 plants in the action area that represent 11 percent of the total population. However, dust and weed impacts should not result in a population-level impact to the species. Our evaluation is supported by the current status of San Rafael cactus despite the ongoing borrow
material excavation near the population.

2. The NRCS’ commitment to minimize impacts from dust generated by avoiding use of borrow areas within 300 ft of plants during the flowering period and implementing dust abatement measures during the growing season will greatly reduce negative effects to San Rafael cactus growth and reproduction. The NRCS’ commitment to minimize indirect impacts from weeds in the action area by cleaning construction vehicles prior to entering the action area; revegetating disturbed areas; and monitoring and controlling invasive weeds will minimize the spread of weeds and impacts to San Rafael cactus associated with plant competition. Based on best available scientific information, these measures are anticipated to reduce dust and weed impacts to 11 percent of the San Rafael cactus population so that the effect is not detectable at the population level.

3. The NRCS, Ferron Canal Company, and BLM’s commitment to apply a deed restriction and implement long-term management for approximately 263 San Rafael cactus on 12.4 acres of private land in the action area.

6. Incidental Take

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. The regulatory definition of harm is “an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.” The regulatory definition of harass is “...an intentional or negligent act or omission which creates the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering.” Incidental take is defined as “...takeings that result from, but are not the purpose of, carrying out of an otherwise lawful activity conducted by the Federal Agency or applicant.” Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Amount or Extent of Take Anticipated

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species and therefore we are not estimating an incidental take level of cacti from this Project. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.
Reporting Requirements

If listed plants are crushed or injured during construction activities, immediate notification must be made to our Salt Lake City Field Office at (801) 975-3330. Pertinent information including the date, time, and location shall be recorded and provided to us.

7. Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

We recommend that NRCS perform shoreline surveys for San Rafael cactus using a combination of drones and ground surveys to evaluate the accuracy of using drone surveys for the species in the future to support recovery efforts. We also recommend that NRCS fund San Rafael cactus experimental propagation efforts if plant mortality of the translocated cacti exceeds 50 percent after 5 years of monitoring.

8. Reporting Requirements

Upon locating dead fish, wildlife, or plant species, where human activity is suspected as a possible cause, immediate notification must be made to the our office at (801) 975-3330 and the U.S. Fish and Wildlife Service (USFWS) Division of Law Enforcement, (435) 734-6446. Pertinent information including the date, time, location, and possible cause of injury or mortality of each species shall be recorded and provided to the USFWS. Instructions for proper care, handling, transport, and disposition of such specimens will be issued by the USFWS’s Division of Law Enforcement.

9. Reinitiation – Closing Statement

This concludes formal consultation on the action outlined in your request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action was retained (or is authorized by law) and if: (1) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (3) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate your commitment in the conservation of endangered species. If the Project changes or it is later determined that the Project affects listed species differently than identified above; it may become necessary to reinitiate section 7 consultation. If you require further assistance or have any questions, please contact Jennifer Lewinson at (801) 975-3330, extension 138.
Sincerely,

[Signature]

Larry Crist
Utah Field Supervisor
10. Literature Cited


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Ivory, James K. 2016. Email chain with Tracey Switek regarding latest Pediocactus despainii fata on BLM lands data as of summer 2016. BLM botanist, Richfield Field Office. 7 pp + 2 shapefiles.

Kass, R.J. 1990. Final report - habitat inventory of threatened and endangered and candidate plant species in the San Rafael Swell, Utah. USDA, Bureau of Land Management, Salt Lake City, Utah. 87 pp


Truman, D. 2014. Phone call with Tracey Switek and Tova Specter regarding the distribution,
threats, and variation of San Rafael cactus, 11/14/2014. BLM Botanist, Price Field Office.


Appendix E-2

BIOLOGICAL ASSESSMENT

Millsite Dam Rehabilitation
Emery County, Utah

U.S. Department of Agriculture
Natural Resources Conservation Service

Prepared By: Derek Hamilton, M.S.
Biologist

Natural Resources Conservation Service
Utah State Office
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Salt Lake City, UT 84138
801.524.4560
derek.hamilton@ut.usda.gov

October 3, 2016
1.0 Introduction

The U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) is providing technical assistance and funding to Emery County and the Ferron Canal and Reservoir Company in order to rehabilitate the existing Millsite Dam in Emery County, Utah. The proposed project would restore capacity to the existing reservoir and implement measures so that the structure meets (or exceeds) current NRCS safety and performance standards. This Biological Assessment (BA) has been prepared to identify the project’s potential impacts on federally-listed species, including critical habitat for such, and make an effects determination in accordance with the Endangered Species Act (ESA) of 1973 (7 U.S.C. 136, 16 U.S.C. 1531 et seq.), as amended.

This BA is being submitted by NRCS in coordination with the Bureau of Land Management (BLM) and the U.S. Army Corps of Engineers (USACE). The NRCS has been designated the lead federal agency by BLM and USACE for the proposed project and will act on their behalf for purposes of compliance with Section 7 of the ESA. Portions of the project would occur on BLM-administered lands and it is anticipated that the project would be authorized by the USACE under the existing Nationwide Permit 3 (Maintenance); accordingly, BLM and USACE are responsible for Section 7 consultation when authorizing actions that may affect species afforded protection under the ESA.

1.1 Background

Millsite Dam is a multi-purpose structure located approximately three miles west of the town of Ferron, Utah in Emery County. It was built in 1971 as a High Hazard Class structure with an anticipated life of 100 years. It is bounded by BLM lands, Ferron City lands (Millsite Golf Course), and private lands. The Ferron Canal and Reservoir Company is responsible for the operation and maintenance of the dam. The need to regulate the irrigation water supply through storage and reduce sediment and flood damages from Ferron Creek was the principal basis for Millsite Reservoir which, when constructed, provided 10,200 acre-feet for water supply and 5,800 acre-feet for sediment storage.
The primary objective of the project is to reduce the risk of loss-of-life and damage from flooding associated with a catastrophic dam failure; furthermore, the project’s secondary objective is to lengthen the time where economic benefits are received as a result of irrigation, municipal, industrial, and recreational water storage. The proposed project is needed to address public health and safety issues associated with a dam that doesn’t meet current safety and performance standards, and address accelerated sediment accumulation that has reduced the reservoir’s storage capacity.

The existing dam is a zoned embankment structure that is approximately 115 feet high with a crest length of 4,150 feet, and a reservoir storage capacity of 16,230 acre-feet. The auxiliary spillway is a 50 feet long by 60 feet wide duckbill reinforced concrete structure with a discharge chute. The principal spillway for the dam is a 54 inch pipe that extends through the dam embankment for approximately 300 feet. This spillway as configured and operated, serves solely to convey flows for irrigation, municipal, and industrial uses. See Figure 1 in Appendix B for details on the existing dam.

Due to changes in engineering safety and performance criteria since construction, Millsite Dam no longer meets the current criteria for a High Hazard Class structure according to NRCS Technical Release 60--Earth Dams and Reservoirs (NRCS 2005) and State of Utah Dam Safety regulations (UDNR 2016a).

A reservoir sediment survey was completed in 2006 with the assistance of the U.S. Bureau of Reclamation to map and compute the existing sediment in the reservoir. Information obtained in this survey revealed that the annual sediment yield to the reservoir has been approximately 75 acre-feet per year. Considering this rate of deposition since 1971, the sediment storage of the reservoir is expected to be at capacity in 32 years.

1.2 Project Responsibility

Project implementation responsibilities are as follows:

**Lead Federal Agency**

NRCS – Bronson Smart, P.E. (State Engineer)
125 South State Street, Room 4010
Salt Lake City, Utah 84138

**Project Sponsor**

Ferron Canal and Reservoir Company – Tracy Behling (President)
P.O. Box 256
Ferron, Utah 84523

**Design Engineer**

Utah Division of Water Resources – Eric R. Dixon, P.E. (Senior Engineer)
1594 West North Temple, Suite 310
Salt Lake City, Utah 84114
1.3 Federal Consultation to Date

- **August 13, 2010** – E-mail from U.S. Fish and Wildlife Service (USFWS) to NRCS. Betsy Hermann (USFWS) provided guidance to Norm Evenstad (NRCS) on migratory bird conservation measures and stated that the project is outside of the known range of the Southwestern willow flycatcher. She also stated that it would be considered a water depletion impact if additional water rights would be used as a result of the project.

- **May 23, 2013** – Meeting between NRCS and USFWS. Meeting held between Norm Evenstad (NRCS), Derek Hamilton (NRCS), and Tova Spector (USFWS) to discuss project scope, schedule, and Section 7 consultation.

- **February 27, 2014** – Letter from NRCS to USFWS. Letter sent from Dave Brown (NRCS) to Larry Crist (USFWS) requesting cooperating agency participation during the preparation of an Environmental Assessment for the proposed project.

- **September 15, 2014** – Meeting between NRCS and USFWS. Meeting held between N. Evenstad, D. Hamilton, and T. Spector to discuss survey findings, design updates, geotechnical investigations, schedule, and Section 7 consultation.

- **April 21, 2015** – Meeting between NRCS and USFWS. Meeting held between N. Evenstad, D. Hamilton, and T. Spector to discuss final survey needs, design updates, schedule, and Section 7 consultation.

- **February 22, 2016** – Draft 1 BA submitted to Jena Lewinsohn (USFWS) for review and comment.

- **March 18, 2016** – Meeting between NRCS and USFWS. Meeting held between D. Hamilton and J. Lewinsohn to discuss Draft 1 BA.

- **May 31, 2016** – Draft 2 BA submitted to J. Lewinsohn for review and comment.

- **July 22, 2016** – Meeting between NRCS and USFWS. Meeting held between D. Hamilton and J. Lewinsohn to discuss Draft 2 BA.

- **August 11, 2016** – Meeting between NRCS and USFWS. Meeting held between D. Hamilton, N. Evenstad, J. Lewinsohn, Paul Abate (USFWS), and Larry Crist (USFWS) to discuss mitigation opportunities and other issues to be resolved before submitting the Final BA.

- **September 9, 2016** – Meeting (and site visit) between NRCS, USFWS, BLM, and the Ferron Canal and Reservoir Company. Meeting held between D. Hamilton, N. Evenstad, J. Lewinsohn, L. Crist, Connie Leschin (BLM), Josh Winkler (BLM), and Jaydon Mead (BLM) to discuss conservation easement details and post-construction land use plans.
2.0 Proposed Action

The proposed action would implement measures needed to meet or exceed current safety and performance criteria for a High Hazard Class dam, and would include measures needed to stabilize the embankment in case of earthquake events. In addition to updating the structure for safety and operation, the proposed action would also extend the service life of Millsite Dam for approximately 62 years as a result of restoring reservoir capacity. The project area includes the dam work area, Millsite Reservoir, and the proposed borrow areas. See Map 1 in Appendix A.

The project features associated with the proposed action are summarized in Table 1 below. Furthermore, Map 2 in Appendix A identifies the general location of these project features and the individual borrow areas proposed for excavation.

Table 1 – Project Features

<table>
<thead>
<tr>
<th>Millsite Dam Rehabilitation -- Project Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Embankment - Downstream Toe: Loose sand and silt materials in the downstream foundation would be excavated and replaced with compacted materials to remove the top zone of potentially liquefiable materials and to help with stability concerns.</td>
</tr>
<tr>
<td>2) Embankment - Seismic Protection: The downstream slope would be flattened and a 100’ x 300’ x 35’ berm placed at the downstream dam toe to improve stability of the dam.</td>
</tr>
<tr>
<td>3) Embankment - Zone Modification: As part of the downstream work, the downstream slope protection rock would be removed so that a chimney drain (filter and drain zones) can be constructed on the slope and in the foundation to collect seepage through the dam. The slope protection rock will then be replaced on the new downstream slope.</td>
</tr>
<tr>
<td>4) Embankment - Drainage: Pipes would be installed in conjunction with the drain materials to collect and monitor seepage through the dam.</td>
</tr>
<tr>
<td>5) Embankment - Raise: The dam crest would be raised 4’ to restore the original reservoir capacity.</td>
</tr>
<tr>
<td>6) Principal Spillway Outlet Works: Downstream embankment work would require extending the 54” principal spillway pipe by approximately 100’. The existing 8” waterline (Ferron drinking water) in the outlet works would be replaced.</td>
</tr>
<tr>
<td>7) Auxiliary Spillway: The existing concrete spillway would be removed and replaced with a new concrete labyrinth weir spillway with the capacity to pass the design flood event (31,000 cubic feet per second).</td>
</tr>
<tr>
<td>8) Structure Monitoring: Piezometers, seepage flow weirs, survey monuments, and other necessary instrumentation would be installed to improve long-term monitoring of the dam.</td>
</tr>
<tr>
<td>9) Construction Restoration: Wave action protection measures would be installed to protect campgrounds at Millsite State Park and Ferron Canyon Road. Millsite Golf Course holes 2, 3 and 4 would be restored, and all disturbed areas would be revegetated.</td>
</tr>
</tbody>
</table>

See Appendix B for detailed plan set drawings of the project features.

Borrow areas would be used in the following order: A) Borrow Area 1; B) Borrow Area 2; C) Borrow Area 6A; D) Borrow Area 4; E) Borrow Area 6; F) Borrow Area 3; G) Borrow Area 5.

Construction activities are anticipated to commence in the spring of 2017 and would be required for approximately one year. See Figure 3 in Appendix B for additional information on the projected schedule. The equipment required to construct the proposed action would include backhoes, bulldozers, cement trucks, dump trucks, pick-up trucks, all-terrain vehicles, and other heavy equipment. The equipment to operate and maintain the proposed action would include backhoes, pick-up trucks, and all-terrain vehicles.

2.1 Action Area

The action area includes locations that may be directly or indirectly affected by the construction, operation, or maintenance of the proposed action. For the purpose of this BA, the action area consists of the lands that would be affected by the construction of project features (including areas required for access, staging, and borrow material). The action area also includes the existing reservoir and the areas above the reservoir’s existing high water mark that would be inundated as a result of the proposed action. Furthermore, a 300 foot buffer surrounding the lands affected by the construction, operation, and maintenance of the project has been included in the action area to assess impacts that may occur in adjacent habitats.
The action area is located in two separate Environmental Protection Agency (EPA) designated ecoregions. A majority of the action area is located in the Semiarid Benchlands and Canyonlands ecoregion, and the remainder is located in the Shale Deserts ecoregion. The EPA definitions of these ecoregions are included below (USEPA 2016).

“The Semiarid Benchlands and Canyonlands ecoregion is characterized by broad grass, shrub and woodland-covered benches and mesas. Elevations mostly range from 5,000 to 7,500 feet and are higher than those of the Arid Canyonlands (20d). Low escarpments separate remnant mesa tops and narrow canyons from surrounding benches. Bedrock exposures (e.g. slickrock and fins) are common along rims, escarpments, and on steep dip slopes. Soils are mostly Entisols. These deep eolian soils are composed of fine sand and support warm season grasses, winterfat, Mormon tea, four-wing saltbush, and sagebrush. Pinyon and juniper occur on shallow, stony soils. Fire suppression and erosion has allowed this woodland to expand beyond its original range. Overall, the vegetation is not as sparse as in drier areas such as Ecoregions 20b, 20d, and 20h.”

“The arid Shale Deserts ecoregion consists of nearly level benches, low rounded hills, and badlands. It is sparsely vegetated with mat saltbush, bud sagebrush, galleta and desert trumpet. Soils are mostly Entisols and Aridisols; they are mostly shallow and clayey and contain salts and gypsum. Clayey soils swell when moist and are slowly permeable. Surface runoff and resultant erosion occur during and after rainstorms. Scattered, gravel-capped benches occur and protrude from the present denudational surface because they are much more resistant to erosion than the surrounding shales. Deep, vertical-walled arroyos are carved where surface water concentrates. These arroyos are major contributor of sediment and salt to the Colorado River. Floodplains have alkaline soils that support greasewood, alkali sacaton, seepweed, and shadscale.”

The following geological formations occur within the action area (UDNR 2016b):

- Lower unit of Emery Member of Mancos Shale (Upper Cretaceous)
- Middle unit of Emery Member of Mancos Shale (Upper Cretaceous)
- Upper unit of Emery Member of Mancos Shale (Upper Cretaceous)
- Blue Gate Member of Mancos Shale (Upper Cretaceous)
- Alluvium (Holocene)

Millsite Dam and Reservoir are the two dominant landscape features in the action area. They are situated where Ferron Canyon emerges from the Wasatch Plateau into Castle Valley. Bluffs rising 2,000 feet surround the dam and reservoir on three sides, and the fourth side opens to the desert badlands of Castle Valley. Ferron Canyon has a large drainage area that consists of a large portion of the southeastern Wasatch Plateau. At the headwaters, small streams arise from glaciated valleys, winter snowpack typically remains late into the season. Duck Fork and Ferron Reservoirs are stabilized lakes near the headwaters of Ferron Creek. The creek cuts a deep gorge through the eastern plateau, and then emerges as the canyon walls flare outward into the edge of the plateau.

Downstream from the reservoir, flat, irrigated desert extends for a few miles beyond the cliffs, then canyons and reefs delineate the western edge of the San Rafael Swell. The reservoir is located in the mouth of the canyon, where vegetation and weather is typical of an arid environment. Irrigation water from the reservoir allows the lands to the east to be irrigated for crops. The watershed high point, Heliotrope Mountain, is 11,130 feet above sea level, thereby developing a complex slope of 7% to the reservoir. The average stream gradient above the reservoir is 4.7 % (249 feet per mile).
3.0 Conservation Measures

The proposed action will adhere to the following conditions in order to minimize the impacts on federally-listed ESA species that may be present in the action area:

1. A pre-construction meeting will be held to discuss all conservation measures. This meeting will be attended by the NRCS on-site inspector, NRCS biologist/botanist, and a representative from the contractor. A handout of the conservation measures will be given to all construction staff.
2. Staging areas (equipment and materials) and refueling areas will be located at least 100 feet from Ferron Creek, Millsite Reservoir, and wetland areas.
3. Construction activities will be confined to designated work areas that are identified by stakes and flagging.
4. Construction equipment will be cleaned to remove invasive weeds/seeds and petroleum products prior to moving on-site.
5. Fill materials will be free of waste, pollutants, and invasive weeds/seeds.
6. Ingress and egress of construction equipment will be kept to a minimum.
7. The contractor will minimize the potential for accidental spills of hazardous materials by implementing Best Management Practices (BMPs) and measures specified in the Storm Water Pollution Prevention Plan (SWPPP) for the project. The contractor will develop a Spill Prevention, Control, and Countermeasures (SPCC) plan and will follow it during construction.
8. The contractor will provide watertight tanks or barrels to dispose of chemical pollutants that are produced as by-products of construction activities, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer wash water, or asphalt. At the completion of construction work, these containers will be removed and the area restored to its original condition.
9. The contractor will keep a hazardous materials spill kit on-site that is appropriate for fluids associated with construction equipment.
10. Sanitary facilities, such as chemical toilets, will be located at a distance sufficient to prevent contamination of any water source and will be disposed of at an off-site, approved facility following construction.
11. Areas disturbed during construction will be revegetated using a seed-mix developed in coordination with USFWS and BLM. The areas will be restored in a manner consistent with current BLM Reclamation Guidelines and will be monitored for invasive plant species for five years. Corrective actions for invasive plants species (if necessary) will be implemented in coordination with USFWS and BLM.
12. Construction traffic will not exceed 25 miles-per-hour in designated work areas to minimize fugitive dust and the potential for collisions with wildlife.
13. Excavated material and construction debris (including grease, oil, or other possible pollutants) will not be placed in Ferron Creek, Millsite Reservoir, or wetlands.
14. A pre-construction survey targeting the San Rafael cactus (SRC) will be completed by a qualified botanist in all areas containing suitable habitat. SRC occupied habitat (current and historic) will be flagged and construction activities will be prohibited in these areas.
15. Excavation activities will not occur within 300 feet of SRC occupied habitat during the SRC flowering period (April-May).
16. SRC individuals that would be directly affected by the proposed action (i.e., inundated by the new high water level) will be moved, in accordance with USFWS translocation protocol, to suitable habitat on BLM lands. Pre-construction surveys and translocation will occur prior to filling the reservoir to its new high water level. All translocation planning and implementation activities will be completed in coordination with USFWS and BLM.
17. NRCS will complete SRC surveys within 50 feet of the reservoir’s high water level for five years in order to monitor SRC abundance and distribution. A report with survey findings will be submitted to USFWS and BLM.
4.0 Species and Critical Habitat

4.1 Species

The USFWS Environmental Conservation Online System was accessed on January 15, 2016 to obtain a list of federally-listed ESA species that are known to occur in Emery County, Utah. Table 2 below identifies the listed species that could be present in Emery County and includes additional information considered in this BA.

Table 2 – Emery County Species List

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Habitat Requirements</th>
<th>Suitable Habitat in Action Area?</th>
<th>Present in Action Area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Condor</td>
<td>Experimental Population (Non-Essential)</td>
<td>Nests in caves and sheltered rock outcrops. Roosts on old growth trees or snags, and on isolated rock outcrops and cliffs. Foraging occurs in grasslands.</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Greater Sage-Grouse</td>
<td>Candidate</td>
<td>Inhabits sagebrush plains, foothills, and mountain valleys. Sagebrush is the predominant plant of quality habitat. A good understory of grasses and forbs, and associated wet meadow areas, are essential for optimum habitat (Idaho Sage-grouse Advisory Committee 2006).</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Mexican Spotted Owl</td>
<td>Threatened</td>
<td>Inhabits benches above canyons associated with undisturbed mixed conifer forests.</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Southwestern Willow Flycatcher</td>
<td>Endangered</td>
<td>Inhabits dense patches of willow or shrubs with similar structure (i.e., alder, tamarisk) along rivers, streams, and wetlands.</td>
<td>Yes</td>
<td>No (outside known range)</td>
</tr>
<tr>
<td>Yellow-Billed Cuckoo</td>
<td>Threatened</td>
<td>Inhabits dense, deciduous riparian forests, at least 25 acres in size with a canopy cover of at least 50% in both the understory and overstory; prefers tall cottonwoods and willows in western habitats (Biosystems Analysis 1989).</td>
<td>No</td>
<td>--</td>
</tr>
</tbody>
</table>

Fishes

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
<th>Habitat Requirements</th>
<th>Suitable Habitat in Action Area?</th>
<th>Present in Action Area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonytail Chub Gila elegans</td>
<td>Endangered</td>
<td>Inhabit the main stem of the Colorado River and some of its tributaries, including the Green River in Utah. Not present in Emery County but projects that deplete water may adversely affect downstream species or critical habitat.</td>
<td>No</td>
<td>--</td>
</tr>
<tr>
<td>Colorado Pikeminnow</td>
<td></td>
<td></td>
<td>No additional water rights to be acquired or used</td>
<td>--</td>
</tr>
<tr>
<td>Razorback Sucker Xyrauchen texanus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Status</td>
<td>Habitat Requirements</td>
<td>Suitable Habitat in Action Area?</td>
<td>Present in Action Area?</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utah Prairie Dog</strong> <em>Cynomys parvidens</em></td>
<td>Threatened</td>
<td>Inhabits rangelands, grasslands, meadows, and agricultural areas in Southwest Utah.</td>
<td>Utah Prairie Dog <em>Cynomys parvidens</em></td>
<td>Threatened</td>
</tr>
<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Barneby Reed-Mustard</strong> <em>Schoenocrambe barnebyi</em></td>
<td>Endangered</td>
<td>A member of the mustard family that occurs in xeric areas with fine textured, red clay soils on steep eroding slopes of the Moenkopi and Chinle formations. Grows in sparsely vegetated sites in mixed desert shrub and pinyon-juniper communities, at elevations ranging from 5,600 to 5,700 feet. There are only two known populations: 1) Capitol Reef National Park—Wayne County 2) San Rafael Swell (BLM land)—Emery County (Tiley, St. John, and Ogle 2011).</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td><strong>Jones Cycladenia</strong> <em>Cycladenia humilis var. jonesii</em></td>
<td>Threatened</td>
<td>A member of the dogbane family that occurs in gypsiferous soils derived from the Summerville, Cutler, and Chinle formations. Grows in mixed desert shrub and pinyon-juniper communities at elevations ranging from 4,390 to 6,000 feet. Known to occur at 26 sites within the canyons of the Colorado Plateau in Emery, Garfield, and Grand Counties, Utah and Mohave County, Arizona (USFWS 2008).</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td><strong>Last Chance Townsendia</strong> <em>Townsendia aprica</em></td>
<td>Threatened</td>
<td>A member of the sunflower family that occurs in clay, clay-silt, or gravelly clay soils derived from the Mancos formation and often covered with biological soil crusts. The species grows in salt desert shrub and pinyon-juniper communities at elevations ranging from 6,100 to 8,000 feet. 15 separate populations are known to occur in Emery, Sevier, and Wayne Counties, Utah (USFWS 1993).</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>San Rafael Cactus (SRC)</strong> <em>Pediocactus despainii</em></td>
<td>Endangered</td>
<td>See Section 4.1.1 below.</td>
<td>Yes</td>
<td>Yes (known occurrence)</td>
</tr>
<tr>
<td><strong>Winkler Cactus</strong> <em>Pediocactus winkleri</em></td>
<td>Threatened</td>
<td>A member of the cactus family that occurs in fine-textures soils derived from the Dakota formation and the Brushy Basin member of the Morrison formation. It is found on benches, hill tops, and gentle slopes on barren, open sites in salt desert scrub communities at elevations ranging from 1490 to 2010 meters. Four separate populations are known to occur in Emery and Wayne Counties, Utah (USFWS 2007).</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td><strong>Wright Fishhook Cactus</strong> <em>Sclerocactus wrightiae</em></td>
<td>Threatened</td>
<td>A member of the cactus family that occurs in soils derived from a variety of geologic formations, including Emery sandstone, Mancos shale, Dakota sandstone, Morrison, Summerville, Curtis, Entrada sandstone, Carmel, Moenkopi, and alluvium. It is found on semi-barron sites within salt desert scrub or open pinyon juniper woodland communities at elevations from 4,200 to 7,600 feet (USFWS 2012).</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Species List Source: USFWS 2016a
Surveys for plant species with suitable habitat in the action area were completed by NRCS, USFWS, and BLM personnel during the planning process. These surveys targeted the Last Chance townsendia, SRC, and Wright fishhook cactus. Numerous SRC individuals from the Millsite/Clawson population were discovered in the action area and may be affected by the proposed action; accordingly, the SRC is being carried forward in this BA for further analysis. The remaining species known to occur in Emery County are not being carried forward in this BA because it has been determined that the proposed action would have no effect on such as they are not expected to be present in the action area based on habitat requirements, range, and/or survey results.

4.1.1 San Rafael Cactus

Species Information

The SRC was listed as endangered on September 16, 1987. It is endemic to Emery County in central Utah occurring on benches, hilltops, and gentle slopes associated with salt desert shrub and pinyon-juniper communities. SRCs are found at elevations between 6,000 and 6,700 feet in limestone gravels, shales, clays, and silty substrates of the Mancos, Morrison, Moenkopi, Dakota, and Carmel formations (USFWS 2015).

The SRC is a very small barrel shaped cactus that typically does not exceed 2 inches in height or 3.5 inches in width. It has spine clusters (and no central spines) with between 9 and 13 radial spines that are approximately 0.5 inches long. The flowers of the SRC are small (approximately 1 inch across) and are peach to yellow in color with a bronze tint. The SRC typically blooms in April and May. Wild bees of the Halietida family are believed to be the primary pollinator (USFWS 1995).

The SRC stores water in its succulent stems (like all cacti) which allows it to survive extended time periods with little or no precipitation; additionally, the SRC has a shallow root system that enables it to effectively collect any precipitation that does fall. It has a unique habit of retracting underground during periods of drought and cold weather in order to survive unfavorable conditions. The size and longevity of the soil seed is unknown.

A majority of known SRC individuals occur on lands managed by the BLM, and remaining SRCs are scattered in areas of private land and State of Utah land that is administered by the School and Institutional Trust Lands Administration. The species range is centered on the San Rafael Swell where the average
annual rainfall is between 6 and 10 inches. The most current estimate is that there are 8,200 individuals distributed amongst 21 known populations (USFWS 2015).

Monitoring efforts indicate that SRC populations are declining (i.e., decrease in the number of individuals capable of flowering and reproducing). SRC threats have been identified in the 2015 Draft Recovery Plan and are listed in Table 3 below.

Table 3 – SRC Threats

<table>
<thead>
<tr>
<th>High-Level Threats</th>
<th>Moderate-Level Threats</th>
<th>Low-Level Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-Highway Vehicle (OHV) Activities</td>
<td>Illegal Collection</td>
<td>Native Ungulate and Wild Horse Disturbance</td>
</tr>
<tr>
<td>Livestock Grazing</td>
<td>Inadequacy of Existing Regulatory Mechanisms</td>
<td>Invasive Species</td>
</tr>
<tr>
<td>Energy and Mineral Development</td>
<td></td>
<td>Predation</td>
</tr>
<tr>
<td>Climate Change</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: USFWS 2015

Suitable Habitat in Action Area

In order to determine SRC suitable habitat that may be affected by the project, field observations and aerial photography were used to identify threats in the action area that have limited the abundance and distribution of SRCs. These threats have altered the landscape resulting in areas that are no longer suitable habitat for the SRC. Previous mineral excavation activities (i.e., gravel pits and disposal areas) and OHV use are both identified threats and major sources of disturbance in Borrow Areas 1, 2, 5, and 6A.

For the purpose of this BA, sites in the action area that are disturbed as a result of mineral excavation have been excluded as SRC habitat. The areas that lack SRC habitat requirements (i.e., Millsite Dam, Millsite Golf Course, Ferron Creek floodplain, Diversion Hollow sediment basin) have also been excluded as suitable habitat. Accordingly, it has been determined that there are approximately 320 acres of SRC suitable habitat in the action area.

Map 3 in Appendix A identifies the disturbed sites in the action area and documents the acreage of SRC suitable habitat that may be affected during the excavation of borrow material. In summary, there are approximately 86.8 acres of SRC suitable habitat in the 174.0 acres proposed for borrow.

Individuals in Action Area

Surveys were completed to document the presence or absence of SRCs (and other target species) in 2009 and 2011-2015. These surveys were completed in coordination with USFWS and BLM, and recorded the distribution and abundance of SRCs in the action area using Trimble Global Positioning System receivers or equivalent. All suitable habitat in the action area, except for a small section of the BLM access area, was surveyed using wandering transects with 5 foot transect spacing (minimum) implemented upon discovery. Please note that surveys were completed in the section of the BLM access area discussed above, but only within 50 feet of the new high water level (unlike 300 feet elsewhere).
Table 4 below summarizes the surveys completed for federally-listed ESA plant species.

<table>
<thead>
<tr>
<th>Date</th>
<th>Personnel</th>
<th>Area</th>
<th>Results</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 7, 2009</td>
<td>Jim Spencer (NRCS) Larry England (USFWS)</td>
<td>1) North and south ends of existing embankment 2) BLM access area and adjacent private lands</td>
<td>1) No SRCS 2) 115 SRCS</td>
<td>79 (of 115) SRCs located east of road in BLM access area.</td>
</tr>
<tr>
<td>May 9, 2011</td>
<td>Dana Truman (BLM) and other BLM staff</td>
<td>1) BLM access area 2) BLM lands adjacent to Borrow Areas 4 and 6A</td>
<td>1) 29 SRCS 2) 114 SRCS</td>
<td>Overlap with 2009 survey of BLM access area (east of road).</td>
</tr>
<tr>
<td>May 9, 2012</td>
<td>BLM</td>
<td>1) BLM access area</td>
<td>1) 95 SRCS</td>
<td>Overlap with 2009 and 2011 surveys of BLM access area (east of road).</td>
</tr>
<tr>
<td>May 9, 2013</td>
<td>J. Spencer Norm Evenstad (NRCS)</td>
<td>1) Borrow Area 1 2) Borrow Area 2</td>
<td>1) No SRCS 2) No SRCS</td>
<td>Borrow Area 1 is severely disturbed by OHVs. Borrow Area 2 is discarded soil and rocky material left over from original construction of dam and is unsuitable SRC habitat.</td>
</tr>
<tr>
<td>April 22, 2014</td>
<td>J. Spencer, N. Evenstad, Derek Hamilton (NRCS), Anthony Beals (NRCS), Tova Spector (USFWS), D. Truman (BLM), and other BLM staff</td>
<td>1) BLM access area (west of road) and adjacent private lands 2) Private lands west of BLM access area 3) BLM lands surrounding reservoir</td>
<td>1) 195 SRCS 2) 61 SRCS 3) 291 SRCS</td>
<td>Overlap with 2009 survey of BLM access area (west of road).</td>
</tr>
<tr>
<td>October 1, 2014</td>
<td>N. Evenstad, D. Hamilton, Ryan Pierce (NRCS), T. Spector</td>
<td>1) Borrow Area 2 2) Borrow Area 3 (geotech sites) 3) Borrow Area 4 4) Borrow Area 6A</td>
<td>1) No SRCS 2) 5 SRCS 3) No SRCS 4) No SRCS 5) No SRCS</td>
<td>Borrow Area 2 was resurveyed at the request of USFWS. Borrow Area 4 contains the Diversion Hollow sediment basin and is unsuitable SRC habitat. Borrow Area 6 determined unsuitable SRC habitat based on its location in historic Ferron Creek floodplain. A majority of Borrow Area 6A has been previously disturbed by gravel pit operations and is unsuitable SRC habitat.</td>
</tr>
<tr>
<td>April 29, 2015</td>
<td>N. Evenstad, D. Hamilton, R. Pierce, Tracey Switek (USFWS contractor)</td>
<td>1) BLM access area (50’ from new high water level) 2) Borrow Area 3</td>
<td>1) 9 SRCS 2) 42 SRCS</td>
<td>USFWS requested an updated survey for SRCS within 50’ of the new high water level in the BLM access area.</td>
</tr>
<tr>
<td>May 4, 2015</td>
<td>N. Evenstad, D. Hamilton, R. Pierce</td>
<td>1) Borrow Area 5</td>
<td>1) No SRCS</td>
<td>A majority of Borrow Area 5 has been previously disturbed by gravel pit operations and is unsuitable SRC habitat.</td>
</tr>
</tbody>
</table>

In summary, these surveys discovered 35.91 acres of SRC occupied habitat in the action area with a total count of 829 individuals. For purpose of this BA, SRC individuals were grouped based on proximity and land ownership. These groups include all locations of SRC occupied habitat in the action area and do not include buffers. Group information is summarized in Table 5, and shown visually in Map 4 - Appendix A.
Table 5 -- SRC Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>SRC Individuals</th>
<th>Occupied Habitat (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>2.27</td>
</tr>
<tr>
<td>B</td>
<td>77</td>
<td>1.44</td>
</tr>
<tr>
<td>C</td>
<td>151</td>
<td>6.84</td>
</tr>
<tr>
<td>D</td>
<td>57</td>
<td>1.45</td>
</tr>
<tr>
<td>E</td>
<td>47</td>
<td>5.51</td>
</tr>
<tr>
<td>F</td>
<td>101</td>
<td>7.09</td>
</tr>
<tr>
<td>G</td>
<td>13</td>
<td>0.28</td>
</tr>
<tr>
<td>H</td>
<td>114</td>
<td>5.93</td>
</tr>
<tr>
<td>I</td>
<td>202</td>
<td>3.70</td>
</tr>
<tr>
<td>J</td>
<td>61</td>
<td>1.40</td>
</tr>
<tr>
<td>Total</td>
<td>829 SRCs</td>
<td>35.91 acres</td>
</tr>
</tbody>
</table>

4.2 Critical Habitat

The USFWS Environmental Critical Habitat Portal was accessed on January 15, 2016 to identify the location of designated critical habitat in Emery County, Utah. The search revealed that designated critical habitat is not located in or adjacent to the action area (USFWS 2016b).

5.0 Effects

5.1 San Rafael Cactus

Direct Impacts – Construction

SRCs may be directly affected by construction equipment during excavation activities in borrow areas. Excavation in borrow areas may result in SRC individuals being crushed by equipment, collected in conjunction with borrow material, or exposed to elevated levels of dust. In order to minimize impacts, borrow areas have been modified so that all known SRC occupied habitat will be avoided during excavation.

A pre-construction survey for SRCs will be completed by a qualified botanist in all areas containing suitable habitat. This survey, and results from previous surveys, will be used in coordination with USFWS and BLM to identify areas that will be avoided during construction. Occupied habitat (current and historic) will be flagged and construction activities will be prohibited in these areas. Impacts to SRC individuals from construction equipment will be minimized by avoiding SRC occupied habitat, although there is the potential for impacts to undiscovered individuals.

Elevated dust levels during construction may negatively affect the photosynthesis, respiration, and/or transpiration mechanisms of SRCs. No individuals are expected to die from fugitive dust; however, high levels of dust may temporarily lower the productivity of SRCs because of smothering impacts and/or avoidance by pollinators. Dust impacts would be minimized by prohibiting excavation within 300 feet of SRCs during the flowering period, although there is the potential for impacts to undiscovered individuals. Elevated dust levels would return to pre-construction conditions once the project is complete.

Approximately 86.8 acres of SRC suitable habitat may be lost/destroyed during the excavation of borrow material. It is unlikely that all of the borrow areas would be needed for the proposed action; therefore, it is not expected that all 86.8 acres of SRC suitable habitat in the borrow areas would be affected.
Direct Impacts – Operation and Maintenance

A new high water level for the reservoir would be established as a result of the dam’s new auxiliary spillway elevation. An additional 28.8 acres surrounding the existing high water level would be periodically inundated, and the maximum size of the reservoir would increase from 438.0 acres to 466.8 acres. Approximately 24.5 acres of the new inundated area is SRC suitable habitat (Mancos formation), and approximately 3.66 acres of such is occupied by SRCs.

Operation of the rehabilitated dam would adversely affect 24.5 acres of SRC suitable habitat and 3.66 acres of occupied habitat as a result of inundation. Surveys discovered 44 SRCs below the new high water level, and it is anticipated that these individuals would die (based on habitat alteration) if not translocated. See Map 5 – Appendix A. Translocating these SRCs as part of mitigation could also result in death or stress to individuals. Protocols established by USFWS will be used to increase translocation success; however, not all translocated SRC individuals are expected to survive and reproduce.

Please note that an analysis of the reservoir’s new high water level (as projected by a Geographic Information System) revealed minor topographic alignment issues. Specifically, the new high water level on the north side of the reservoir is slightly skewed due to steeper slopes. This skewed reservoir level results in the inclusion of additional SRCs that would be directly affected (i.e., inundated) by the proposed action. These additional SRCs are included in the 44 individuals discussed above.

Indirect Impacts – Construction

SRCs located beyond the project footprint may be negatively affected as a result of fugitive dust during construction. As discussed above, elevated dust levels during construction could negatively affect the photosynthesis, respiration, and/or transpiration mechanisms of SRCs. No individuals are expected to die.
from indirect impacts associated with fugitive dust; however, high levels of dust may temporarily lower the productivity of adjacent SRCs because of smothering impacts and/or avoidance by pollinators.

For the purpose of this BA, it has been determined that SRCs (and their pollinators) located within 300 feet of borrow areas would be indirectly affected by elevated dust levels during construction. Approximately 6.31 acres of SRC occupied habitat (87 individuals) in Group F are located within 300 feet of Borrow Area 6A and would be adversely affected by dust during construction.

Fugitive dust impacts would be minimized by prohibiting excavation within 300 feet of SRCs during the flowering period. Elevated dust levels would return to pre-construction conditions once the project is complete.

Invasive plants may be introduced into the action area by seeds on equipment or in fill material. Invasive plant seeds (introduced and existing) may be spread during clearing and grubbing activities. Short-term landscape conditions in disturbed areas would be favorable for annual weeds until plants in the seed-mix are established. Indirect impacts that occur as a result of invasive plants following construction are not expected to adversely affect SRC individuals or suitable habitat based on adherence to conservation measures 4, 5, and 11.

**Indirect Impacts – Operation and Maintenance**

SRCs adjacent to the new high water level would likely be killed/stressed based on a potential increase in soil moisture or exposure to surface water during periods when the reservoir is filled. This impact on SRCs is expected to occur from soil-wicking and/or potential wave-action that affects areas above the new high water level during high wind events.

SRCs adjacent to the new high water level may be adversely affected as a result of competition from vegetation that is more tolerant of the additional soil moisture. The forested and scrub-shrub communities that surround the reservoir are expected to expand as a result of the new reservoir level. This would result in encroachment into areas where SRCs are known to occur and may lead to death or stress of individuals.

Certain areas of the reservoir’s existing high water level are buried with large quantities of woody debris. It is likely that the same scenario would occur in areas near the new high water level, and SRCs which are adjacent to the new high water level may be killed/stressed by the deposition of woody debris.

Recreational activities may also adversely affect SRCs (i.e., trampling, crushing) as a result of people relocating campsites and associated access routes because of the new high water level. Furthermore, existing OHV trails that are located near or below the reservoir’s new high water level may shift in the future and encroach into areas where SRCs are known to occur.

**Indirect Impact Buffer**

Survey results revealed that the nearest SRCs to the reservoir’s existing high water level are generally at least 10 linear feet away. Therefore it is anticipated that this is the approximate distance surrounding the new high water level where SRCs would not be found in the future as a result of habitat alterations and recreational activities (discussed above). This distance was used to establish an indirect impact buffer area surrounding the new high water level in order to identify SRC individuals and habitat that may be affected over the course of time.

The indirect buffer for this BA is 12.0 acres in size and contains approximately 11.45 acres of SRC suitable habitat. Surveys in the buffer discovered 55 individuals and approximately 1.24 acres of occupied habitat.
5.2 Critical Habitat

The proposed action would have no direct or indirect impact on critical habitat.

5.3 Interrelated and Interdependent Actions

An interrelated action is the Ferron Canal and Reservoir Company’s Millsite Reservoir Dredging Project. This project is an annual sediment removal activity that disposes excess material from the reservoir area into storage sites or Ferron Creek (when the auxiliary spillway is flowing). It is needed to maintain the sediment storage capacity and thus extend the life of the reservoir in conjunction with the proposed action. The project received USFWS concurrence on October 17, 2014 and October 21, 2015; furthermore, U.S. Army Corps of Engineers authorization was issued for the project on September 28, 2015.

5.4 Cumulative Effects

Future state and private actions were considered in analyzing cumulative effects of the project on SRCs. Currently, there are no plans to expand Millsite State Park or Millsite Golf Course. Millsite Golf Course will be restored following construction and the activity is included in the proposed action. There are no known projects planned that will require borrow material from the existing gravel pits in the action area. Furthermore, there are no known state or private projects in Emery County that will affect SRC populations. Based on this information, it has been determined that future state and private actions are not likely to result in additional impacts to SRCs.
5.5 Impacts Summary

The proposed action is not expected to directly impact SRC individuals during construction. Borrow areas have been modified to avoid occupied habitat and pre-construction surveys in borrow areas will provide additional assurance that no SRCs are directly impacted. All borrow sites avoid occupied habitat by at least 300 feet with the exception of Borrow Area 6A. In order to minimize dust impacts on SRCs adjacent to Borrow Area 6A, excavation activities will not occur within 300 feet of occupied habitat during the flowering period. Table 6 below summarizes the group information and the anticipated impacts of the proposed action.

<table>
<thead>
<tr>
<th>Group</th>
<th>SRCs</th>
<th>Occupied Habitat</th>
<th>SRCs</th>
<th>Occupied Habitat</th>
<th>SRCs</th>
<th>Occupied Habitat</th>
<th>SRCs</th>
<th>Occupied Habitat</th>
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<th>Occupied Habitat</th>
<th>SRCs</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>2.27 ac</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1.74 ac</td>
<td>0</td>
<td>1.22 ac</td>
<td>0</td>
<td>1.33 ac</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>77</td>
<td>1.44</td>
<td>26</td>
<td>24</td>
<td>0</td>
<td>0.54</td>
<td>0</td>
<td>0.31</td>
<td>0</td>
<td>0.36</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>151</td>
<td>6.84</td>
<td>8</td>
<td>12</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>0.43</td>
<td>0</td>
<td>0.85</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>57</td>
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In summary, it is anticipated that the proposed action would permanently affect 99 SRCs, 4.90 acres of occupied habitat, and 7.46 acres of suitable habitat (located within 300 feet of occupied habitat). The project is also expected to temporarily affect 87 SRCs and 6.31 acres of occupied habitat during construction activities.

6.0 Mitigation

The proposed action includes conservation measures that avoid and minimize SRC impacts to the greatest extent practicable. In addition to adhering to these commitments, the project will implement the actions below in order to offset the adverse impacts to SRCs identified in this BA.

Translocation

In coordination with USFWS and BLM, a survey will be completed during the SRC flowering period to identify the individuals that will be salvaged and translocated (in accordance with USFWS protocol) prior to being affected by the new high water level. Presently, all SRCs that would be directly affected are on the north side of the reservoir on BLM lands. These individuals will be moved to adjacent areas of SRC habitat on BLM lands that would not be affected by the proposed action. Map 6 in Appendix A identifies four potential mitigation sites (7.4 total acres) on BLM lands where SRCs could be translocated.
The salvaged SRCs may be translocated to a number of areas on BLM lands in order to study their response with regards to planting location (i.e., slope direction/position/angle). The final location of the translocated individuals will be determined in coordination with USFWS and BLM. Translocated individuals will be tagged and monitored for five years by NRCS staff in coordination with USFWS and BLM. These SRCs will be monitored for mortality, emergence, size, flowers, recruitment, etc. A report will be submitted to USFWS and BLM following each monitoring event.

Monitoring

NRCS will complete SRC surveys within 50 feet of the new high water level for five years in order to study the potential indirect impacts associated with the proposed action. SRC abundance and distribution will be analyzed for trends and the findings will be included in the monitoring report discussed above.

Conservation Easement

The following commitments were verbally agreed upon in a September 9, 2016 meeting between the Ferron Canal and Reservoir Company, NRCS, USFWS, and BLM.

The Ferron Canal and Reservoir Company will forfeit development rights on approximately 12.4 acres contained within two parcels in order to preserve occupied habitat and manage the lands for SRC recovery. See Map 6 in Appendix A. These parcels are occupied by SRCs and are directly adjacent to BLM lands that are actively being managed for the recovery of SRCs. Both parcels are currently experiencing high levels of disturbance from unauthorized OHV use and other recreational activities.

The Ferron Canal and Reservoir Company will forfeit development rights in perpetuity by placing a deed restriction on the two parcels with the Emery County Recorder’s Office. This deed restriction is anticipated to be in place by December 31, 2016 and documentation will be sent to USFWS once recorded.

The BLM will provide long-term oversight of the easement and manage the lands in conjunction with adjacent efforts to recover SRCs. The long-term oversight will require that the Ferron Canal and Reservoir Company become signatory to a Memorandum of Understanding (MOU) with BLM. This MOU will document the roles and responsibilities of each party and will identify the specific land management actions to occur over the next 20 years. These land management actions will include, but are not limited to: 1) trespass barricades; 2) trail reclamation/realignment; 3) parking areas; 4) fencing and signage; and 5) weed suppression. A copy of the draft MOU will be submitted to USFWS for comment and approval. It is anticipated that the MOU will be finalized by March 31, 2017. A copy of the final MOU will be sent to USFWS once signed by all parties.

7.0 Conclusion

Based on the information presented above, it has been determined that the proposed action is likely to adversely affect the SRC; furthermore, it has been determined that the proposed action will have no effect on the remaining federally-listed ESA species (including critical habitat) known to occur in Emery County.
References


United States Fish and Wildlife Service (USFWS).


2015. Draft Recovery Plan for Winkler Cactus (Pediocactus winkleri) and San Rafael Cactus (Pediocactus despainii). December 2015.


Utah Department of Natural Resources (UDNR).


APPENDIX A

Millsite Dam Rehabilitation
Biological Assessment
Maps

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<th>Map 1</th>
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<td>Map 2</td>
<td>Project Features</td>
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<tr>
<td>Map 3</td>
<td>SRC Habitat Disturbance</td>
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<tr>
<td>Map 4</td>
<td>SRC Occupied Habitat</td>
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<td>Map 5</td>
<td>SRC Impacts</td>
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<tr>
<td>Map 6</td>
<td>SRC Mitigation</td>
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Millsite Dam Rehabilitation

Project Features

1. Embankment - Downstream Toe: Loose sand and silt materials in the downstream foundation would be excavated and replaced with compacted materials. The toe zone of potentially liquefiable materials would be removed and replaced with compacted material.

2. Embankment - Seismic Protection: The downstream slope would be flattened and a 100 x 300 x 35 berms placed at the downstream toe to improve stability concerns.

3. Embankment - Zone Modification: As part of the downstream work, the downstream slope protection rock would be removed so that a chimney drain (filter and drain zones) can be constructed on the slope and in the foundations to collect seepage through the dam. The slope protection rock will then be replaced on the newly downstream slope.

4. Embankment - Drainage: Pipes would be installed in conjunction with the drain materials to collect and remove seepage through the dam.

5. Embankment - Raise: The dam crest would be raised 4 ft to restore the original reservoir capacity.

6. Principal Spillway Outlet Works: Downstream embankment work would require extending the 54 ft principal spillway by approximately 100 ft. The existing 8 water line (Ferron drinking water) in the outlet works would be replaced.

7. Auxiliary Spillway: The existing concrete spillway would be removed and replaced with a new concrete lift at the weir spillway with the capacity to pass the design flood event (31,000 cubic feet per second).

8. Structure Monitoring: Piezometers, seepage flow weirs, survey monuments, and other necessary instrumentation would be installed to improve long-term monitoring of the dam.

9. Construction Restoration: Wave action protection measures would be installed to protect infrastructure in Millsite State Park and Ferron Canyon Road. Millsite Golf Course holes 1, 2, and 4 would be restored, and all disturbed areas would be revegetated.
Millsite Dam Rehabilitation
SRC Habitat Disturbance

Map 3
SRC Habitat Disturbance
- Dam Work Area (29.0 acres)
- Borrow Areas (174.0 acres)
- Lacks Habitat Requirements (49.0 acres)
- Mineral Excavation (38.2 acres)
- New Reservoir Level (466.8 acres)

Total SRC Suitable Habitat in Borrow Areas = 86.8 acres
Millsite Dam Rehabilitation SRC Impacts

Map 5
SRC Impacts
- Dam Work Area (29.0 acres)
- Borrow Areas (17.4 acres)
- SRC Occupied Habitat (35.9 acres) (629 individuals)
- New Reservoir Level (466.8 acres)

BLM Access Area

Group A (6 SRCs)
4 Direct
1 Indirect

Group B (77 SRCs)
26 Direct
12 Indirect

Group C (151 SRCs)
8 Direct
10 Indirect

Group D (57 SRCs)
6 Direct
10 Indirect

Group E (47 SRCs)
0 Direct
0 Indirect

Group F (101 SRCs)
0 Direct
87 Indirect

Group G (13 SRCs)
0 Direct
0 Indirect

Group H (114 SRCs)
0 Direct
6 Indirect

Group I (202 SRCs)
0 Direct
2 Indirect

Group J (61 SRCs)
0 Direct
0 Indirect

Millsite Dam Rehabilitation Plan/EA
Feb-2017
Appendix -E- Other Supporting Information
**APPENDIX B**

Millsite Dam Rehabilitation
Biological Assessment
Plan Set Figures

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<td>Final Overall Rehabilitation Plan</td>
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<td>Figure 3</td>
<td>Rehabilitation Measures -- Projected Schedule</td>
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<td>Figure 4</td>
<td>Maximum Cross Section</td>
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<td>Figure 5</td>
<td>Auxiliary Spillway Outlet Demolition Items</td>
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<td>Figure 7</td>
<td>Plunge Pool Plan</td>
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<td>Figure 8</td>
<td>Spillway Final Grading Plan View</td>
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<td>Figure 9</td>
<td>Final Spillway Plan View</td>
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Project Rehabilitation Measures – Proposed – Maximum Cross Section

Figure 4
Figure 5

Auxiliary Spillway Outlet

Demolish & Dispose of Existing Powerplant Control Building

Demolish & Dispose of Existing RCM Control Vault See Sheet T1 for Demolition & Salvage Details

Remove & Stockpile Riprap from plunge pool

Remove & Dispose of U/B Manhole

Remove & Dispose of Asphalt Pavement

NOTE

I. Remove and dispose of all utility pipelines from their building or vault to the connection point to the new utility.

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D Emulsion

80% Preliminary Drawings
Plot Date: 11/6/2015

STATE OF UTAH
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Figure 6
Auxiliary Spillway Outlet

NOTE: EXISTING 24" FIBERGLASS WATERLINE IS NOT TO BE CUT. CONTRACTOR TO REMOVE FIBERGLASS WATERLINE TO FIRST JOINT DOWNSTREAM OF DIAMETER BEND. 45° BEND THAT WILL ALLOW SPACE FOR THE ADAPTOR AND OTHER FITTINGS TO BE INSTALLED PROPERLY.

Furnish & Install 24" DI 45° Bend

Vault Piping Plan

Furnish & Install 24" DI 45° Bend

Flush Pool Plan

Furnish & Install 24" DI 22.5° Bend

Install Owner Supplied Shoot and Flanged Fitting and ICM Style 35B Adapter, and Connect to Existing 25" Fiberglass Waterline

Furnish & Install 24" DI 22.5° Bend

Proposed Toe of Dam

Manhole Detail

Furnish & Install 12" DI 45° Bend

Connect to Existing 12" Waterline

Furnish & Install 12" DI 45° Bend

Connect to Existing 12" Waterline

Furnish & Install 24" DI 22.5° Bend

Connect to Existing 24" Waterline

Furnish & Install 12" DI 22.5° Bend

Connect to Existing 12" Waterline

Furnish & Install 15" Solid Drain Pipe

Contractor to verify positive drainage

Furnish & Install 15" Solid Drain Pipe (Extends to Daylight with Constant Slope)

Furnish & Install 15" Solid Drain Pipe

Connect to Existing 6" Waterline

80% Preliminary Drawings
Post Date: 11/08/2015

STATE OF UTAH
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Millsite Dam Rehabilitation
Proposed Work

Auxiliary Spillway Outlet

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FINAL SPILLWAY PLAN VIEW

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SCOPING INFORMATION

Millsite Dam Rehabilitation
Emery County, Utah
SUMMARY COMMENTS AND RESPONSES – SCOPING PROCESS

A Rehabilitation Assessment Report for Millsite Dam was completed by the NRCS in September 2004 which provided the SLO with information relating to the overall condition of the dam and whether or not it would be eligible for rehabilitation. The structure was eligible and the SLO requested assistance from NRCS to help them meet the current Dam Safety and performance criteria for Millsite Dam.

The SLO and NRCS held multiple public meetings to receive input and discuss Project alternatives and update on the technical investigation progress. The meetings held and summary comments received are listed below.

- **September 5, 2003** – SLO meeting at Ferron City Hall, Ferron, Utah. Rehabilitation Program on the Board’s agenda. Discussed sedimentation in Millsite Dam reservoir. Discussed progress of the rehabilitation assessment report. Discussed evaluation of upper watershed.

- **January 11, 2006** – Joint public and SLO meeting, Ferron City Hall, Ferron, Utah. The objective was for NRCS State Office to explain the rehabilitation program to the SLO and other attendees and cover the process required to develop a Rehabilitation Plan/EA. There were twenty-two attendees including representatives from the U.S. Bureau of Reclamation, State Division of Wildlife Habitat, Utah State Parks, Utah Division of Water Rights, Utah Division of Water Quality, Emery County, USFS, and Emery County Public Lands.
  - The agenda covered in this meeting included:
  - **Next Steps:** Agency meetings to get input/comments on rehab – concerns, impacts etc.; Initiate Reservoir Sediment Survey; Set time for public participation (open house) to get input, comments, concerns, resource needs from the public, ID alternatives for Rehab: 4 alternatives are mandated for the EA, Start to assemble parts/sections of a Draft EA document where possible.

- **September 15, 2006** – Regular meeting of the Utah State Water Resources Board. Presentation about the NRCS Rehabilitation Program and Millsite Dam rehabilitation planning progress to the Board and gather any comments, concerns from the Board. The board is responsible for promoting the orderly and timely planning, conservation, development, utilization, and protection of Utah’s water resources and to enhance the quality of life for the citizens of the state. The Board supported the efforts to rehabilitate Millsite Dam to meet current Engineering Design criteria.

- **December 14, 2006** – Agency Scoping meeting held at Murray NRCS office in Salt Lake County, which is close proximity to several agencies. A powerpoint presentation was given to explain the Rehabilitation Program, Existing Conditions at the Dam, and preliminary alternatives to rehab the dam to meet the current Engineering Design criteria. Nineteen people were in attendance including 4 from NRCS, 4 from PacifiCorp, Utah Division of Water Quality, U.S. Fish and Wildlife (USFWS), U.S. Bureau of Land Management (BLM), San Rafael Soil Conservation District, Brigham Young University, State Dam Safety Office and State Division of Water Resources.
  - Questions revolved around potential alternatives for the auxiliary spillway and what dimensions
were needed to pass the Probable Maximum Precipitation (PMP) event. Discussed Roller Compacted Concrete (RCC) spillway alternative that would be positioned over the right side of the embankment (looking downstream). Questions about estimated cost for rehabilitation. Response to this item involved investigating numerous feasible options for an updated auxiliary spillway, along with cost estimates for the options. These options are discussed briefly in the Plan/EA, section 4.2.

- **February 21, 2007** – Public Scoping open house meeting at Ferron City Hall, Ferron, Utah. Hosted by the SLO. Forty-three people attended the meeting including 6 from NRCS. The meeting format included an initial open house to give attendees a chance to view displays and other information about the Project. A formal presentation was given by the SLO and NRCS later to explain existing conditions, investigation results to date and summarize the alternatives considered. A tri-fold brochure summarizing the Project was disseminated at the meeting. A comment space was available on the tri-fold if an attendee wanted to comment later and send to the SLO or NRCS. Comment forms were also made available at the meeting.

Questions were asked concerning availability of funding for the project and what would the timeline look like. Some residents and the City were concerned about Golf Course operations and the upcoming additional 9 holes that were in the design phase. Questions about the earthquake hazard to the dam and what would be done to investigate that further and the possible fixes. There was concern expressed about sediment in the dam and losing water storage capacity. Question about auxiliary spillway flows during snowmelt runoff and whether or not that will continue. Runoff provides some flow downstream into Ferron Creek that provides some wildlife habitat.

All of these items are covered in the Plan/EA and information was used in the evaluation of the various alternatives.

- **November 10, 2011** – Public open house at Ferron City Hall, Ferron, Utah. Hosted by the SLO. The format included a background and update presentation by NRCS and the Utah Division of Water Resources to summarize the extensive investigation work completed since the last public meeting which has facilitated the development of the rehabilitation design and a preferred alternative that will meet the purpose and need for the project. The overall projected costs (and cost-share) for the proposed rehab alternative to meet dam safety and performance criteria were presented. Time was afforded for questions from the attendees. There were questions referring to the sponsors 35% cost-share in relation to what the State of Utah may be able to contribute toward the sponsors’ share of the project. Other comments related to evaluating the use of the sediment in the reservoir for appropriate use in the rehabilitation (potential to be reviewed during the remaining design process). Thirty-nine (39) were in attendance.

The responses to the questions are covered in the Plan/EA showing the cost-share breakdown for the proposed alternative for rehabilitation of the structure to meet the current high hazard class engineering and performance criteria. The use of a portion of the sediment in the reservoir may be used in the construction of the seismic stability berm on the downstream face of the dam. A final determination will be made in the final engineering design process for the proposed rehabilitation elements.
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Final - Millsite Dam Rehabilitation Plan/EA
Appendix - E - Supporting Docs
### Millsite Dam Rehabilitation – Meeting/Update/Scoping
**November 10, 2011**
**Ferron, Utah City Hall**

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<td>Kent Peterson</td>
<td>Ferron Corp</td>
<td>P.O. Box 935</td>
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<td>Kyle Singleton</td>
<td>Ferron Corp</td>
<td>Box 569</td>
<td>749-3527</td>
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<td>Joe Treacy</td>
<td>Ferron City</td>
<td>306-910</td>
<td>749-2021</td>
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<td>Bruce Fish</td>
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<td>Box 193</td>
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<td>Wayne Urie</td>
<td>NRCS</td>
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<td>Rusty J. Oakeson</td>
<td>Ferron City</td>
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<td>Gary Allred</td>
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<td>Chad Anderson</td>
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<td>Linda Hambrowan</td>
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<td>Michael Reder</td>
<td>Ferron City</td>
<td>Box 237</td>
<td>351-3504</td>
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<td>Scott Black</td>
<td>Fortran</td>
<td>Box 3</td>
<td>384-3924</td>
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<tr>
<td>Michelle Miller</td>
<td>Ferron City</td>
<td>Box 72, Ferron Wk</td>
<td>394-3455</td>
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- Presented Preferred Alternative: $24,718,000 @ 65% WAC = $15,715,700
- Comments Summary:
  - Road becoming need #3 raise/lake 945.00 = $9,039,185
  - 40th lane access E. of #3 construction 495.00 = $423,115
  - Use material in pool if possible planed and stronger material
  - Gate Valve intake
  - Outlet pipe will have thickness for potential problems (next-related)
  - Water release? Same as before upstream to downstream Road = ok
  - Local paper reported attending to get story for record
  - Handout pamphlet with all info

(2 of 2)
A Rehabilitation Plan/Environmental Assessment (EA) is required as part of NRCS's Watershed Rehabilitation Program to meet requirements of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190). The Draft Plan/EA will be ready for public review in the coming months following internal NRCS reviews. If you wish to receive an electronic copy of the Draft Plan/EA, please contact Norm Evenstad, NRCS. Contact information is listed at the end of this pamphlet.

Alternatives Considered

1. No Action: Sponsors continue to operate and maintain Millsite Dam. Eventually leads to decommissioning of the dam due to dam safety standards not being met.

2. Rehab Alternative: Rehab/modify the dam to meet the current dam safety performance standards.

A number of alternatives have been evaluated since the planning and investigation phase started in 2006. Three separate drilling programs were needed to adequately assess the foundation of the dam for seismic (earthquake) risk and to determine feasible rehabilitation design elements.

A preferred alternative has been identified considering the time needed for safe construction and to minimize the impact to shareholders and other stakeholders while the dam is under construction. This alternative is summarized on the front cover of this pamphlet.

3. Decommission Alternative: Designed removal of the embankment in accordance with established NRCS standards. Would eliminate the catastrophic flood hazard associated with a potential failure of the dam and restore the geomorphology of stream channel.

Note: Input from the public is solicited and required under NRCS watershed planning policy. Please let us know if you have concerns, or comments relating to the proposed rehabilitation of Millsite Dam.

Please indicate below any concerns or comments relating to the proposed rehabilitation work at Millsite Dam.

Name
Address
Phone
Email

Send written or electronic comments to:
Norm Evenstad, Water Resources Coordinator
USDA-NRCS
Wallace F. Bennett Federal Building
125 S State Street, Room 4418
Salt Lake City, UT 84138-1100
Phone: 801-524-4569
Fax: 801-524-4598
Email: norm.evenstad@ut.usda.gov
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November 2011

NRCS
United States Department of Agriculture

Final - Millsite Dam Rehabilitation Plan/EA
Feb-2017

Appendix -E- Other Supporting Information 69
NEWS RELEASE

For Immediate Release

Millsite Dam Rehabilitation – Geologic Investigation & Planning Continue

The geologic investigation and planning for the rehabilitation of Millsite Dam has resumed with recent funding through the Natural Resources Conservation Service (NRCS)-Watershed Rehabilitation Program. The NRCS recently signed a cooperative agreement with the Utah Division of Water Resources to complete the geologic investigation and evaluate rehabilitation alternatives so that the dam meets current dam safety and engineering performance criteria.

Some of the issues that must be addressed for these aging projects include:

- Replacing deteriorating components.
- Dealing with unanticipated urban development below or near dams, which increases the potential for loss of life and increased property development.
- Dealing with sediment that has accumulated in reservoirs to the point that the dams can no longer properly function.
- Upgrades to meet current state dam safety regulations.
- Meeting natural resource needs not previously addressed, such as water quality, wetland restoration and wildlife habitat.

The 35 year old multi-purpose dam located just upstream of the town of Ferron, Utah was constructed for irrigation, flood prevention, sediment control for rural agricultural land, municipal and industrial use as well as recreation. “Because of the age and condition of the dam and the changes in safety and performance criteria, we have asked for assistance from NRCS in rehabilitating the dam to ensure it remains safe and continues to function as it was designed,” said Roger Barton, District Board Chairperson. The dam was designed for a 100-year lifespan and has provided irrigation storage, flood protection and recreation for 35 years, but now updates are needed to bring the structure into full compliance with State Dam Safety and NRCS safety and performance criteria.
The NRCS will soon begin looking at alternatives and developing a rehabilitation plan. Landowners and others who are involved or affected by the project will have an opportunity to provide input into the plan. Rehabilitation alternatives can include removal of the dam or combinations of several other options such as replacement of concrete and metal components of the principal spillway, increasing the height of the dam and width of the auxiliary spillway, and other options depending on conditions of the dam and what is located downstream.

The Millsite Dam is one of 10 dams built in the Ferron Watershed. These 10 dams provide an estimated $3,000,000 in annual benefits. This is Utah’s first rehabilitation project initiated through the Watershed Rehabilitation Amendment to the Watershed Protection and Flood Prevention Act (PL-83-566). The Act authorizes the USDA-NRCS to work with local communities and watershed project sponsors to address public health and safety concerns and potential adverse impacts of aging dams. If the plan is approved NRCS can provide sixty-five percent of the funding for rehabilitation and the other thirty-five percent of the funding will come from state and/or local appropriated funds.

-End-
Dear Sylvia;

This letter is in response to your inquiry dated August 24, 2010, regarding the Ferron Watershed – Millsite Dam Rehabilitation Plan. This letter is to confirm that the Ferron/Price Ranger District of the Manti-La Sal National Forest agrees to be a cooperating agency for the Ferron Watershed – Millsite Dam Rehabilitation project.

Please let us know how we can be of further assistance. We look forward to working with you in the future. If you have any further questions please contact me at (435) 636-3586.

Sincerely,

DARREN OLSEN
District Ranger
NEWS RELEASE

For Immediate Release

Millsite Dam Rehabilitation – Geologic Investigation & Planning Continue

The geologic investigation and planning for the rehabilitation of Millsite Dam has resumed with recent funding through the Natural Resources Conservation Service (NRCS) Watershed Rehabilitation Program. The NRCS recently signed a cooperative agreement with the Utah Division of Water Resources to complete the engineering design and evaluate feasible rehabilitation alternatives to upgrade the dam to meet current dam safety and engineering performance criteria.

Some of the issues that must be addressed for rehabilitation of aging dams include:

- Replacing deteriorating components.
- Dealing with unanticipated urban development below or near dams, which increases the potential for loss of life and increased property development.
- Dealing with sediment that has accumulated in reservoirs to the point that the dams can no longer properly function.
- Upgrades to meet current state dam safety regulations.
- Meeting natural resource needs not previously addressed, such as water quality, wetland restoration and wildlife habitat.

The 39 year old multi-purpose dam located about 2.5 miles west of Ferron was constructed for irrigation, flood prevention, sediment control for rural agricultural land, municipal and industrial use as well as recreation. The dam was designed for a 100-year lifespan and has provided irrigation storage, flood protection and recreation for 39 years, but now updates are needed to bring the structure into full compliance with State Dam Safety and NRCS safety and performance criteria.

Rehabilitation alternatives can include combinations of several options such as replacement of concrete and metal components of the principal spillway, increasing the height of the dam and width of the auxiliary spillway, and other options depending on conditions of the dam and what is located downstream.

The Millsite Dam is one of 10 dams built in the Ferron Watershed. These 10 dams provide an estimated $3,000,000 in annual benefits. This is Utah’s first rehabilitation project initiated through USDA’s Watershed Rehabilitation Amendment to the Watershed Protection and Flood Prevention Act (PL-83-566). The Act authorizes the NRCS to work with local communities and watershed project sponsors to address public health and safety concerns and potential adverse impacts of aging dams. If the plan is approved, NRCS can provide 65% of the funding for rehabilitation and the other 35% of the funding will come from
state and/or local appropriated funds. For more information, please contact Bronson Smart, NRCS, State Conservation Engineer (801) 524-4559 or Norm Evenstad, NRCS, Water Resources Coordinator (801) 524-4569.

Geo-technical drilling operations at the toe of Millsite Dam, October 2009.

Photo by NRCS-Utah
Summary of Work Accomplished during FY2006

- 2 Meetings with Sponsors to identify problems, issues
- News Article to local paper announcing funding, intent for rehab planning
- Letters to local, state and federal leaders announcing funding and rehab planning intent
- Archaeologic Studies for area around the Dam: $6,250 + $3,200 = $9,450 - Complete
- Acoustic Reservoir Sediment Survey: $12,050 Agreement w/BOR - Complete
  - NRCS Completed Topographic modeling work to determine original pool topography and existing pool topography to determine reservoir sediment volume (2600 ac-ft)
- Reservoir Sediment Sampling Testing for Contaminants: Sampling Complete; Testing is underway
- Submerged Riser Tower Inspection - Dive Team Agreement w/BOR - Scheduled for Nov 7th.
- Breach Routing/Inundation Mapping Complete
- PMP Study/Watershed Hydrology Complete
- T&E Species review underway
- Topographic Survey of the Dam, Pool Area Complete
- X-Sections of Outlet Channel Complete
- National Water Management Center Staff – Site Visit and Plan input
- Input of original test pit and drill hole logs into Geologic graphing/x-section software package
- Seismic evaluation of existing structure to establish acceleration values, fault analysis
- Review of Phase II Study completed by Rollins-Brown-Gunnell Consulting Engineers
- 2 Meetings conducted with Utah State Dam Safety personnel on hydrology & coordination
- Presentation of Rehab Program and Millsite Rehab Planning to the Utah Water Resources Board
- Presentation to the San Rafael SCD Board about Rehab Program and Millsite Planning efforts
- Dam Embankment Seepage model developed. Existing Chimney drain evaluated for adequacy
- Alternatives of raising the dam and the auxiliary spillway to provide at least another 50 years of sediment is currently underway
- Draft Plan document is underway – Inter-Agency meeting planned for Nov 29 to discuss issues, problems, alternatives.
- Consultation with Regional Design Team on alternative design feasibility
FY2007 Update:

- Gathering of Resource information continued in FY2007 including:
  - Hydrology, breach inundation maps finalized
  - Dive Inspection of the submerged Riser/Intake Tower – Condition OK
  - Review of Geology, Original Drill Logs
  - Geotechnical drilling agreement established with the Bureau of Reclamation (BOR) to determine seismic and liquefaction hazard at the dam
  - Biological Assessment – Bat inventory near right abutment
  - Economic Data gathered for alternative analysis
  - Evaluation of Alternative Rehab measures:
    1) Roller Compacted Concrete (RCC) Spillway over the crest of the Dam to provide the needed extra hydrologic capacity – various options evaluated to give the minimum additional 50-yr sediment capacity as required through the Rehab Program – Cost approximately $7.8 million for the preferred RCC option. After further review of this option, NRCS specialists determined this option was too high of risk given the seismic potential at the site
    2) Left Abutment Spillway – evaluated for feasibility – not feasible due to abutment material conditions and the extensive excavation needed in addition to Public Lands issues: Cost approximately $25 million for this alternative
    3) Right Abutment – not considered early in the planning process due to impacts to the existing and planned holes of the Golf Course
  - Public Meeting: February 21, 2007 – Presented RCC spillway options to the public at Ferron City Hall – no significant comments or major concerns with an RCC spillway over the crest of the dam. Impacts to the Golf Course were still concern, but no major objections.
  - Further Review of RCC alternative by NRCS technical specialists: after site visit to Millsite Dam, it was determined that a lower risk alternative was to look closer at the Right Abutment for the additional spillway to meet the hydrologic capacity needs for dam safety
  - Right Abutment and Left Abutment spillway alternatives were evaluated closer for technical, economic and environmental feasibility. Right Abutment area is determined to be the preferred alternative to address the hydrologic deficiency of the dam.
  - Drilling Plan Agreement – finalized – to be done in November 2007 by the BOR – focus for gathering this information is to determine the liquefaction hazard/risk to the dam. Holes to be completed at the downstream toe of the dam as the first priority. Second priority for drilling will be for 2 holes at the right abutment area to gather spillway rock/soil data
  - Meeting August 23, 2007 with Sponsors: Ferron City, Irrigation Co, others to discuss/inform about the Right Abutment Spillway alternative – at Ferron City Hall
  - Sponsors make contact with BLM regarding Land Rights at the Right Abutment: Easements held by the Ferron Canal Co. (U-432) for construction, operation-maintenance of Millsite Dam; Ferron City (U-54668) for operation & maintenance of the Millsite Golf Course. Questions regarding approvals/permits for drilling and the proposed new auxiliary spillway are being addressed through the Sponsors who are responsible for securing land rights regarding Rehabilitation of Millsite Dam
  - NRCS State Office: Sept 7, 2007 - Meeting with Sponsors, Ferron City (Golf Course Rep), PacifiCorp Rep about Right Abutment alternative, more details discussed. Golf Course impacts discussed
March 5, 2007

Maurice W. Anderson
P.O. Box 775
300 N. 140 W.
Ferron, Utah 84523

We have received your comments regarding the rehabilitation of Millsite Dam in Emery County, Utah. Thank you for your interest and concern and taking the time to inform us.

We will consider your comments as we move forward with the rehabilitation plan for Millsite Dam. We understand that recreation in the area is an important resource for the community and we will carefully weigh the impacts of the Millsite Dam rehabilitation on the Millsite Golf Course operations.

Regards,

NORM EVENSTAD, PG
Water Resources Coordinator
The Daggett Soil Conservation District reviewed the proposed rehabilitation correspondence concerning the Millsite Dam during its regular meeting on January 10th, 2007. The District supports any rehabilitation efforts that are needed to bring the dam to a safe and healthy status.

Carol Gardiner, Chairperson
Daggett SCD - Manila, UT

Talk now to your Hotmail contacts with Windows Live Messenger.
http://get.live.com/messenger/overview
FY2007 Update:

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  - Dive Inspection of the submerged Riser/Intake Tower – Condition OK
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  - NRCS State Office: Sept 7, 2007 - Meeting with Sponsors, Ferron City (Golf Course Rep), PacifiCorp Rep about Right Abutment alternative, more details discussed. Golf Course impacts discussed
Tracy Behling welcomed everyone to the meeting. Encouraged everyone to sign in and fill out the comments sheets. Eric Fleming introduced all NRCS employees in attendance.

Tracy Behling stated the canal company has asked for assistance through NRCS to upgrade the dam to meet current safety and performance standards. They must follow and have been following dam safety criteria.

Norm Evenstad gave a PowerPoint presentation overview of the Watershed Rehab Program and discussed the various alternatives for rehab of the dam. Discussed why we (NRCS) are here. Discussed the safety standards from Dam Safety that must be met. Discussed how the watershed program created 11,000 dams nationwide. The intent of the rehab program is to provide assistance to watershed sponsors to evaluate dams built under the USDA - PL-566 Watershed Program and determine the needs for upgrading the dam/s. This is done in coordination with the Utah State Dam Safety office.

Millsite is classified as a Class C (high hazard) dam that needs upgrades to meet current dam safety criteria. Discussed how this project has been looked at locally since 2001 (mostly in regards to the reservoir sediment issue). Discussed the needs of the sponsor for upkeep and maintenance of the dam in order to be eligible for Rehab funds. We are in the planning phase of the project at the moment. Millsite is a Class C structure. Class C structure hazard classification means "failure leads to loss of life typically in homes, businesses or vehicles – need to consider depth of water at downstream locations with a
breach." Gave an overview of rehab planning. Discussed different alternatives: no action, decommission of the dam, rehab, etc.

Utah has 43 dams built under USDA’s Small Watershed Program (PL-566) with 27 in the high hazard classification.

A 65% cost-share can come through USDA’s Watershed Rehab Program. The remaining (35%) can come from non-federal sources.

Showed pictures of Millsite Dam. Showed the debris basins that are on the map. Showed how the golf course is below the dam and the state park is adjacent to the reservoir. Summarized the dam stats: Class C (large, high hazard dam), zone embankment (structural height of 115 feet), crest (4,150 feet), total storage (18,000 acre-feet, 435 acres), sediment storage (5,800 acre-feet), conservation pool (2,000 acre-feet), outlet pipe (54 inch diameter steel welded pipe).

Showed a picture of the auxiliary spillway. Explained how the spillway works. Showed how soil is eroding around the bottom of the spillway. There has been some treatment done to slow the erosion. Currently 12,000 CFS flows through the spillway. Flow needed now is 30,000 to 40,000 CFS to meet the current safety criteria. Discussed whether we should rebuild the original spillway and/or create a new one.

Discussed sediment deposition in the reservoir. The sediment yield comes from the upper watershed. Some treatments have been done to help retard the overland flow and keep the sediment in place and out of the reservoir. With the rehab program the minimum work we can do is a 50-year extension of the life of the dam. Possibilities include excavation, raising the auxiliary spillway, adding another auxiliary spillway to accommodate the extra flow. A sediment survey was completed in June. The current sediment level of the reservoir is 2,600 acre-feet, which is a 74 acre-feet per year average over 35 years since the dam was built. Discussed (relatively) the principal erosion/sediment sources in the upper watershed.

Mentioned USFS’s preliminary qualitative survey of the upper watershed which included relative rankings by each sub-basin for: most sediment, worst groundcover, most active roads, and most problematic grazing to creative a relative rank.

Discussed the safety implications: auxiliary/emergency spillway capacity, seismic and whether the structure can handle a 7.0 earthquake, riser intake tower stability during an earthquake. A dive team contracted through the Bureau of Reclamation performed an underwater inspection of the concrete riser (intake tower). Photos were taken for documentation of the riser condition. The final report of the riser inspection is due shortly.

Discussed breaching the dam. Discussed the eligible purposes besides flood prevention: recreation, fish and wildlife development, water quality management, agricultural water management, groundwater recharge (not cost-shared), conservation and proper utilization of land, municipal and industrial water supply. Many items were already written into the original plan.

Discussed the rehab planning effort and what it includes. Discussed historical artifacts (cultural resources). A cultural resources survey and final report based on the proposed undertaking in the area has been approved and concurred upon by the Utah State Historical Preservation Office (SHPO). There will be no impact on cultural resources as per the current proposed work/undertaking for rehab of Millsite Dam.
The eventual Rehab Plan will be a supplement to the original Ferron Watershed work plan developed in the 1960's. Discussed land rights and permitting. Discussed the emergency action plan that must be completed for the dam. Discussed slide of the different phases of rehab progress. We are in between Phase 2 and 3.

Discussed alternatives:

1. **No action** - Summarized no action and discussed the risk if no action is taken. Eventually lead to action through Utah Dam Safety for the sponsors to upgrade the dam to meet current safety criteria or breach the dam.

2. **Decommission** - Need to look at what the community is losing if the dam is decommissioned. Flood, irrigation, recreation, social...etc...benefits lost with this alternative. The drainage corridor/geomorphology would be returned to its original condition. Need to account for sediment delivery downstream.

   Cost for Decommission – general estimate is forthcoming- not available at time of meeting

3a **Rehab Option 1** – Raise existing auxiliary spillway 1.0 feet with no crest and an additional 1,320 feet of Roller Compacted Concrete (RCC) auxiliary spillway over the top of the dam.

   Cost is $9,300,000 and provides 50 years of additional sediment storage.

3b **Rehab Option 2** – Raise existing spillway 2.5 feet with no crest raise - and an additional 680 feet of RCC auxiliary spillway over the top of the dam.

   Cost is $15,800,000 and will provide 100 years of additional sediment storage.

3c **Rehab Option 3** – Raise existing spillway and crest 2.5 feet - and an additional 500 feet of RCC auxiliary spillway over the top of the dam.

   Cost is $7,800,000 and will provide 100 years of additional sediment storage

3d **Rehab Option 4** – Raise the auxiliary spillway and dam crest 7.0 feet

   Cost is $9,900,000 and will provide an additional 100 years of sediment storage and an additional 2,000 acre-feet of water storage. The additional water storage cost will be covered by the sponsor 100 percent.

   Sediment excavation will cost $51,126,000 to dredge and haul the soil away.

Alternative 1 – No Action
- Leave as is
- Will still need to be updated as per state Dam Safety criteria
- Risk during PMP (probable maximum precipitation) event
- O&M (operation and maintenance) still continues
- Sediment continues to fill reservoir

Alternative 2 – Decommission
- Dam is taken out of service - breached
- Drainage corridor is returned to pre-dam condition – geomorphology, etc.
- Usually not feasible – not acceptable to sponsors and community
- Community will need to find new water source

Discussed the new auxiliary spillway. Option 1 is the least we can do. Showed a cross-section of the spillway and how it will work. The original spillway will be used most of the time. The concrete will protect the face of the dam. Showed an example of what the spillway would look like. Discussed Option 2. Option 3 is the favored option with dam crest of 2.5 feet list. The dam itself would not be raised, but a wall would be placed above the dam. There is no impact on the state park with Option 3. The golf course would be impacted during construction. Option 4 is another concrete structure on top of the dam to raise the height. Will have 2,000 acre-feet extra storage. Option 4 will cost extra and must
be handled by the sponsors. NRCS can go up to 100-years sediment storage. Option 3 is the most economical even if it's not the minimal NRCS should do. Would need to provide more embankment on the west side of the auxiliary spillway. Nate Anderson discussed the difference between permanent sediment storage and temporary storage.

Showed a 3D video of what would happen if the dam breached during a catastrophe. Showed where the water would flow. Showed a 3D view of the terrain and how the water would flow. Discussed what the dam could handle.

Question (Q): How fast would the dam fail? How many hours would it take?
Answer (A): Nate Anderson explained it would take a few hours if the dam were overtopped. If the reservoir were completely full, approximately 82,000 CFS would come over the dam.

Q: Discussed a retrofit cement spillway up in Idaho and what it looked like.
A: Eric Fleming explained how the RCC spillway will look and how it will be built. It will look like 2 by 2 foot steps up the dam.

Q: If the spillway has to pass 30-40 CFS and the dam holds 15, where do we get the 82,000 CFS?
A: The 82,000 would be a complete breach. The breach is theoretical worst case scenario if something happened to the dam. It is a safety requirement to look at but not to upgrade the dam.

Q: When Dam Safety came into being (after Quail Creek), there are a new set of numbers in the criteria. Is there state money and grants to help with the 35% cost share?
A: NRCS cannot speak for the state. Working with Dam Safety on this project. There is a possibility that they (local) could work with Dam Safety on funding.

Q: Can you make the spillway bigger and raise it, what about the earthquake problem.
A: Will continue to look at the earthquake issue.

Q: There is no problem with the dam if an earthquake hit.
A: The existing dam is fine. Running more inventories if the auxiliary spillway changes the flow.

Q: RB&G did a seismic review and the dam would settle 2 feet during an earthquake. Dam Safety is looking into this.
A: NRCS has another design team that is also looking into the structure and what else could be done.

Q: If you went with Option 3, what is the construction time line? How long would the golf course be affected?
A: The time line has not been generated yet. It would take a minimum of a year. Other alternatives up to 2 years.

Q: Is the relocation added into the figure of the options?
A: No, would have to look at easements of the structure. The canal company owns the land below the dam. The city has a lease with the canal company.

NEW OPTION SUGGESTED: Discussed moving the spillway more in line with the old channel (other end of dam). The hill would have to be taken out. Explained how half the mountain
would be affected. It was suggested to look at going through the canyon. **Look at this as an option.**

**Q:** What is the timeline on starting this project?

**A:** Looking to finish the plan by the end of September. We must go through a number of channels and approvals by the public, agencies, etc. Next year would be the final design phase and detailing the option chosen. The following year would be construction (2009).

**Q:** How can we stop the sediment from coming in?

**A:** Treatments on the upper watershed have been done in the past as part of the original watershed work plan. Treatments are aging and protection is probably not as good as it once was. A lot of treatment has been done. Forest Service has provided diversions, installed terraces, etc. The city has also done work at the top of the watershed. There are some things that can be.

Could look at approaches to bypass sediment around the reservoir. Could look at sluicing sediment from the reservoir – matching the inflow of sediment with the outflow of sediment. Right now, water spilling over the spillway when it runs in the spring is clean (implying the inflow of sediment from Ferron Creek is depositing in the reservoir).

Norm Evenstad introduced Dr. Hotchkiss, BYU. NRCS’s main issue is the safety of the dam and viability of the structure for 100 years. Sediment is a part of that, but mostly from the perspective of ensuring that there’s at least 50 to 100 years of additional sediment storage as part of the rehab plan/design.

**Q:** Is your criteria different than the state’s (Dam Safety)?

**A:** There are differences, but we would take the more stringent criteria. We are working closely with Dam Safety and are in pretty close agreement.

**Q:** Can the sediment committee tie a feasibility study to this project?

**A:** We are not prepared to do this at this time, but could do it later.

**Q:** Tracy Behling stated the dam is opened up in the spring and it pulls sediment. They are cautious because of fish and wildlife, etc., to balance the sediment.

**A:** Could be addressed in the operation and maintenance plan to operate the structure the way you need to.

**Q:** Is the operation and maintenance plan being done with this plan?

**A:** An operation and maintenance plan will be redone. There is a current one in place.

Discussed concerns with discharge in a major event.

**Q:** Has anyone calculated sediment storage from different flooding?

**A:** A study is being done around the country with stream gages to look at flows.

**Q:** Asked about the rocks in the streambank along the highway? Is it for sediment control?

**A:** Is probably a highway project.

Three or four years ago, a USFS person from Denver toured the area and noted that most everything is in good shape. NRCS will be looking at opportunities to document whether further work is needed. There are failures that are happening and have been treated. There are failures that need to be addressed.
Q: Asked about the in-flow USGS Stream Gage.
A: It has been there since the 1960's. Don't know what the flow is. The biggest flow could have been during 1983/84.

Discussed the cost that the canal company and producers will have to come up with. Roger Barton stated they are working with Senator Bennett’s office. We need to get a plan. There is support from the state. This has been presented to the State Water Resources Board.

Q: In the process of expanding the golf course. Need the impacts of what these options are going to be on the golf course. Can they get information in the next couple of months? 
A: Will not have a final plan until after September. There are too many reviews that are needed; too many reviews to know the final scope of changes around the dam. NRCS requested the GIS data layers of the golf course proposal to determine potential impacts based on current options.

Will look at where the water would be if the dam were raised by 7 feet. Could reconfigure the holes in the golf course.

Tracy Behling asked that concerns from everyone be sent to the canal company. They will meet with NRCS. Could look at other options. Please send golf course, fish and wildlife, etc., concerns to the canal company.

Roger Barton discussed the benefits of the dam rehab and the benefit to the community. Tracy Behling stated these are dam safety concerns that we will have to meet anyway. We will have to adjust and work through it and look at all options. It’s amazing what we can accomplish if we work together.

Reminded everyone to sign the sign-in sheet and fill out the comment forms.

Meeting adjourned at 7:30 pm.

After the meeting adjourned, sponsors mentioned that NRCS should look closer at a Fuse Plug option for the auxiliary spillway. NRCS will be looking at that option in more detail to determine feasibility, alignments, downstream (exit channel) conditions, costs and impacts with this option.

Comments received after the meeting:

Maurice W. Anderson, concerned citizen and golfer – On February 21, 2007, I attended the meeting on the rehabilitation of aging watershed dams held at the Ferron City Hall. At first my main concern was for Ferron Millsite Golf Course. After the meeting my outlook broadened immensely. The golf course is a drop in the bucket compared to the overall importance of what is about to take place with our livelihood in Emery County. This project doesn't just effect Ferron, it effects the whole county, the power plants, the coal mines and all the power users throughout the country. Having worked on the Central Utah Project gives me a good idea of the importance of the benefits of what is about to take place with our future in Emery County. Without the Central Utah Project, Salt Lake and the Utah Valley would have a moratorium on future growth. Water is the blood of any community. So, what I'm trying to derive at is, I think it would be foolish not to go for the number 4, raise the existing auxiliary spillway and crest of the dam 7 feet, construct additional rolled concrete construction (r.c.c) auxiliary spillway (600 feet) 9,945,000. Please try not to disrupt play at our golf course. We are having a hard enough time staying afloat financially.
Kash Winn, citizen – I would really like to see this rehabilitation project done. The lost storage due to the sediment has been a real problem for irrigators. I would also feel more comfortable with a dam that met safety specifications. Preferred option No. 4 raise auxiliary spillway and crest of the dam 7 feet, plus 600 feet RCC spillway over the crest of the dam. (Biggest concerns: reservoir sediment, reservoir water storage, upper watershed health, weeds)

Reg Soepnel, Managing Director, Hunter Plant, PacifiCorp Energy – PacifiCorp appreciates the opportunity to comment on the NRCS scoping meeting for rehabilitation of Millsite Dam which was held on February 21, 2007 in Ferron, Utah. The purpose for the public scoping meeting was to identify Millsite Dam rehabilitation alternatives for the spillway of the dam.

On January 16, 2007, PacifiCorp submitted comments to the NRCS after attending the first public scoping meeting regarding this issue held on December 14, 2006. In addition to those comments, PacifiCorp hereby submits the following comments for your consideration:

• PacifiCorp owns and operates a buried, 24-inch pipeline and valve control building used to convey PacifiCorp-entitled water from Millsite Reservoir to the Hunter Plant.
• The pipeline and control building are generally located in the central/northern portion of the dam structure and extend away from the reservoir in a northeasterly direction.

PacifiCorp hereby requests that any and all aspects of the Millsite rehabilitation project carefully consider the existence and location of our pipeline and valve control building. The efficient and reliable operation of the pipeline and valve control building are critical to the long term operation of the Hunter Plant. PacifiCorp cannot support any activities that may impact their ability to deliver water through this pipeline.

PacifiCorp commends the efforts of to date by the NRCS, the Ferron Canal Company, and the San Rafael Soil Conservation District and we support the continued effort toward the development of the Millsite rehabilitation project.
January 16, 2007

Natural Resources Conservation Service
Wallace F. Bennett Federal Building
125 South State Street Room 4402
Salt Lake City, UT 84138-1100
Attn: Norm Evenstad

RE: Millsite Dam Rehabilitation, Emery County, Ferron, Utah
Comments on December 14, 2006 public scoping meeting

Dear Mr. Evenstad:

PacifiCorp appreciates the opportunity to comment on the NRCS scoping meeting for rehabilitation of Millsite Dam which was held on December 14, 2006 in Salt Lake City. The purpose for the public scoping meeting was to identify Millsite Dam rehabilitation alternatives for the spillway and dam. PacifiCorp hereby submits the following comments for your consideration:

- PacifiCorp commends NRCS for its ongoing efforts to reduce sedimentation through various watershed rehabilitation projects and strongly recommends that watershed improvements be vigorously pursued into the future.

- PacifiCorp operates the Hunter Power Plant, a 1,320 megawatt coal fired thermal-electric facility which is located near Castle Dale, Utah. The water supply for the Hunter Plant originates from several sources on Cottonwood Creek and Ferron Creek. The Ferron Creek water supply consists of irrigation company shares as well as a firm contract for the use of 7,000 acre feet per year from the Millsite Reservoir storage supply.

- PacifiCorp's total acquired supply in the Ferron Creek drainage amounts to a significant portion of its annual water supply. Ferron Creek and Millsite Dam are both critical components to the operation of PacifiCorp's Hunter Plant.
PacifiCorp has reviewed the six alternatives for rehabilitation and believes that Alternative 1 (No action) and Alternative 2 (Decommission) are not viable alternatives at this time.

Alternatives 3 and 4 identify options that would provide additional sediment storage ranging from an additional 50 years under Alternative 3 to 100 years under Alternative 4. PacifiCorp believes that Alternatives 3 and 4 do not represent a new depletion of water in the Ferron Creek drainage but merely represent replacement storage for the capacity lost as a result of reservoir sedimentation in the past.

PacifiCorp believes Alternatives 5 and 6, which provide for sediment storage as well as additional water storage capacity in Millsite Dam, are the most viable alternatives.

The construction of additional storage capacity provides numerous benefits including: (1) improving the water supply for irrigation, (2) reducing the problems associated with downstream uncontrolled flood flows and associated scouring of the streambed, (3) increasing habitat for wildlife in the reservoir and (4) potentially improving habitat in the downstream stream channel for wildlife benefits, especially if a high flow bypass structure is evaluated for species that rely on turbid water conditions for survival. Additionally, PacifiCorp recognizes that an additional benefit to PacifiCorp is potentially a more secure water supply for the Hunter Plant, especially during drought years and extended drought cycles.

PacifiCorp has worked closely for many years with the Ferron Canal Company on all matters related to the supply and delivery of water, including the Millsite facility. The two companies continue this ongoing positive relationship and anticipate the same for many years to come. PacifiCorp supports the rehabilitation project and asks that NRCS continue diligently moving forward with the project.

If you have any questions or require additional information, please contact myself or Cody Allred at (435) 687-4306. Thank You.

Regards,

Reg Soepnel
Managing Director
Hunter-Huntington Plants

cc: Tracy Behling – President, Ferron Canal & Reservoir Company
Objective of the meeting: As part of the planning process for this project we would like to get public input regarding the proposed rehabilitation work on the Millsite Dam. The work on the Dam is proposed so that owners of the dam can meet current State and NRCS dam safety criteria. This meeting is an opportunity for members of the public to voice any concerns or other issues regarding the proposed work on the dam.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Discussion</th>
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| Opening Remarks                    | Sponsors: SCD, Ferron Canal & Reservoir Co., County Commission/s - ???
| Introductions                      | Sponsors                                                                  |
| Rehabilitation Program & Planning Process | Norm Evenstad, USDA-NRCS                                                   |
| Overview of rehab of Millsite Dam  | Information Posters – for open house                                      |
| Comments from the Public           | Sponsors                                                                  |
| Adjourn Meeting                    | Sponsors                                                                  |
PRESS RELEASE

Millsite Dam Rehabilitation Group to hold Public Scoping Meeting

The Ferron Canal & Reservoir Company and the San Rafael Soil Conservation District in cooperation with the USDA-Natural Resources Conservation Service will host a public scoping meeting **February 21, 2007 at City Hall in Ferron, Utah.**

**Location:** Ferron City - City Hall  
15 South State, Ferron, UT 84523  
(435) 384-2350  

**Time:**  
5:00 pm to 6:00 pm (Open House)  
6:00 pm to 7:30 pm (Project Discussion)

The meeting will begin with an informal open house starting at 5:00 pm to give attendees a chance to view displays and other information about the project. A more formal presentation will begin at 6:00 pm conducted by the Sponsors of the project. The objective of the meeting is to identify public concerns relating to the proposed rehabilitation of Millsite Dam located in Emery County about 3 miles west of Ferron, Utah.

The primary purpose of these dams is flood control but many also are multipurpose dams and are used for water supplies, recreation, and wetland wildlife habitat.

Some of the issues that must be addressed for these types of rehabilitation projects include:

- Replacing deteriorating components.
- Dealing with unanticipated urban development below or near dams, which increases the potential for loss of life and increased property development.
- Dealing with sediment that has accumulated in reservoirs to the point that the dams can no longer properly function.
- Upgrades to meet current state dam safety regulations.
- Meeting natural resource needs not previously addressed, such as water quality, wetland restoration and wildlife habitat.

The Rehabilitation amendment to the PL83-566 Law was passed in 2000. Assistance from NRCS is available to assess, plan and implement the necessary rehabilitation of structures (dams) where PL83-566 assistance was used in the original planning and implementation. Under the current amendment NRCS can provide rehabilitation planning and financial assistance only for dams.

Rehabilitation assistance is provided in three phases, namely, assessment, planning and implementation. Assessment entails evaluating the status of dams in terms of their hazard class and potential downstream impacts if failure should occur as well as the degree to which sedimentation has taken place within the storage pool behind the dam. Planning requires that all
natural resources needs within the watershed be addressed and that all possible scenarios (including removal of the structure) be analyzed. Implementation entails design and construction.

For more information or questions about this project, contact either Norm Evenstad, Water Resources Coordinator, NRCS, 801-524-4569 or email at norm.evenstad@ut.usda.gov; or Eric Fleming, State Conservation Engineer, NRCS 801-524-4559 or email at eric.fleming@ut.usda.gov.

Sponsor Contacts are: Roger Barton, Emery Soil Conservation District, Castle Dale, Utah. (435) 381-2300 x113; email: Roger.Barton@UT.nacdnet.net or Tracey Behling, Ferron Canal & Reservoir Company, email: tfbehling@hotmail.com.

Attachment: Millsite Rehab – Brochure, General Information
Some Benefits of Millsite Dam rehabilitation

- The dam will conform to current safety and performance criteria of the State of Utah and NRCS as required by law
- Life of the structure will be extended another 50 to 100 years
- Sediment storage in the reservoir will be extended another 50 to 100 years
- Structure will safely pass the required storm event runoff volume as required by state law
- Funding for rehabilitation can be provided through NRCS to the Sponsors at a 65% cost share rate
- Recreation and use of the reservoir will continue well into the future

Notes:

Tri-fold available to the public for information and updates through the planning and concept design process.

For More information the rehabilitation of aging watershed structures access the NRCS Web Page at: www.nrcs.usda.gov/programs/WSRehab/

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February 2007

Rehabilitation of Aging Watershed Dams

Millsite Dam
Ferron Watershed
Emery, Sanpete Counties, Utah

Auxiliary Spillway for Millsite Dam. Flows from the spillway create a waterfall effect that is well known in the area and often photographed in operation.

Over 11,000 flood control dams have been built in 2,000 watershed across the nation since 1948. These dams were built by watershed project sponsors in 47 states with funding and technical help provided through USDA watershed programs. These programs are administered by the USDA Natural Resources Conservation Service (NRCS). Local units of government, serving as project sponsors assume operation and maintenance responsibility of the dams after they are built.

The Millsite Dam within the Ferron Watershed Project is an example of one of these dams.

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Planning for Millsite Rehabilitation Underway

The Ferron Canal & Reservoir Company and the Emery County Soil Conservation District (Sponsors) have requested technical and financial assistance from NRCS to bring Millsite Dam into compliance with applicable safety and performance standards.

Before funds can be approved for rehabilitation sponsors must:

• Be current in operations and maintenance of their dam
• Provide non-federal cost-share funds (35% of the cost of the project
• Obtain permits
• Develop a new operation and maintenance agreement
• Certify land rights and land treatment
• Develop and emergency action plan for high hazard dams

Steps in Implementation:

• Sponsor submits application
• NRCS ranks the applications and selects projects for funding
• Complete project planning (economic analysis, environmental review, cultural resources evaluation, etc.)
• Complete design
• Complete Construction

Preliminary Alternatives Under Consideration

1. No Action: Sponsors continue to operate and maintain Millsite Dam. Eventually leads to decommissioning of the dam due to dam safety standards not being met

2. Rehab Alternative(s): Rehab/modify dam to meet dam safety performance standards
   a) raise the crest of the auxiliary spillway 1 foot to allow for another 50 years of sediment storage and construct additional auxiliary spillway over the dam to pass the required storm volume
   b) raise the crest of the auxiliary spillway 2 feet to allow for another 100 years of sediment storage and construct an additional auxiliary spillway over the over to pass the required storm volume
   c) other alternatives are being evaluated for engineering, economic, ecologic feasibility

3. Decommission Alternative: Designed removal of the embankment in accordance with established NRCS standards. Would eliminate the catastrophic flood hazard associated with a potential failure of the dam

Input from the public is solicited and required under NRCS watershed planning policy. Please let us know if you have concerns, or comments relating to this proposed rehabilitation of Millsite Dam.

Issues/Concerns/Problems

Please indicate below the biggest concerns relating to rehabilitation work on Millsite Dam.

Soils Resource Concerns

- Erosion during construction
- Reservoir Sediment
- Other:

Water Resources Concerns

- Reservoir water storage
- Flooding
- Recreation—swimming, fishing
- Other:

Air Resources Concerns

- Construction emissions
- Blowing soils
- Other:

Plant—Animal Resource Concerns

- Upper watershed health
- Weeds
- Other:

Comments—Other: In the box below, please expand on other concerns pertaining to any concerns you have about the rehabilitation of Millsite Dam.

Send written or electronic comments to:

Norm Evenstad, Water Resources Coordinator
Ferron Watershed Area
County Line
Upper Watershed
Treatment Areas
Debris Basins
Millsite Dam
Ferron Watershed Area
Ferron Watershed Area
Feb-2017
Appendix -E- Other Supporting Information 93
To: Interested Parties

Re: Rehabilitation of Millsite Dam, Emery County, Ferron, Utah

Work proposed to upgrade the Dam to meet current Utah Dam Safety criteria

**Deadline:** December 14, 2006, and January 17, 2007

In 1971 the USDA Soil Conservation Service (now NRCS) originally assisted local sponsoring organizations in the engineering and construction of the Millsite Dam located above the town of Ferron, Utah, in Emery County.

The USDA Natural Resources Conservation Service (NRCS), in cooperation with the San Rafael Soil Conservation District and the Ferron Irrigation and Reservoir Company will be preparing an Environmental Assessment on a proposal to upgrade Millsite Dam to meet current Utah Dam Safety statutory regulations and NRCS standards.

The proposed rehabilitation will likely involve raising the existing auxiliary spillway inlet to account for at least an additional 50 years of sediment accumulation in the reservoir. An additional auxiliary spillway will likely be required to safely pass the probable maximum precipitation (PMP) as required by Utah Dam Safety regulations. The most current definition of PMP is as follows: "Theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of the year." *(Hydrometeorological Report 55A (HMR 55A)).*

Alternatives under consideration at this point include:

1. Take no action;
2. Decommission the dam;
3. Raise the auxiliary spillway inlet 1.5 feet and construct a new roller compacted concrete auxiliary spillway over a portion of the dam to pass the PMP and provide an additional 50 years of sediment storage;
4. Raise the existing auxiliary spillway inlet and dam 2.5 feet and construct a roller compacted concrete cap over a larger area of the dam to provide an additional 100 years of sediment storage;
5. Raise the existing auxiliary spillway and dam 7 feet to provide for additional sediment and water storage as well as pass the PMP.

Incorporated into and studied with the various rehab alternatives will be design variations of grade and alignment.

Issues that will be analyzed include the project's effect on erosion/sediment deposition, air, water quality, and cultural and recreational resources, as well as other social, economic and environmental effects.

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As part of the process for determining the scope of issues to be addressed in the Environmental Assessment and for identifying the important issues related to the proposed action, we request your comments on the above issues and any other issues that you can identify as important or under the jurisdiction of your organization. We intend to use your comments to:

- Identify the range of alternatives and impacts and the important issues to be addressed in the Environmental Assessment.
- Identify and eliminate from detailed study the issues which are not important or which have been covered by prior environmental review.
- Identify other environmental review and consultation requirements.

We are holding a meeting to discuss the project in general and to take questions and comments regarding the project. The meeting is scheduled for 9:00 to 11:00 a.m., December 14, 2006, at the NRCS Murray Field Office, 1030 West 5370 South, Suite 100, Murray, Utah 84123 (map attached).

If you cannot make the meeting, we request your comments by January 17, 2007. Comments on the project can be sent hard copy to USDA-NRCS, Wallace F. Bennett Federal Building, 125 South State Street, Room 4402, Salt Lake City, Utah 84138-1100, Attention Norm Evenstad or through E-mail to norm.evenstad@ut.usda.gov.

If you do not reply by the date specified above, we will assume that you have no comments at this stage of project development. If you have any questions regarding this project, please contact Norm Evenstad at (801) 524-4569 or E-mail at the above address.

**Project Location:** Millsite Dam, Emery County, Utah

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**Millsite Dam:**

- Orangeville
- Castle Dale
- State 37
- State 19
- Clawson
- Ferron

**Millsite Dam:**

39.09667,-111.185

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Attachment

Millsite Scoping Meeting/Briefing Location:

December 14, 2006
9:00 a.m. to 11:00 a.m.
Murray NRCS Conference Room
1030 West 5370 South, Suite 100, Murray, Utah
Funding for FY2006: $65,000 for Technical Assistance

Product Output for Earmark: Initiate Planning for Rehab of Millsite Dam –
Ferron Watershed

Summary of Work Accomplished during FY2006

- 2 Meetings with Sponsors to identify problems, issues
- News Article to local paper announcing funding, intent for rehab planning
- Letters to local, state and federal leaders announcing funding and rehab intent
- Archaeologic Studies for area around the Dam: $6,250 + $3,200 = $9,450 - Complete
- Acoustic Reservoir Sediment Survey: $12,050 Agreement w/BOR - Complete
  - NRCS Completed Topographic modeling work to determine original pool topography and existing pool topography to determine reservoir sediment volume (2600 ac-ft)
- Reservoir Sediment Sampling Testing for Contaminants: Sampling Complete; Testing is underway (included BOR Agreement)
- Submerged Riser Tower Inspection – Dive Team Agreement w/BOR – Scheduled for Nov 7th.
- Breach Routing/Inundation Mapping Complete
- PMP Study/Watershed Hydrology Complete
- T&E Species review underway
- Topographic Survey of the Dam, Pool Area Complete
- X-Sections of Outlet Channel Completed
- National Water Management Center Staff – Site Visit and Plan input
- Input of original test pit and drill hole logs into Geologic graphing/x-section software package
- Seismic evaluation of existing structure to establish acceleration values, fault analysis
- Review of Phase II Study completed by Rollins-Brown-Gunnell Consulting Engineers
- 2 Meetings conducted with Utah State Dam Safety personnel on hydrology & coordination
- Presentation of Rehab Program and Millsite Rehab Planning to the Utah Water Resources Board
- Presentation to the San Rafael SCD Board about Rehab Program and Millsite Planning efforts
- Dam Embankment Seepage model developed. Existing Chimney drain evaluated for adequacy
- Alternatives of raising the dam and the auxiliary spillway to provide at least another 50 years of sediment is currently underway
- Draft Plan document is underway – Inter-Agency meeting planned for Nov 29 to discuss issues, problems, alternatives.
- Consultation with Regional Design Team on alternative design feasibility

Helping People Help the Land
# Millsite Briefing - Scoping - Agencies

**December 14, 2006**

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>
Evenstad, Norm - Salt Lake City, UT

**om:** Barton, Roger - Castledale, UT  
**nt:** Tuesday, December 12, 2006 2:03 PM  
**J:** Evenstad, Norm - Salt Lake City, UT; Cummings, Dee - Salt Lake City, UT  
**Subject:** RE: Millsite Scoping Meeting Reminder

Did not see a "yes" button, but I will be attending the meeting. I also believe Tracy Behling (President, Ferron Canal and Reservoir Company - this is the correct name of the Company) and Kyle Singleton (Rocky Mountain Power) will be coming up.

Thanks for the reminder,

Roger Barton, Watershed Coordinator  
Utah Association of Conservation Districts  
1120 N Des Bees Dove Road  
P O Box 1114  
Castle Dale, Utah 84513  
Office: 435-381-2300, ext 113  
Mobile: 435-749-2169

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**From:** Cummings, Dee - Salt Lake City, UT  
**Sent:** Tuesday, December 12, 2006 01:41 PM  
**To:** Barrett, Bruce; Blackham, Leonard; Carter, Kevin; Cockett, Noelle; Crist, Larry; Gay, Chuck; Gillen, Sylvia - Salt Lake City, UT; Mickelson, Richard - Salt Lake City, UT; Johnson, Larry; Nelson, Dianne; Richerson, Bruce - Salt Lake City, UT; Roy, Cordell; Styler, Mike; Terland, Gene; Troyer, Jack; Wagner, Mary; Werner, Nel; A. J. Martinez (ajmartine@netscape.com); Anderson, Kathleen; Baker, Walt; Davidson, Ron - Salt Lake City, UT; Fortsby, Bart; Hopkins, Bill; Jacobson, Jake; Krueger, Faye; Martinez, AJ - Salt Lake City, Utah; Mickelson, Richard - Salt Lake City, UT; Reichert, Mike; Reynolds, Roy; Warrick, Curtis; Youker, Gordon - Gordon, UT; Zinszer, Shawn; Mesner, Nancy; Mesner, Terry; Mitchell, Dean; Monahan, Peter; Montague, Chris; Naranjo, Ed; Nitchees, Maxine; Newhall, Bob; Nickle, Jim; Olds, Jerry; Pace, Paul - Richfield, UT; Parker, Randy; Peterson, Doug; Quamburg, Dallen - Richfield, UT; Quilter, Mark; Richards, Jeff; Roberts, Mike; Robinson, WD; Schwartz, Kerry; Selman, Fred; Shirley, Joe; Skeem, Kenneth A.; Steele, Rupert; Stoddard, Scott; Tanner, Brent; Tom, Lora; Toombs, Ted; Torgerson, Ron; Vanoy, Debbie; Wadsworth, Colette; Waldron, Dee; Warr, Charles; Williams, Shauna - Salt Lake City, UT; Wongan, Ivan; Adams, Carl; Anderson, Jan; Atcitty, Elayne; Bagley, Orel; Bagley, Ver; Balls, Reed; Barnett, Dan; Barnett, Jack; Barton, Roger - Castledale, UT; Bassett, Howard; Baxter, Lee; Bear, Leon; Bennett, John; Bederichuk, Michael; Brown, Bob; Brown, Christopher; Bryant, Lisa; Burton, Thomas; Canning, Mike; Cardon, Grant E.; Chamberlain, Scott; Chappell, Dean; Christensen, William E (Bill); Cottam, Brian; Cox, Jack - Salt Lake City, UT; Cutch, Forrest; Dapper, Curtis; Douglas, Arthur; Drake, David; Eye, Amanda; Fairchild, John; Gardiner, Carol; Grierison, David; Groves, Ronald; Gunnell, Roy; Hamaker, Dale; Harward, Richard; Heart, Manuel; Hendrick, Haven; Herrmann, Betsy; James, Travis - Salt Lake City, UT; Jordan, Lucy; Judd, Harry; Karpowitz, Jim; Karren, Bruce; Keate, Nancy; Kenison, Alan B.; King, Robert; Kleeman, Gary; Lehmann, Jill; Leishman, Paul; Leishman, Paul; Abate, Paul; Atcitty, Elayne; Baker, Walt; Rignary Migratory Bird Refuge; Bloodworth, Ben; Brown, Kevin; Chaney, Jerry; Downs, Dennis; Elder, Tom; Evenstad, Norm - Salt Lake City, UT; Falvey, Sharon; Finnefrock, Dave; Frandsen, Joel; Haddon, Stan; Hansen, Mike; Hasenayer, Bob; Hernandez, Juan - Salt Lake City, UT; James, Bill; Jensen, Steve; Johnson, Brad; Jones, Alan; Jones, Kevin; Lamb, Leah Ann; Macauley, Ying-Ying; Mann, John; Notarianni, Philip; Olsen, David; Parrish, Rob; Quick, Shell; Schroeder, Robin; Seddon, Matthew; Stacey, Randy; Talbot-Holt, Cynthia; Weisheit, John; Williams, Jeff - Salt Lake City, UT; George, Mike; Harris, Jim; Hopkins, George; Johnson, Kate; Klotz, Eric; Leifson, Michael; Loveless, Ray; Mesner, Nancy; Newhall, Bob; Rushing, Tom; Sibiging, Virginia; Taylor, Paul; Terry, Shazelle; Wallace, Kimball; Wallanabe, Judy (judywallanabe@utah.gov); Way, Terry; Willur, Jack; Angeroth, Cory; Burnett, Paul; Closed, Kim; Clark, Cindy; Cruz, George; Coreham, Dennis; Hadley, Heidi; Hopson, Rick; Johnson, Heather - Murray, UT; Lambert, Pat; Loveland, Corey; Noyes, Steve; Noyes, Steve; Salt, Jeff; Schlothauer, Bill; Stonely, Todd; Weland, Mike; Wilcox, Rick; Williams, Jeff - Murray, UT  
**Cc:** Evenstad, Norm - Salt Lake City, UT; Davidson, Ron - Salt Lake City, UT; Fleming, Eric - Salt Lake City, UT; Todea, Nathaniel - Salt Lake City, UT; Anderson, Nate - Salt Lake City, UT; Hamilton, Barry - Price, UT; Greenhalgh, Wayne - Price, UT; Barton, Roger - Castledale, UT; Wilson, Marnie - Salt Lake City, UT; Fullen, Karen - Salt Lake City, UT  
**Subject:** Millsite Scoping Meeting Reminder  
**Importance:** High

---

**REminder!**

A Millsite Scoping meeting will be held **December 14, 2006**, from 9:00 to 11:00 a.m., at the NRCS Murray Field Office, 10 West 5370 South, Suite 100, Murray, Utah 84123.

If you plan to **attend** the meeting, please click on the "Yes" button in the header above so we have an idea of how many will be attending.
If you cannot make the meeting, we request your comments by **January 17, 2007**. Comments on the project can be sent hard copy to USDA-NRCS, Wallace F. Bennett Federal Building, 125 South State Street, Room 4402, Salt Lake City, Utah 84138-1100, Attention Norm Evenstad or through E-mail to norm.evenstad@ut.usda.gov.

If you do not reply by the date specified above, we will assume that you have no comments at this stage of project development. If you have any questions regarding this project, please contact Norm Evenstad at (801) 524-4569 or E-mail at the above address.

Thanks.
Norm Evenstad
Ladies and Gentlemen:

Re: Rehabilitation of Millsite Dam, Emery County, Ferron, Utah

Work proposed to upgrade the Dam to meet current Dam Safety criteria

The USDA Natural Resources Conservation Service (NRCS), in cooperation with the San Rafael Soil Conservation District and the Ferron Irrigation & Reservoir Company will be preparing an Environmental Assessment on a proposal to upgrade the operation of Millsite Dam to meet statutory Utah Dam Safety regulations.

The proposed rehabilitation will involve raising the existing auxiliary spillway inlet to account for at least an additional 50 years of sediment accumulation in the reservoir. An additional auxiliary spillway is required to safely pass the probable maximum precipitation past the dam.

Alternatives under consideration include (1) taking no action; (2) decommission the dam; (3) raise the auxiliary spillway inlet 2.5 feet and place a roller compacted concrete cap over a portion of the dam; (4) raise the auxiliary spillway inlet 2.5 feet and place a roller compacted concrete cap over a larger area of the dam.

Incorporated into and studied with the various rehab alternatives will be design variations of grade and alignment. Enclosed for your information is one copy of the "Preliminary Evaluation of Design Alternatives" report. (thoughts on doing this??)

Issues that will be analyzed include the project's effect on air, water quality, and cultural and recreational resources, as well as other social, economic and environmental effects.

As part of the process for determining the scope of issues to be addressed in the Environmental Assessment and for identifying the important issues related to the proposed action, we request your comments on the above issues and any other issues that you can identify as important. We intend to use your comments to:

- Identify the range of alternatives and impacts and the important issues to be addressed in the Environmental Assessment.
- Identify and eliminate from detailed study the issues which are not important or which have been covered by prior environmental review.
- Identify other environmental review and consultation requirements.

We request your comments by January 17, 2007. If you do not reply by that date, we will assume that you have no comments at this stage of project development. If you have any questions regarding the enclosed, please contact me at _________.

Very truly yours,

[Signature]

Helping People Help the Land
An Equal Opportunity Provider and Employer
NEWS RELEASE

For Immediate Release

Dam Rehabilitation Gets Approval For Planning

The Natural Resources Conservation Service (NRCS) has approved the request from the San Rafael Soil Conservation District for development of a rehabilitation plan for the Millsite Dam within the Ferron Watershed. The 35 year old multi-purpose dam located just upstream of the town of Ferron, Utah was constructed for irrigation, flood prevention, sediment control for rural agricultural land, municipal and industrial use as well as recreation. “Because of the age and condition of the dam and the changes in safety and performance criteria, we have asked for assistance from NRCS in rehabilitating the dam to ensure it remains safe and continues to function as it was designed,” said Roger Barton, District Board Chairperson. The dam was designed for a 100-year lifespan and has provided irrigation storage, flood protection and recreation for 35 years, but now updates are needed to bring the structure into full compliance with State Dam Safety and NRCS safety and performance criteria.

The NRCS will soon begin looking at alternatives and developing a rehabilitation plan. Landowners and others who are involved or affected by the project will have an opportunity to provide input into the plan. Rehabilitation alternatives can include removal of the dam or combinations of several other options such as replacement of concrete and metal components of the principal spillway, increasing the height of the dam and width of the auxiliary spillway, and other options depending on conditions of the dam and what is located downstream.

The Millsite Dam is one of 10 dams built in the Ferron Watershed. These 10 dams provide an estimated $3,000,000 in annual benefits. This is Utah’s first rehabilitation
project initiated through the Watershed Rehabilitation Amendment to the Watershed Protection and Flood Prevention Act (PL-83-566). The Act authorizes the USDA-NRCS to work with local communities and watershed project sponsors to address public health and safety concerns and potential adverse impacts of aging dams. If the plan is approved NRCS can provide sixty-five percent of the funding for rehabilitation and the other thirty-five percent of the funding will come from state and/or local appropriated funds.

-End-
Some Benefits of Millsite Dam rehabilitation

- The dam will meet current safety and performance criteria of the State of Utah and NRCS as required by law.
- Life of the structure will be extended another 50 to 100 years.
- Sediment storage in the reservoir will be extended another 50 to 100 years.
- Structure will safely pass the required storm event runoff volume as required by state law.
- Funding for rehabilitation can be provided through NRCS to the Sponsors at a 65% cost share rate.
- Recreation and use of the reservoir will continue well into the future.

Notes:

For More information the rehabilitation of aging watershed structures access the NRCS Web Page at: www.nrcs.usda.gov/programs/WSRehab/

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February 2007
Planning for Millsite Rehabilitation Underway

The Ferron Canal & Reservoir Company and the Emery County Soil Conservation District (Sponsors) have requested technical and financial assistance from NRCS to bring Millsite Dam into compliance with applicable safety and performance standards.

Before funds can be approved for rehabilitation sponsors must:

- Be current in operations and maintenance of their dam
- Provide non-federal cost-share funds (35% of the cost of the project)
- Obtain permits
- Develop a new operation and maintenance agreement
- Certify land rights and land treatment
- Develop an emergency action plan (high hazard dams)

Steps in Implementation:

- Sponsor submits application
- NRCS ranks the applications and selects projects for funding
- Complete project planning (economic analysis, environmental review, cultural resources evaluation, etc.)
- Complete design
- Complete Construction

Preliminary Alternatives Under Consideration

1. No Action: Sponsors continue to operate and maintain Millsite Dam. Eventually leads to decommissioning of the dam due to dam safety standards not being met

2. Rehab Alternatives: Rehab/modify dam to meet dam safety performance standards

   1) raise the crest of the existing auxiliary spillway 1 foot to allow for another 50 years of sediment storage and add 685 ft wide roller compacted concrete (RCC) spillway over the dam
   2) raise the auxiliary spillway and crest of the dam 2.5 feet to allow for another 100 years of sediment storage and construct an additional RCC auxiliary spillway 1320 ft over the crest
   3) raise the auxiliary spillway and crest of the dam 2.5 feet for 100 years of sediment storage; additional RCC auxiliary spillway 500 feet

3. Decommission Alternative: Designed removal of the embankment in accordance with established NRCS standards. Would eliminate the catastrophic flood hazard associated with a potential failure of the dam and restore the geomorphology of stream channel.

Issues/Concerns/Profs

Soil Resource Concerns
- Erosion during construction
- Reservoir Sediment
- Other:

Water Resources Concerns
- Reservoir water storage
- Flooding
- Recreation—swimming, fishing
- Other:

Air Resource Concerns
- Construction emissions
- Blowing soils
- Other:

Plant—Animal Resource Concerns
- Upper watershed health
- Weeds
- Other:

Comments—Other: In the box below, please expand on other concerns you have about the rehabilitation of Millsite Dam.

Send written or electronic comments to:
Norm Evenstad, Water Resources Coordinator
USDA-NRCS
Wallace F. Bennett Federal Building
125 S State Street, Room 4418
Salt Lake City, UT 84138-1100
Phone: 801-524-4569
Fax: 801-524-4593
Email: norm.evenstad@ut.usda.gov

Final - Millsite Dam Rehabilitation Plan/EA

Feb-2017

Appendix -E- Other Supporting Information 106
scoping meeting dam rehab - Google Search

EPA: Federal Register: Arrowrock Dam Outlet Works Rehabilitation ...
Arrowrock Dam Outlet Works Rehabilitation, INT-DES 00-45, Federal Register ... Notices of intent to prepare an EIS and to hold public scoping meetings were ...
www.epa.gov/fedregstr/EPA-IMPACT/2000/October/Day-26/27595.htm - 19k -
Cached - Similar pages

EPA: Federal Register: Arrowrock Dam Outlet Works Rehabilitation ...
Arrowrock Dam Outlet Works Rehabilitation, Boise, ID, Federal Register document. ...
Scoping meetings to obtain input about concerns and issues associated ...
www.epa.gov/fedregstr/EPA-IMPACT/1998/October/Day-20/28031.htm - 18k -
Cached - Similar pages

PDF Dam Rehabilitation Program Wisconsin Experience
File Format: PDF/Adobe Acrobat
2) Dam removal or decommissioning. 3) Non-structural rehabilitation and. 4) Structural rehabilitation. During open public scoping meetings the Sponsors, ...
asae.flymulti.com/request.asp?JID=5&AID=20738&CID=por2006&T=2 - Similar pages

PDF Paper No: 200000
File Format: PDF/Adobe Acrobat
Scoping meetings were held for each project to address the needs of the dam and local. concerns and interests. A list of alternatives was developed and ...
asae.flymulti.com/request.asp?JID=5&AID=9844&CID=cil2002&T=2 - Similar pages

PDF Federal Register /Vol. 71, No. 8/Thursday, January 12, 2006/Notices
File Format: PDF/Adobe Acrobat - View as HTML
2001. The request was a result of local concern and interest in addressing dam. safety, flood protection, and sediment. control. A scoping meeting was held ...
a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/E6-189.pdf - Similar pages

PDF Federal Register /Vol. 71, No. 8/Thursday, January 12, 2006/Notices
File Format: PDF/Adobe Acrobat - View as HTML
structures and addressing dam safety. Scoping meetings were held. September 30, 2004. An afternoon. meeting was held involving. Interdisciplinary efforts. ...
a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/pdf/E6-190.pdf - Similar pages

NYSDOT | Press Releases
... Village Reconstruction and Dam Rehabilitation (Montgomery County); August 10, ... June 16, 2004 - DOT Announces Open Forum Scoping Meeting on Wednesday, ...
https://www.nysdot.gov/portal/page/portal/modal/truck/press-releases - 71k -
Cached - Similar pages

2003 Federal Register, 68 FR 35910; Centralized Library: U.S. Fish ...
A scoping meeting was held in Redding, California on May 9, 2002. ... of anadromous fish on the Trinity River mainstem downstream of Lewiston Dam. ...
www.fws.gov/policy/library/03-15219.html - 17k - Cached - Similar pages

Page 1 of 2
Final - Millsite Dam Rehabilitation Plan/EA
Appendix -E- Other Supporting Information

Dear __________________________,

We would like to make you aware that the San Rafael Soil Conservation District has requested the USDA-Natural Resources Conservation Service (NRCS) to develop a rehabilitation plan for Millsite Dam within the Ferron Watershed. The dam was planned, designed and installed under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended. The request followed the receipt of a rehabilitation assessment report made by NRCS in which they recommended the dam be rehabilitated. The dam located just upstream of Ferron, Utah in Emery County 35 years old and has been determined to not meet the current safety and performance standards for a dam of this size.

The NRCS also informed us that the dam meets the requirements for assistance under the NRCS rehabilitation program and we have made a formal request to NRCS for technical and financial assistance with the project. The NRCS rehabilitation program can provide up to 65 percent of the cost of such a project.

If the request is approved, NRCS will assist in developing a rehabilitation plan. If the rehabilitation plan is approved, funds for carrying out the plan will depend on money appropriated by Congress for rehabilitation projects and by the state legislature through the State Dam Safety office. We would appreciate your support in helping make sure adequate federal funds are appropriated for rehabilitation projects such as this one.

We have enclosed a pamphlet on rehabilitation of aging dams for your information. If you have questions please call Roger Barton, Chair, San Rafael Soil Conservation District at 435-381-2300 x113.

This is the first watershed structure rehab project in Utah. Rehabilitating these aging dams will ensure they remain safe and continue to provide multiple benefits for at least another 100 years. Utah has 43 watershed dams that make up an infrastructure that provides millions of dollars in annual benefits.

Chair - San Rafael Soil Conservation District Board

Enclosure: Rehabilitation of Aging Watershed Dams

cc: Leonard Blackham, Chair, Utah Soil Conservation Commission,
    Gordon Younker, Executive Director, Utah Association of Conservation Districts
    Emery County Commission
    Sylvia Gillen, State Conservationist, Natural Resources Conservation Service
Appendix E-5

ENVIRONMENTAL EVALUATION / CPA-52 FORM

Millsite Dam Rehabilitation
Emery County, Utah

**NOTE:** The CPA-52 included here reflects the preliminary determinations of resources and impacts, and that the “Environmental Consequences” section of the EA should be referred to for final analysis of impacts.
Environmental Evaluation / CPA-52 Form

**U.S. Department of Agriculture**  
**NRCS-CPA-52**  
Natural Resources Conservation Service  
6/2010

**ENVIRONMENTAL EVALUATION WORKSHEET**

**A. Client Name:** Ferron Canal & Reservoir Company

**B. Conservation Plan #** (as applicable):  
Program Authority (optional): **WF-07 - Watershed Rehab**

**D. Client’s Objective(s) (purpose):**  
Rehabilitation of Millsite Dam for the Sponsoring Local Organization (SLO) - under the NRCS Watershed Rehabilitation Program. (See Plan/EA for Rehab of Millsite Dam).

**C. Identification #** (farm, tract, field, etc as required):  
Ferron Watershed - Emery & Sanpete Counties, Utah  
Lat: 39.0981, Long: -111.1895, 2.5 miles West of Ferron, Utah  
Link: http://maps.google.com/maps?hl=en&amp;tab=wl

**E. Need for Action:**  
1) Auxiliary Spillway is undersized & does not meet required PMP criteria. 2) Liquefiable soil material in a section of the foundation of the dam. 3) Embankment filter zones do not meet current filtering criteria. 4) Seismic stability needs to be evaluated. 5) Need to meet dam safety engineering criteria for a high hazard class dam and extend the life of the structure for at least another 50 years.

**F. Alternatives**

<table>
<thead>
<tr>
<th>Action</th>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action/FWOP: Assumes no Federal Project.</td>
<td>Erosion in the upper watershed - eventually depositing about 74 acre feet of sediment in the reservoir</td>
<td>Excavate downstream slope - replace with adequate filter material.</td>
<td>Federal Decommissioning: results in complete removal of the embankment and deposited sediment, reconnection and restoration of the stream &amp; floodplain.</td>
</tr>
<tr>
<td>Erosion (Ephemeral Gully)</td>
<td>Erosion likely will stay about same as it has for the last 20 years.</td>
<td>Future O&amp;M of past watershed treatments may reduce small percentage of the total 74 acre feet of sediment reaching the reservoir</td>
<td>Sediment will reach stream reaches below the embankment - careful control will be needed.</td>
</tr>
<tr>
<td>Erosion in the upper watershed - eventually depositing about 74 acre feet of sediment in the reservoir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion (Sheet and Rill)</td>
<td>Expected to stay the same as last 20 years.</td>
<td>Potential to improve conditions with future O&amp;M on the watershed treatments installed 40+ years ago.</td>
<td>Increased sheet &amp; rill around the embankment and establishment of vegetation.</td>
</tr>
<tr>
<td>Upper watershed range managed by USFS - soils are highly erodible in areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Quality</td>
<td>Reservoir will continue to fill with sediment at an average of about 74 ac-feet per year.</td>
<td>Treatment in the upper watershed can help slow the amount of sediment reaching the reservoir and extend the storage life of the reservoir.</td>
<td>Reservoir storage would no longer exist.</td>
</tr>
</tbody>
</table>

**G. Resource Concerns and Existing / Benchmark Conditions**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and record the existing/benchmark conditions for each identified concern</td>
<td>Amount, Status, Description (short and long term)</td>
<td>Amount, Status, Description (short and long term)</td>
<td>Amount, Status, Description (short and long term)</td>
</tr>
<tr>
<td>SOIL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion (Ephemeral Gully)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion in the upper watershed - eventually depositing about 74 acre feet of sediment in the reservoir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir capacity being diminished and threatening irrigation storage for water shareholders in the future.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Resource Concerns**

In Section "F" below, analyze, record, and address concerns identified through the Resources Inventory process. (See FOTG Section III - Resource Quality Criteria for guidance).

**H. Resource Concerns and Existing / Benchmark Conditions**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and record the existing/benchmark conditions for each identified concern</td>
<td>Amount, Status, Description (short and long term)</td>
<td>Amount, Status, Description (short and long term)</td>
<td>Amount, Status, Description (short and long term)</td>
</tr>
</tbody>
</table>

**Total Construct Cost:** $24,652,400  
NRCSS: $11,291,600 (65%)
### AIR
No resource concern identified

<table>
<thead>
<tr>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>QD</td>
<td>QD</td>
<td>QD</td>
</tr>
</tbody>
</table>

### PLANTS
Condition (impacts to Endangered or Threatened Plants)
T&E Plant survey conducted May 7th, 2009 with USFWS. See T&E Survey Report. Conclusion = no effect on species surveyed given the proposed work areas and water level raises.

| No effect | Adverse Affect on 48 San Rafael Cactus individuals - Consultation with USFWS underway - Finalized for the Final Plan/EA Doc. - Three separate surveys completed for mapping of plants. | No effect |
| QD         | QD            | QD            |

### ANIMALS
Fish and wildlife (impacts to Declining Species, Species of Concern)
Excluding the area to provide reservoir capacity.

| No effect | Potential for Despains’s Footcactus, Wright Fishhook Cactus, and Last Chance Townsendia, USFWS & NRCS did review. Site visit May 7, 2009 = NO TES plants found in the Proposed Project Area. | No effect |
| QD         | QD            | QD            |

### HUMAN - Economic and Social Considerations
Capital
- Sponsors would eventually have to cover cost of rehabilitation or lose use of the reservoir.
- About 90% of installation of rehabilitation elements paid with NRCS and State Dam Safety Financial Assistance. Continued irrigation of croplands and 18 hole golf course.
- Federal Decommission would pay for 65% of the cost for this alternative.

| Increasing risk of engineering performance of the structure (hydrologic, embankment, irrigation storage). Dam continues to not meet High Hazard Class dam safety & engineering performance criteria. | Reduced risk with rehabilitation of the dam. Continued ag operations with irrigation water. Continued operation of the Millsite Golf Course. | Increased risk of flooding in the City of Ferron without the dam. Need to replace reservoir water source with another source to serve irrigation needs. |
| QD         | QD            | QD            |

### Special Environmental Concerns: Environmental Laws, Executive Orders, policies, etc.

In Section 1 complete and attach applicable Environmental Procedures Guide Sheets for documentation. Items with a * may require a federal permit or consultation/correlation between the lead agency and another government agency. In these cases, effects may need to be determined in consultation with another agency. Planning and practice implementation may proceed for practices not involved in consultation.

### I. Special Environmental Concerns
(Document compliance with Environmental Laws, Executive Orders, policies, etc.)

<table>
<thead>
<tr>
<th>No Action</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status and progress of compliance (Complete and attach Guide Sheets as applicable)</td>
<td>Status and progress of compliance (Complete and attach Guide Sheets as applicable)</td>
<td>Status and progress of compliance (Complete and attach Guide Sheets as applicable)</td>
</tr>
</tbody>
</table>

- **Clean Air Act**
  - Upon Review, No Action Needed
  - See Attached Documentation Multiple large earth moving equipment. Temporary

- **Clean Water Act / Waters of the U.S.**
  - Upon Review, No Action Needed
  - See Attached Documentation ADEE permit required (404 or NWP 27; County grading permit

- **Coastal Zone Management**
  - Upon Review, Not Applicable
  - Upon Review, Not Applicable
  - Upon Review, Not Applicable

- **Cultural Resources / Historic Properties**
  - Upon Review, No Action Needed
  - See Attached Documentation Investigation completed - June 22
  - See Attached Documentation Alternative not likely to proceed

---

Final - Millsite Dam Rehabilitation Plan/EA  Feb-2017  Appendix -E- Other Supporting Information  111
### Important Farmland Criteria
- 3,645 acres meet Prime/Other needs for 14,435 acres of which
  - Wild and Scenic Rivers
  - Wetlands
  - Reservoir serving irrigation
  - Prime and Unique Farmlands
  - Golden Eagle Protection Act
  - Neotropical migrants, bald & golden eagles

### Other Agencies and Broad Public Concerns
#### Easements, Permissons, Public Review, or Permits Required and Agencies Consulted
- No Action: All permits may be required.
- Alternative 2: USFWS & Div of Wildlife Resources, BLM, USFS, and State Dam Safety offices were consulted during preliminary planning in 2005-06. Permits will be acquired by NRCS: ACOE 404 or Nationwide permit 27; County grading permit; NHPA Sec 106 consultation for CR will be completed prior to implementation.

#### Cumulative Effects Narrative
- No Action: Existing, past, other present, reasonably foreseeable; Will likely pursue alternative funding to rehab Millsite Dam to protect property & safety. Does not meet need or desired FC.
- Alternative 1: Meet State/Federal Dam Safety and performance criteria for a High Hazard Class Dam. Continues irrigation service for 14,475 acres of cropland, the Millsite 18-hole Golf Course, and the State Park & Camping facilities. Continues recreation opportunities and provide water for the Hunter Power Plant.
- Alternative 2: Decommission of the structure does not meet the desired future condition. Irrigation service would have to developed somewhere else, recreation would stop, golf course would have to develop another water source, hunter power plant would have to develop another water source for the 7,000 ac-ft of water provided by the Millsite Dam.

#### Mitigation
- On-site monitoring for CR during implementation will inform any additional mitigation that may be needed. Restoration of Golf Course operations will be performed during/after construction of the dam safety elements.

#### Supporting reason
- Meets Watershed Rehabilitation (WF-07) program objectives

### Context (Record context of alternatives analysis)
- National national national
O. Determination of Significance or Extraordinary Circumstances

Intensity: Refers to the severity of impact. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial. Significance cannot be avoided by terms an action temporary or by breaking it down into small component parts.

If you answer ANY of the below questions "yes" then contact the State Environmental Liaison as there may be extraordinary circumstances and significance issues to consider and a site specific NEPA analysis may be required.

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<th>Yes</th>
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P. The information recorded above is based on the best available information:

In the case where a non-NRCS person (i.e. a TSP) assists with planning they are to sign the first signature block and then NRCS is to sign the second block as the responsible federal agency for the planning action.

<table>
<thead>
<tr>
<th>Signature (TSP if applicable)</th>
<th>Title</th>
<th>Date</th>
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<tbody>
<tr>
<td>Norm Evenstad</td>
<td>Water Res. Coordinator</td>
<td>1/26/2016</td>
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The following sections are to be completed by the Responsible Federal Official (RFO)

Q. NEPA Compliance Finding (check one)

The preferred alternative:

<table>
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<th>Action required</th>
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<td>1) is not a federal action where the agency has control or responsibility.</td>
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<td>2) is a federal action that is categorically excluded from further environmental analysis and there are no extraordinary circumstances.</td>
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<td>3) is a federal action that has been sufficiently analyzed in an existing Agency state, regional, or national NEPA document and there are no predicted significant adverse environmental effects or extraordinary circumstances.</td>
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<tr>
<td>4) is a federal action that has been sufficiently analyzed in another Federal agency’s NEPA document (EA or EIS) that addresses the proposed NRCS action and its effects and has been formally adopted by NRCS. NRCS is required to prepare and publish the agency’s own Finding of No Significant Impact for an EA or Record of Decision for an EIS when adopting another agency’s EA or EIS document. Note: This box is not applicable to FSA.</td>
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<tr>
<td>5) is a federal action that has NOT been sufficiently analyzed or may involve predicted significant adverse environmental effects or extraordinary circumstances and may require an EA or EIS.</td>
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R. Rationale Supporting the Finding

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<th>Findings Documentation</th>
<th>Action required</th>
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<tr>
<td>R.1</td>
<td>The proposed project will assist the Sponsors meet the current High Hazard Class dam safety criteria and allow the structure to continue to operate and provide benefits for public health and safety, agriculture and recreation.</td>
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<tr>
<td>R.2</td>
<td>Does not meet categorical exclusion definition due to the proposed change in the footprint area of the existing dam.</td>
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Scoping activities were performed to identify applicable resource concerns. A listing of those activities can be found in the Millsite Rehabilitation Plan/EA document. The concerns were incorporated into the Plan/EA in Chapter 3 - Scope of Environmental Assessment and indicated in Table-3, Summary of Scoping. The scoping process heavily utilized coordination meetings, site visits, and public meetings. The information gathered through this process is maintained as part of the Administrative Record in the form of trip reports, meeting minutes, technical specialist reviews, comments received, etc. The resource considerations for this large scale type of project is captured more completely in the Millsite Dam Rehabilitation Plan/EA.

Additional notes

(See Millsite Dam Rehabilitation Plan/EA Completed for this project). Scoping activities were performed to identify applicable resource concerns. A listing of those activities can be found in the Millsite Rehabilitation Plan/EA document. The concerns were incorporated into the Plan/EA in Chapter 3 - Scope of Environmental Assessment and indicated in Table-3, Summary of Scoping. The scoping process heavily utilized coordination meetings, site visits, and public meetings. The information gathered through this process is maintained as part of the Administrative Record in the form of trip reports, meeting minutes, technical specialist reviews, comments received, etc. The resource considerations for this large scale type of project is captured more completely in the Millsite Dam Rehabilitation Plan/EA.

I have considered the effects of the alternatives on the Resource Concerns, Economic and Social Considerations, Special Environmental Concerns, and Extraordinary Circumstances as defined by Agency regulation and policy.

Signature of Responsible Federal Official:

Norm Evenstad

Water Res. Coordinator

1/26/2016

Signature Title Date
APPENDIX E-4

EMERGENCY ACTION PLAN

Millsite Dam
Emery County, Utah
EMERGENCY ACTION PLAN

Millsite Dam

Emery County, Utah

OPERATED BY
Ferron Canal & Reservoir Co.
Ferron, Utah

APPROVED FOR USE BY:

____________________________________
President
Ferron Canal & Reservoir Co.

____________________________________
Date

Copy No.________
Millsite Dam

EMERGENCY ACTION PLAN

Participant Concurrence

We, the undersigned, representing our respective organizations, have read the Emergency Action Plan for Millsite Dam, and understand our responsibilities should an emergency occur.

______________________________________  Date
Emery County Sheriff

______________________________________  Date
Emery County Emergency Management Director

______________________________________  Date
President, Ferron Canal & Reservoir Co.

______________________________________  Date
Water Master, Millsite Dam

______________________________________  Date
Millsite Dam Engineer

______________________________________  Date
Division of Comprehensive Emergency Management

______________________________________  Date
Colorado Basin River Forecast Center,
National Weather Service
Millsite Dam

EMERGENCY ACTION PLAN

This copy includes the following revisions:

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Final - Millsite Dam Rehabilitation Plan/EA

Feb-2017

Appendix -E- Other Supporting Information
Part I. INTRODUCTION

EAP SUMMARY SHEET

A. FOREWORD

This Emergency Action Plan defines responsibilities and provides procedures to identify unusual and unlikely conditions, which may endanger Millsite Dam, in time to take remedial actions and to notify appropriate public officials of possible, impending, or actual failure of the dam. The plan also provides for notification when flood releases may cause major flooding.

The “Water Master” is the individual having onsite supervisory control of the dam and reservoir. In the absence of the Water Master, the next highest ranking official associated with the organization owning the dam is designated as the Water Master.

The “engineer” is an individual or corporation, generally having a continuing professional relationship with the dam owner, who provides technical advice and assistance pertaining to the dam. The engineer may be an employee of the owner, an officer in the organization, or may be a consultant retained to provide advice and support. The engineer should possess qualifications, training, and experience with the specific type of dam and be a licensed professional engineer in the state of Utah.

The Water Master must be knowledgeable in recognizing an emergency situation or unusual condition and must act immediately to minimize danger to the structure and to all persons within the immediate area – especially those in the downstream channel.

As a minimum procedure the Millsite Dam Water Master shall immediately:

- Identify the emergency situation
- Contact Emery County Sheriff
- With assistance from the State Office of Comprehensive Emergency Management, as needed, determine necessary actions
- Maintain contact with State Office of Comprehensive Emergency Management (if necessary, enlist help to remain at communications source or to relay information)
Potentially Dangerous Situation

CHART A

- Dam Tender
- Continue Monitoring
  - No
  - Yes: Go to CHART B
- Dam Owner
  - Condition Worsens
- State Division of Comprehensive Emergency Management
- State Engineers Office – Dam Safety Section
  - Threat to Dam?
    - Yes
    - No
    - Contact County Sheriff

EAP – 2
Impending Failure

CHART B

- Dam Tender
- Continue Monitoring
  - No
  - Condition Worsens
    - Yes: Go to CHART D
    - No
- Dam Owner
- Division of Comprehensive Emergency Management
- County Sheriff
  - Threat to Dam or People?
    - Yes
      - Prepare for possible evacuation of downstream areas
    - No
- Other state & federal agencies
- River Forecast Center 534-5130

EAP - 3
Dam has Failed

**CHART C**

1. **Dam Tender** → **Call 911**
2. **Call 911** → **County Sheriff**
   - Call for immediate evacuation of flood plain
3. **County Sheriff** → **Utah Dam Safety**
4. **Utah Dam Safety** → **State Division of Comprehensive Emergency Management**
5. **State Division of Comprehensive Emergency Management** → **River Forecast Center 534-5130**

EAP – 4
PART II. RESPONSIBILITIES

A. GENERAL RESPONSIBILITIES UNDER THE PLAN

1. Owner Responsibility

Millsite Dam is owned by Ferron Canal & Reservoir Co. The owner has the responsibility to operate, maintain, and repair Millsite Dam. The responsible official of Ferron Canal & Reservoir Co. is Tracy Behling. Daily operations of the dam are delegated to Lamond Smith, who also serves as the Water Master.

The Owner
- Insures safe operation of the dam
- Maintains and repairs the dam as needed to insure safe operation
- Directs the Water Master in operating the dam
- Insures the dam complies with applicable local, state and federal law
- Secures and appoints a Water Master
- Provides or arranges training for the Water Master
- Prepares and distributes the Emergency Action Plan and Standard Operating Procedures for Millsite Dam
- Communicates with local public safety officials, Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section, and State Division of Comprehensive Emergency Management, as needed

The Water Master
- Operates and maintains the dam according to approved Standard Operating Procedures
- Determines and identifies conditions or triggering events that initiate or require emergency actions
- Initiates actions to be taken
- Clearly communicates the emergency situation to those who need to be contacted
- Issues warning messages if dam failure is impending or has occurred
- Maintains records as required by law and by the owner
- Cooperates with local public safety officials in exercising the Emergency Action Plan

2. Sample Warning Messages

**DAM HAS FAILED**

"This is Tracy Behling, President of Ferron Canal & Reservoir Co., Millsite Dam, located 3 miles upstream from Ferron, has failed. Flooding can be expected. The floodplain below must be evacuated immediately."

EAP-5
DAM FAILURE IS POSSIBLE

“This is Tracy Behling, President of Ferron Canal & Reservoir Co., Millsite Dam, located 3 miles upstream from Ferron, failure of Millsite Dam is possible. Flooding in the floodplain may be expected at any time. The floodplain below may require evacuation.”

A POTENTIAL EMERGENCY SITUATION AT THE DAM HAS DEVELOPED OR IS DEVELOPING

“This is Tracy Behling, President of Ferron Canal & Reservoir Co., Millsite Dam, located 3 miles upstream from Ferron. A potential emergency situation at the dam has developed, which, if it continues may result in failure or uncontrolled releases from Millsite Dam. Flooding in the floodplain may be expected. Further information will be provided as it develops.”

3. Emergency Declaration

Tracy Behling, President, Ferron Canal & Reservoir Co., is responsible for declaring the existence of an emergency at Millsite Dam.

Tracy Behling, President, Ferron Canal & Reservoir Co., is responsible for declaring the termination of an emergency at Millsite Dam, after consulting the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

The State Engineer, State Dam Safety Officer, county sheriff, or other responsible public safety official, may also, upon cause, declare an emergency condition at Millsite Dam.

Consultation among the parties concerned with the dam should take place prior to declaring an emergency, if time permits.

4. Responsibility For Notification

The President, Ferron Canal & Reservoir Co. is responsible to notify local officials. If time allows in an emergency situation, onsite personnel should seek advice and assistance. However, if failure is impending or has occurred, the responsibility and authority for notification is delegated to the Water Master if the owner cannot be quickly contacted.

The President, Ferron Canal & Reservoir Co., is responsible to notify the National Weather Service (NWS) Colorado Basin River Forecast Center, which has general responsibility for issuing flood warning. The National Weather Service, Colorado River Forecast Center must be notified of any impending or actual dam break flooding, so that flood warning can be issued via the Emergency Broadcast System.
The President, Ferron Canal & Reservoir Co., is responsible to notify the Utah State Office of Comprehensive Emergency Management (CEM) (Public Safety) for emergency management assistance. CEM will in turn contact all the appropriate governmental entities such as the Governor’s Office, FEMA, the State Geologist, Water Resources, State Engineer Area Offices, and Dam Safety Section personnel.

5. Responsibility For Evacuation

The Emery County Sheriff is responsible for warning and evacuation planning. The Ferron Canal & Reservoir Co. is responsible for notifying the Emery County Sheriff when flooding is anticipated or a failure is impending or has occurred.

The Ferron Canal & Reservoir Co. cannot assume the responsibility of governmental entities for evacuation of people.

6. EAP Coordinator Responsibility

The President, Ferron Canal & Reservoir Co., is designated as Emergency Action Plan coordinator. The EAP Coordinator is responsible for EAP-related activities, including (but not limited to) preparing revisions to the EAP, establishing training seminars, coordinating EAP exercises with Emery County Sheriff and Emery County Emergency Preparedness Director, etc. Persons having questions or concerns should address their interest to President, Ferron Canal & Reservoir Co.

7. EAP Revisions

This EAP should be reviewed every three years for applicability and accuracy. Phone numbers listed in the Communications should be verified annually by the EAP Coordinator and revised communications directory pages should be prepared. The EAP Coordinator should issue revisions to all copy holders. When conditions or personnel change revisions should be made prior to the review cycles listed above.
PART III.  

EMERGENCY PROCEDURES

A. EMERGENCY SITUATION

1. Failure or Impending Failure of the Dam

DOWNSTREAM HAZARD POTENTIAL. Millsite Dam could present a high hazard potential to the downstream area as a result of failure or unsound operations. Should it fail, loss of life and potential economic loss may occur.

The dam's location in the canyon above Ferron requires prompt notification in event of a dam failure.

WARNING MESSAGES: The initial warning message to the 24-hour dispatch center would be one of three possible emergency conditions.

1. Advice that a POTENTIAL emergency situation exists or is developing and expressing concern for the safety of the dam.

2. A WATCH of the strong possibility of failure and calling for the evacuation of the flood plain.

3. A WARNING of failure and calling for immediate evacuation of the flood plain.

Notification Flowcharts A, B, and C, located in the front of this EAP graphically define the notification and warning process.

a. Failure

If the dam is failing, the Water Master (or other operating personnel at the dam) must immediately initiate downstream evacuation using the following procedures:

(1) Inform the Emery County Sheriff by phone, radio, or by driving to the nearest phone (refer to the Communications Directory for phone numbers, radio, or backup systems).

(2) Contact Utah Division of Comprehensive Emergency Management; they will inform other appropriate federal, state and county government offices.

(3) Coordinate efforts with Emery County Sheriff's Office and Emery County Emergency Preparedness Director in alerting all downstream areas.
(4) Maintain contact with Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

b. Impending failure

If the Water Master suspects impending failure, the following procedures should begin immediately.

(1) Contact the Utah Division of Comprehensive Emergency Management and Larry Bruno:
   a) determine if and what downstream entities should be notified

(2) Initiate corrective measures and other actions as recommended by Larry Bruno.

(3) Maintain contact with Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

NOTE: Notify Emery County Sheriff's Office of possible flooding downstream as early as possible; make certain all officials understand the situation.

2. Flooding

a. With normal communications — If the reservoir water surface is projected to rise above the spillway crest and flooding is imminent, immediately contact Emery County Sheriff and the Utah State Division of Comprehensive Emergency Management. Information reported should include:

   (1) Current reservoir water surface elevation

   (2) Observed water surface rise rate

   (3) Observed weather conditions in the vicinity—past, present, and predicted

   (4) The discharge condition of the stream above and below the reservoir

   (5) Known conditions at locations upstream or downstream from Millsite Dam.

b. The Utah Division of Comprehensive Emergency Management will contact the Utah State Department of Natural Resources, State Engineer's Office, Dam Safety Section.
3. Earthquake

LATITUDE: 39° 5'51" North       LONGITUDE: 111° 11'10" West

ZONE: Millsite Dam is located in an area subject to earthquakes of major damaging intensity. The dam lies in seismic risk zone 3.

a. Normal communications - If an earthquake is felt or one is reported to have occurred in the area, use the following procedures:

(1) Immediately conduct an overall visual dam inspection.

(2) IF THE DAM IS DAMAGED TO THE EXTENT THERE IS INCREASED FLOW PASSING DOWNSTREAM, IMMEDIATELY IMPLEMENT FAILURE OR IMPENDING FAILURE PROCEDURES.

(3) If visible damage occurred but is not serious enough to cause dam failure, immediately:

   (a) Observe nature, location, and extent of damage. The description of slides, sloughs, and sudden subsidence should include:

       Location
       Extent (severity)
       Rate of subsidence
       Effects on adjoining structures
       Springs or seeps
       Reservoir and tailwater elevations
       Prevailing weather conditions
       Other facts believed pertinent

   Evaluate impending failure hazard.

   (b) Report all information to Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section; if key personnel are unavailable, report directly to the Emery County Sheriff.

   It is extremely important that the person receiving your report understands your evaluation and description of the potential hazard at the dam. A decision on further actions required should be made promptly.

EAP-10
(c) Reinspect the damage site and maintain communications with key personnel previously receiving the report.

(d) If dam failure is not impending, continue to the following step (4).

(4) Thoroughly inspect for damage

(a) Both dam faces for cracks, settlement, or seepage
(b) Abutments for possible displacement
(c) Drains and seeps
(d) Spillway structure
(e) Outlet works control house, shaft, and gate chamber
(f) Power supply and standby power unit
(g) Visible reservoir and downstream areas for landslides
(h) Other appurtenant structures
(i) Read critical instruments and note any abnormal or changed readings.

(5) Report inspection findings to Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section following the earthquake incident.

(6) If apparent damage has not occurred to the dam, embankments, or appurtenant structures, a “No Damage” report should be made to the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

(7) Continue to inspect and monitor the facilities for at least 48 hours or as instructed by Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section – in the event unobservable or delayed damage should occur.

(8) Some damage to structures may not be apparent during the inspection immediately following an earthquake. It is possible that the settlement of structures, the reactivation of old slides, or the development of new slides may not occur with ground shaking and would manifest itself after the initial
inspection. A secondary inspection 2 weeks to a month after the initial inspection should be made.

(9) Survey settlement and alignment measurement points if requested by Larry Bruno or the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

b. Communication outage – IF ALL COMMUNICATIONS FROM THE DAM ARE LOST and there is potential for impending failure of the dam, use the following checklist as a guide during an earthquake event:

(1) Quickly inspect the dam and evaluate potential failure hazard.

(2) Check for sloughs, slides, slumps, and other signs of distress near dam abutments.

(3) If failure is impending, use all measures that can reduce reservoir storage. Warning downstream residents is imperative. If possible, enlist aid of Emery County Emergency Preparedness Director and the Emery County Sheriff's Office. Personal warning of downstream residents will be performed by the Emery County Sheriff.

NOTE: Caution should be used when increasing discharge through the outlet works because the conduit may be sheared and increased flow may cause piping in the dam. It may be necessary to shut off the outlet works flow (if possible) to avoid piping.

(4) Continue trying to contact or send word to the Emery County Sheriff, Larry Bruno, and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

B. UNUSUAL OCCURRENCES

1. Slumping or Cracking of the Dam or Abutments

   a. Determine –

      (1) Location

      (2) Size of affected area(s) in height, width, and depth

      (3) Extent (severity)

      (4) Estimated discharge (whether clear or cloudy water)

      EAP-12
(5) Reservoir and tailwater elevations

b. Contact Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

2. Failure of Appurtenances or Operating Equipment

a. Determine –

(1) Probable cause of failure, duration, and effects on reservoir operation

(2) Immediate assistance required from Larry Bruno and contact the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section to remedy the problem, including:

(a) Replacement parts

(b) Type of labor available

(c) Repair equipment

(3) Available temporary replacements or temporary alternatives

(4) Any other facts believed pertinent

b. Contact Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

3. New Springs, Seeps, or Boggy Areas

If new springs, seeps, and boggy areas develop, use the following procedures:

a. Determine –

(1) Location

(2) Size of affected area(s)

(3) Estimated discharge

(4) Nature of the discharge (whether clear or cloudy water)

(5) Reservoir and tailwater elevation

EAP-13
b. Read data from all pertinent instrumentation

c. *Map data* — If necessary to further analyze conditions, a map should be prepared showing the extent of all seep areas, springs, and any other pertinent data, including the dates of recording reservoir levels.

d. Contact Larry Bruno

e. Contact the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section and continue to monitor situation.

f. Initiate corrective measures as directed by Larry Bruno.

4. **Rapid Increase or Cloudy Appearance in Seepage**

If existing or new springs, seeps, and boggy areas develop rapid increases in cloudy water, use the following procedures:

a. *Determinations* —

   (1) Location

   (2) Size of affected area(s)

   (3) Estimated discharge

   (4) Nature of the discharge (whether clear or cloudy water)

   (5) Reservoir and tailwater elevation

b. Contact Larry Bruno or the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section for assistance.

   (1) Read and report other instrumentation readings

   (2) Monitor continuously until instructed otherwise

c. *Map Data* — If necessary to further analyze conditions, a map should be prepared showing the extent of all seep areas, and any other pertinent data, including the dates of recording reservoir levels.

d. *Settlement points* — If surface measurement (reading settlement points) will help clarify abnormal condition, such observations should be made, reported, and recorded.
5. **Abnormal Instrumentation Readings**

During instrument recording, the Millsite Water Master will compare the current readings with the previous readings and, if necessary, with readings at the same reservoir elevation. If the reading appears to be abnormal, the Millsite Water Master should:

a. **Determine** –

   (1) Possible reading or computation error or instrument failure
   
   (2) Calculate change in reading from normal
   
   (3) Reservoir elevation
   
   (4) Weather conditions
   
   (5) Any other facts believed pertinent

b. Contact Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section for assistance.

6. **Landslide**

Any *landslide* that could move into the outlet works, spillway area, or into the reservoir – rapidly displacing large volumes of water – would be dangerous to the dam. Landslides or potential landslides into the downstream channel which may impound water should be reported.

Any landslide which may affect either abutment should be reported to the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section immediately.

All landslides or potential landslides which may affect the dam, abutments, outlet works, or reservoir basin should be reported to the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section. Identify landslide areas by name and location.

a. **Determine** –

   (1) Size
   
   (2) Possible cause
   
   (3) Degree of effect on operation
   
   (4) Probability of additional movement of disturbed area or of other slide areas

EAP-15
(5) Development of new slides

(6) Any other facts believed pertinent

b. Contact Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section for assistance.

For a landslide that occurs in the downstream channel:

a. Determine –

(1) Size (including depth and percent across river channel)

(2) Capability of immediately closing outlet works

(3) Other inflows

(4) Location in relation to the toe of the dam and other appurtenant structures

(5) Availability or need for heavy equipment

b. Contact Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section for assistance.

7. **Severe Storms**

Contact the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section and report local data and personal observations of severe storms, including heavy rainstorms, unusually heavy snowfall, high winds, tornadoes, etc. Data should include pertinent information to aid in evaluating the impact of the event upon the Millsite Dam.

8. **Fires**

a. For forest or range fires –

(1) Determine

(a) Location and extent

(b) Possibility of fire spreading to or damaging dam facilities

(c) Prevailing weather conditions

(d) Communications outage

EAP-16
(e) Any other facts believed pertinent

(2) Contact the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section, if the fire affects the dam or outlet works.

b. For fire within or about the structure --

(1) Determine location and severity

(2) Contact Emery County fire department

(3) Initiate use of available fire equipment

(4) Contact Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section and report

   (a) Extent (severity)

   (b) Possibility of additional damage

   (c) Damage to operating equipment

   (d) Loss of records or communications equipment

   (e) Any other pertinent facts

9. Demonstrations, Sabotage, or Act of War

For a demonstration at the dam use this checklist as a minimum procedure:

   a. Show restraint

   b. Lock all gates and doors

   c. Notify Emery County Sheriff's Office

   d. Notify the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section, as soon as possible.

If a bomb threat call is received, use the following checklist during and after the incident:

   a. Keep the caller on the line as long as possible. Ask the caller to repeat the message. Record every word spoken by the caller.
b. If the caller does not indicate the location of the bomb nor the time of detonation, the person receiving the call should ask the caller to provide this information.

c. It may be advisable to inform the caller that detonation of a bomb would result in death or serious injury to many innocent people.

d. Pay particular attention for any strange or peculiar background noises such as: motors running, background music (type), and any other noises that might give a remote clue as to the caller’s location.

e. Listen closely to the voice (male or female), voice quality, accent, or speech impediment.

f. Immediately after the caller hangs up, the person receiving the call should report to

   (1) Emery County Sheriff’s Office

g. Evacuate all unnecessary personnel and visitors from the facility.

h. Immediately suspend ALL radio transmissions in the vicinity until directed to resume radio use by the public safety official directing the bomb search. CAUTION: The use of radios during a bomb search could be dangerous. The radio transmissions could cause premature detonation of an electric initiator (blasting cap).

i. If a suspicious package or object is found, DO NOT TOUCH. It should be left for trained personnel to remove or disarm.

j. The Water Master, after consultation with on-site public safety or fire authorities, shall be responsible for giving the “all clear” for normal duty to be resumed.

In the event of a nuclear attack or an act of war, and assuming communications are lost, the following procedures will be used as a checklist:

a. Evacuate dam area and downstream vicinity if failure is impending.

b. As soon as possible, check for any damage to the dam.

c. If there are any injuries, assist with first aid treatment.

d. Protect essential records.

e. Maintain a complete blackout.

EAP-18
f. Maintain 24-hour watch over all facilities to prevent sabotage.

g. Notify Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section as soon as communications are restored.

IF ALL COMMUNICATIONS FROM THE DAM ARE LOST and impending failure is possible due to an act of sabotage, use the following checklist as a guide:

a. Immediately perform an overall visual dam inspection to determine location and extent of damage.

b. IF THE DAM IS FAILING, use procedures outlined above.

c. If damage to the embankment is substantial, reservoir evacuation should be initiated.

d. Check to see whether the saboteur has left the area.

e. When it is determined that the saboteur has left, check area for further sabotage potential and any evidence that might aid in apprehending the saboteur.

f. As soon as possible, notify the Emery County Sheriff.

g. Continue trying to contact the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

10. Oil and Hazardous Substance Spills

For an oil spill (Environmental Protection Agency defines as "***a visible sheen or film on the water***") from any source, perform these procedures:

a. Contact the Emery County Sheriff for onsite coordinator and instruction.

b. Pinpoint source of spill, if possible.

c. Contact responsible party(ies) to ensure that they are aware of spill and to determine what remedial measures they are taking.

d. Determine nature (including but not limited to petroleum, fuel oil, sludge, oil refuse, or oil mixed with wastes; industrial chemicals, herbicides, or pesticides) and quantity

   Minor spill: less than 1,000 gallons
   Medium spill: 1,000 to 10,000 gallons
   Major spill: more than 10,000 gallons

EAP-19
CAUTION: IF IDENTITY AND POTENTIAL HAZARD IN HANDLING THE SUBSTANCE IS UNKNOWN, immediately notify Emery County Sheriff for surveillance and DO NOT ATTEMPT TO HANDLE.

e. Determine if and to what extent resources in the area may be affected by discharge. Ascertain whether discharge will affect adjacent lands or facilities.

f. Make initial determination regarding the extent of effort and equipment required to contain the spill.

g. Notify the Emery County Sheriff and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section and report above information.

h. Assess threat posed to public health and make appropriate warnings –

   (1) Municipal water system
   (2) Law enforcement
   (3) Fire protection

i. Initiate cleanup, disposal, and documentation as directed by Emery County Sheriff.

11. Large or Sudden Releases into the Downstream Channel

   a. Notify Emery County Sheriff
   b. Emery County Emergency Preparedness Director
   c. Contact the Utah Division of Wildlife Resources
   d. Notify Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section.

12. Fish and Wildlife Losses

   a. Describe loss, species, numbers, location, possible further losses, probable cause, and other pertinent information.
   b. Contact Utah State Division of Wildlife Resources Area Office.

13. Drowning

   a. Notify the Emery County Sheriff.
   b. Call an ambulance.

EAP·20
14. Major Accident
   a. Call 911

15. Criminal Action
   a. Emery County Sheriff

C. ATTENDANCE AND COMMUNICATIONS PROCEDURES

The Water Master may be contacted at the telephone number listed in the Communications Directory. The dam will be monitored on a routine basis by the Water Master.

The dam should be attended continuously when threatened by physical harm such as bomb threat or during extreme runoff conditions.

Refer to the Communications Directory for normal and emergency phone numbers and methods of communications.
PART IV. PREVENTATIVE ACTIONS

A. SURVEILLANCE

It may be necessary to send an observer to the dam during these periods and not rely on the instrumentation alone. In addition, it is recommended that an observer be at the dam when flood conditions or signs of serious structural distress have been identified.

B. ACCESS TO THE SITE—TRANSPORTATION

Millsite Dam is located approximately three miles west of Ferron, Utah.

1. From Ferron, Utah – Access to the dam spillway and outlet structure is via Canyon Road which intersects with U-10 at 100 South in Ferron. To view the spillway vehicles must be parked in the Millsite Golf Course parking lot and then proceed on foot alongside fairway No. 1 of the golf course. The outlet structure is reached via a dirt road which crosses the north end of the golf course near the junction of Canyon Road and Mill Road. The north toe of the dam can be reached via an unimproved dirt road from Mill Road which intersects with U-10 at 100 North in Ferron. Vehicle access to the dam crest and the spillway is at the north toe of the dam.

Canyon Road and Mill Road are paved all-weather roads. The unimproved dirt road to the north toe may not be passable during the winter or during periods of heavy rainfall or snowmelt runoff.

2. From Salt Lake City, Utah – Follow I-15 south to the Price Spanish Fork exit, thence south on U-6 to Price thence south on U-10 to Ferron. Then follow the directions from Ferron, Utah, listed above. During severe storms four-wheel drive vehicles may be required to travel the route.

3. The nearest airport is the Huntington Airport located 2 miles north of Huntington, approximately 27 miles north of the dam. Helicopters may land at either end of the dam.

C. RESPONSE DURING PERIODS OF DARKNESS

Response to potential or actual emergency conditions during periods of darkness is complicated by poor visibility. If 24-hour surveillance is required at the dam, portable light plants, located on the abutments, will be used to illuminate the operating deck, crest, groins and toe.

D. POWER FAILURE

During power failure, releases may be made from the outlet works by hand.

EAP-22
E. RESPONSE TIME

Millsite Dam is located only three miles from Ferron near an all weather road. Access to the spillway and outlet works is across the Millsite golf course. Estimated time to Millsite dam from Ferron is approximately 7 minutes in all except deep snow conditions.

F. RESPONSE DURING PERIODS OF ADVERSE WEATHER AND FLOODING

ALTERNATIVE SYSTEMS OF COMMUNICATION

In the event of power or communications failure, the Emery County Sheriff would be contacted by dispatching a courier with a written message to the nearest public safety official’s office and having them contact the sheriff via their radio system.

If time permits, the Emery County Sheriff may dispatch emergency radio communications technicians to the dam to establish direct communications with the sheriff’s office. The sheriff is responsible for recruiting, training, and supervising volunteer communications staff as appropriate.

G. COORDINATING INFORMATION ON FLOWS

Information on flows based on weather and runoff forecasts, failure and other emergency conditions will be coordinated with downstream water users and the National Weather Service, when possible. Coordination with the National Weather Service and state Dam Safety Section is recommended to monitor storms, river stages, and flood waves resulting from a dam break. The NWS or Dam Safety Section may also supplement warnings being issued by using its own communication system.

H. EMERGENCY RESERVOIR EVACUATION

Emergency evacuation of the reservoir should only be undertaken under extreme emergencies. Ferron Canal & Reservoir Co., in consultation with Larry Bruno and the Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section, decides if emergency evacuation is appropriate. Notification should be given to the Emery County Sheriff and National Weather Service in advance. Releases should be ramped so that downstream users receive visual confirmation of increased streamflows in addition to public warnings.
PART V. INUNDATION MAPS

Inundation maps for Millsite Dam are located on the following pages. (NOTE: inundation maps are being prepared for Millsite Dam by the Soil Conservation Service. They will be available by late summer 1994. They will be made a part of this EAP as soon as they are available.)

Below is a summary list of major structures and populated areas downstream from the dam which may be affected. This list serves only as a guide for evacuation purposes.

A. Ferron, Utah
B. Molen, Utah

Structures and features downstream from dam include:

A. Bridge across Ferron Creek on Canyon Road
B. Bridge across Ferron Creek on 4th West
C. Bridge across Ferron Creek on U-10

WARNING SYSTEM

There is a telephone located in the outlet structure of the dam. The nearest telephone to the spillway is located in the Millsite Golf Course Clubhouse.

Warning of failure or notification of impending failure would be telephoned to the Emery County Sheriff’s Office. That office will implement appropriate procedures to warn or evacuate the downstream population.
PART VI. APPENDICES

APPENDIX 1. COMMUNICATIONS DIRECTORY

Millsite Dam
Ferron, Utah

A. DAM OWNER AND OPERATOR
Ferron Canal & Reservoir Co.
C/o Tracy Behling
1695 Mill Road
PO Box 256
Ferron, UT 84523
Phone: (435) 384-2990

B. Water Master
The Water Master lives at 990 East Bench Road in Ferron, approximately 5 miles from the dam.

C. Normal and Emergency Communications:

<table>
<thead>
<tr>
<th>NAME</th>
<th>POSITION</th>
<th>ADDRESS</th>
<th>HOME PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracy Behling</td>
<td>President, Ferron Canal &amp; Res. Co.</td>
<td>1695 W. Mill Rd, PO Box 256, Ferron, UT 84523</td>
<td>(435) 384-2990</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cell: (435) 749-2990</td>
</tr>
<tr>
<td>LaMond Smith</td>
<td>Water Master, Ferron Canal &amp; Res. Co.</td>
<td>990 E. Bench Rd, PO Box 846, Ferron, UT 84523</td>
<td>(435) 384-2387</td>
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</tbody>
</table>

D. NOTE
Access to the dam spillway and outlet structure is via Canyon Road which intersects with U-10 at 100 South in Ferron. The north toe of the dam can be reached via an unimproved dirt road from Mill Road which intersects with U-10 at 100 North in Ferron. Vehicle access to the dam crest is at the north toe of the dam.
E. LOCAL LAW ENFORCEMENT

Emery County Sheriff (Emergency) ......................................................... 911
Business calls ............................................................................. (435) 381-2404

F. SUPPORTING AGENCIES AND ORGANIZATIONS

Ambulance ......................................................................................... 911
Colorado Basin River Forecast Center ........................................ 801-524-5130
Ferron Canal & Reservoir Co. (Tracy Behling) ............................... 435-384-2990
Engineer, Larry Bruno .................................................................... 435-148-5114
(Home) 435-637-1985
Fire – Ferron ................................................................................... 911
Hazardous material Spill

Emery County .................................................................................. 435-381-2404
National Response Center ............................................................... 1-800-424-8802
Environmental Protection Agency 24-Hour Spill Reporting ......... HOTLINE 1-800-227-8914
Utah State Division of Comprehensive Emergency Management .... 1-801-538-3400
Hospital – Castle View Hospital, Price ........................................... 435-637-4800
Oil Spill ............................................................................................ see Hazardous Material Spill
Sheriff - Emery County Sheriff (Emergency) ................................. 911
(Business) ...................................................................................... 381-2404
Utah Highway Patrol ...................................................................... 1-888-221-7070
Price ............................................................................................. 435-637-0893
Radio Station KSL, Salt Lake City ................................................ 801-575-7600
Utah Division of Wildlife Resources, Price .................................. 613-3700
Emery Water Conservancy District ................................................. 381-2311

EAP-26
APPENDIX 2

MILLSITE DAM, DESCRIPTION AND ACCESS

A. DESCRIPTION OF THE DAM

Millsite Dam is an earth filled dam, constructed by USDA, Soil Conservation Services during 1969 and 1970. The reservoir impounded by Millsite Dam is known as Millsite Reservoir. Its primary purpose is to store flows of Ferron Creek for irrigation use near Ferron in Emery County, Utah. Additional reservoir uses include recreation, irrigation storage, and industrial. The dam is located in Section 6 & 7, T 20S, R 7E and Sections 1 & 12, T 20S R 6E, Salt Lake Base and Meridian.

Construction of Millsite Dam began on April 22, 1969. The embankment was completed ***. Initial filling began ***.

B. DIRECTIONS AND ACCESS TO DAM

1. From Ferron, Utah – Access to the dam spillway and outlet structure is via Canyon Road which intersects with U-10 at 100 South in Ferron. To view the spillway vehicles must be parked in the Millsite Golf Course parking lot and then proceed on foot alongside fairway No. 1 of the golf course. The outlet structure is reached via a dirt road which crosses the north end of the golf course near the junction of Canyon Road and Mill Road. The north toe of the dam can be reached via an unimproved dirt road from Mill Road which intersects with U-10 at 100 North in Ferron. Vehicle access to the dam crest and the spillway is at the north toe of the dam.

Canyon Road and Mill Road are paved all-weather roads. The unimproved dirt road to the north toe may not be passable during the winter or during periods of heavy rainfall or snowmelt runoff.

2. From Salt Lake City, Utah – Follow I-15 south to the Price Spanish Fork exit, thence south on U-6 to Price thence south on U-10 to Ferron. Then follow the directions from Ferron, Utah, listed above. During severe storms four-wheel drive vehicles may be required to travel the route. Millsite Dam is located approximately 3 miles west of Ferron, Utah.

3. The nearest airport is the Huntington Airport located 2 miles north of Huntington, approximately 27 miles north of the dam. Helicopters may land at either end of the dam.
APPENDIX 3

POTENTIAL PROBLEMS AND IMMEDIATE RESPONSE ACTIONS

The information listed below is provided for general information. In the event one or more of these conditions exist at Millsite Dam, the Ferron Canal & Reservoir Co. should contact Larry Bruno immediately for specific advice based on field observation.

The Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section should be contacted as soon as possible and details of the problem and emergency action taken.

OVERTOPPING BY FLOOD WATERS

Open outlet to maximum safe capacity.

Place sandbags along the crest to increase freeboard and force more water through the spillway.

Create additional spillway capacity by making a controlled breach in the dike section south of the spillway where the foundation materials are erosion resistant.

LOSS OF FREEBOARD OR DAM CROSS SECTION DUE TO STORM WAVE EROSION

Place additional riprap or sandbags in damaged areas to prevent further embankment erosion.

Lower the water level to an elevation below the damaged area.

Restore freeboard with sandbags or earth and rock fill.

Continue close inspection of the damaged area until the storm is over.

SLIDES ON THE UPSTREAM OR DOWNSTREAM SLOPE OF THE EMBANKMENT

Lower the water level at a rate and to an elevation considered safe given the slide condition. If the outlet is damaged or blocked, pumping, siphoning, or a controlled breach may be required.

Restore lost freeboard if required by placing sandbags or filling in the top of the slide.

Stabilize slides on the downstream slope by weighing the toe area with additional oil, rock, or gravel.

EAP-29
EROSIONAL FLOWS THROUGH THE EMBANKMENT, FOUNDATION, OR ABUTMENTS

Plug the reservoir side of the flow with whatever material is available (hay bales, bentonite, or plastic sheeting if the entrance to the leak is in the reservoir basin).

Lower the water level until the flow decreases to a non-erosive velocity or until it stops.

Place a protective sand and gravel filter over the exit area to hold materials in place.

Continue lowering the water level until a safe elevation is reached.

Continue operating at a reduced level until repairs can be made.

FAILURE OF APPURTEENANT STRUCTURES SUCH AS OUTLETS OR SPILLWAYS

Implement temporary measures to protect the damaged structure, such as closing an outlet or providing temporary protection for a damaged spillway.

Employ experienced professional divers if necessary to assess the problem and possibly implement repair.

Lower the water level to a safe elevation. If the outlet is inoperable, pumping, siphoning, or controlled breach may be required.

MASS MOVEMENT OF THE DAM ON ITS FOUNDATION (SPREADING OR MASS SLIDING FAILURE)

Immediately lower the water level until excessive movement stops.

Continue lowering the water until a safe level is reached.

Continue operation at a reduced level until repairs can be made.

EXCESSIVE SEEPAGE AND HIGH LEVEL SATURATION OF THE EMBANKMENT

Lower the water to a safe level.

Continue frequent monitoring for signs of slides, cracking or concentrated seepage.

Continue operation at a reduced level until repairs can be made.
SPILLWAY BACKCUTTING THREATENING RESERVOIR EVACUATION

Reduce the flow over the spillway by fully opening the main outlet.

Provide temporary protection at the point of erosion by placing sandbags, riprap materials, or plastic sheets weighted with sandbags.

When inflow subsides, lower the water to safe level.

Continue operating at a low water level in order to minimize spillway flow.

EXCESSIVE SETTLEMENT OF THE EMBANKMENT

Lower the water level by releasing it through the outlet or by pumping, siphoning, or a controlled breach.

If necessary, restore freeboard, preferably by placing sandbags.

Lower water to a safe level.

Continue operating at a reduced level until repairs can be made.
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<td>National Weather Service, Colorado Basin River Forecast Center</td>
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<td>Engineer</td>
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<td>San Rafael Resource Center Office, Bureau of Land Management, Price</td>
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<td>Utah State Department of Natural Resources, State Engineers Office, Dam Safety Section</td>
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Ferron Canal & Reservoir Co.
Millsite Dam

RECORD OF PHONE CONVERSATIONS

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APPENDIX E-5

FERRON WATERSHED WORK PLAN

Original - 1965
WATERSHED WORK PLAN
FERRON WATERSHED
EMERY and SANPETE COUNTIES, UTAH

January 1965

United States Department of Agriculture
Soil Conservation Service
Washington, D.C. 20250

September 10, 1965

To: Josiah A. Libby, State Conservationist, SCS
Salt Lake City, Utah

From: D. A. Williams, Administrator, SCS

Subject: WS-FL-566 - Ferron Watershed, Utah

The Watershed Work Plan for Ferron Watershed, Emery and Sanpete Counties, Utah, has been approved by resolutions adopted on July 12, 1965, by the Committee on Public Works of the Senate and on September 9, 1965, by the Committee on Public Works of the House of Representatives.

You are authorized to provide Federal assistance in the installation of works of improvement on the Ferron Watershed in accordance with the terms, conditions, and stipulations contained in the Work Plan as funds appropriated for this purpose are made available.

Please submit field cost estimate SCS-207 report in accordance with Watersheds Memorandum SCS-47.

We are returning nine signed copies of the watershed work plan for your files and the sponsoring local organizations.

Attachments

cc:
ERS - Melvin L. Upchurch, Administrator
FS - Edward P. Cliff, Chief
ANS - George W. Irving, Jr., Administrator
FBS - Lloyd E. Davis, Administrator
PHA - Howard Bertsch, Administrator
OGC - John C. Bagwell, General Counsel
ASCS - John B. Vance, Director, Conservation and Land Use Division
Sec. Office - John A. Eber, Assistant Secretary, Rural Development and Conservation
EWP - Portland, Oregon
WATERSHED WORK PLAN

PERRON WATERSHED

Emery and Sanpete Counties, Utah


Prepared and Sponsored by: San Rafael Soil Conservation District
Ferron Canal and Reservoir Company
Ferron City
Emery County Water Conservancy District
Emery County
Utah State Department of Fish and Game

with assistance by:
U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, U. S. Forest Service
U. S. Department of Agriculture, Farmers Home Administration
U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service
U. S. Department of Interior, Bureau of Land Management
State of Utah, Water and Power Board
State of Utah, Land Board
State of Utah, State Engineer
State of Utah, Department of Forestry and Fire Control
State of Utah, Cooperative Extension Services

January 1965
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WATERSHED WORK PLAN AGREEMENT

between the

San Rafael Soil Conservation District
Local Organization

Ferron Canal and Reservoir Company
Local Organization

Ferron City
Local Organization

Emery County Water Conservancy District
Local Organization

Emery County
Local Organization

Utah State Department of Fish and Game
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of Utah

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Ferron Watershed, State of Utah, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration for the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and
Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Ferron Watershed, State of Utah, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed within a ten-year period.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost, $75,900.) The percentage of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

<table>
<thead>
<tr>
<th>Works of Improvement</th>
<th>Sponsoring Local Org. (Percent)</th>
<th>Service (Percent)</th>
<th>Estimated Cost (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir and Recreation Facilities</td>
<td>66.2</td>
<td>33.8</td>
<td>43,000</td>
</tr>
<tr>
<td>Payments of landowners for about 370 acres and cost of relocation or modification of improvements</td>
<td>100.0</td>
<td>0</td>
<td>11,000</td>
</tr>
<tr>
<td>Other land, legal fees, survey costs</td>
<td>100.0</td>
<td>0</td>
<td>21,900</td>
</tr>
</tbody>
</table>

2. The Sponsoring Local Organization will not sell or otherwise dispose of land acquired for the Mill Site Reservoir and Dam and recreation facilities for which P.L. 566 cost sharing is provided during the evaluated life of the project except to a public agency which will operate the development in accordance with operation and maintenance agreements. The lease of land for concessions for essential purposes such as lunch stands, boat rental docks, etc., will be permitted.

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of works of improvement. (Estimated cost, $100,000.)
4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<table>
<thead>
<tr>
<th>Multipurpose Structure and Recreation Facilities</th>
<th>Sponsoring Local Org. (Percent)</th>
<th>Service (Percent)</th>
<th>Estimated Construction Cost (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir and Dam, Irrigation Outlet, Remaining (Joint)</td>
<td>50</td>
<td>50</td>
<td>64,000</td>
</tr>
<tr>
<td>Recreation Facilities</td>
<td>41.2</td>
<td>58.8</td>
<td>2,536,000</td>
</tr>
<tr>
<td>System Improvements</td>
<td>50</td>
<td>50</td>
<td>66,800</td>
</tr>
<tr>
<td>Debris Basins</td>
<td>0</td>
<td>100</td>
<td>286,000</td>
</tr>
<tr>
<td>Fish and Wildlife Water Resource Improvements</td>
<td>50</td>
<td>50</td>
<td>382,700</td>
</tr>
</tbody>
</table>
| 5. This table is modified by addition of a footnote to the 5th column:

Works of Recreation Reservoir  The Service may provide a portion of their share of costs three four arrangements. The quantity of costs to be borne by the Service are as follows:

<table>
<thead>
<tr>
<th>Local Org. (Percent)</th>
<th>Service (Percent)</th>
<th>Service Cost (Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreation Reservoir</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>All Other</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

6. 7. .11 bear the costs of administration $75,900.

8. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

10. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement does not constitute a financial document to serve as a basis for the obligation of federal funds, and financial and other assistance to be furnished by the Service and other federal agencies in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

Where there is a federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. Sec. 15.1-15.13), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

15. No member of or delegate to Congress or resident commissioner shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
San Rafael Soil Conservation District  
Local Organization

By  L. Z. Henderson
Title  Chairman
Date  Jan. 18, 1965

The signing of this agreement was authorized by a resolution of the governing body of the San Rafael Soil Conservation District  
Local Organization

adopted at a meeting held on  Jan. 18, 1965
(Secretary, Local Organization)

Date  Jan. 18, 1965

Perron Canal and Reservoir Company  
Local Organization

By  Ellis Wilcox
Title  President
Date  Jan. 18, 1965

The signing of this agreement was authorized by a resolution of the governing body of the Perron Canal and Reservoir Company  
Local Organization

adopted at a meeting held on  Jan. 14, 1965
(Secretary, Local Organization)

Date  Jan. 18, 1965
Ferron City
Local Organization

By

Max M. Halvorsen

Title
Mayor

Date
January 18, 1965

The signing of this agreement was authorized by a resolution of the
governing body of the Ferron City Council
Local Organization

adopted at a meeting held on

January 18, 1965

Casidy Nelson

(Secretary, Local Organization)

Date
January 18, 1965

Emery County Water Conservancy District
Local Organization

By

Oral C. Johnson

Title
Chairman

Date
Feb. 5, 1965

The signing of this agreement was authorized by a resolution of the
governing body of the Emery County Water Conservancy District
Local Organization

date

Feb. 5, 1965

adopted at a meeting held on

Feb. 5, 1965

Mark Humphrey

(Secretary, Local Organization)

Date
February 5, 1965

vi
Emery County
Local Organization
By
Title
Board Chairman
Date
Feb. 4, 1965
The signing of this agreement was authorized by a resolution of the
governing body of the Emery County Commission.
Local Organization
adopted at a meeting held on
(Secretary, Local Organization)
Date
2-4-65

Utah State Department of Fish and Game
By
Title
Director
Date
February 9, 1965

Soil Conservation Service
United States Department of Agriculture
By
Title
acting Administrator
Date
May 13, 1965

vii
THE WATERSHED WORK PLAN

FERRON WATERSHED

Emery and Sanpete Counties, Utah

January 1965

SUMMARY OF THE PLAN

The Ferron Watershed is located principally in Emery County with a small portion in Sanpete County. The watershed area is about 19,000 acres, all within the San Rafael Soil Conservation District.

Watershed Problems

Heavy grazing use of the watershed by livestock and big game, together with unstable soil conditions and erratic climate, have brought about depletion in plant cover and contributed to land deterioration, erosion, and the abnormal production of floodwater and sediment.

Floodwater and sediment damages to crops, irrigation canals, cropland, channels, and other improvements are widespread and make up the principal flood problems.

Because of seasonal fluctuations, the natural streamflow of Ferron Creek provides a water supply which meets about half the need for irrigation. Efforts to store water in the soil profile during high flow creates drainage, salt, erosion, and other problems. Seepage losses further deplete an inadequate water supply during periods of low flow. These conditions have contributed to low irrigation efficiencies and have limited the application of conservation treatment.

Fish and wildlife and recreation improvements within and adjacent to the watershed are inadequate. Wildlife population is limited by scarcity and poor distribution of water, food, and cover. Limited winter range is an important factor in the management of the mule deer herd.

Emery County has been designated as a distressed area under provisions of the Area Redevelopment Act. Approximately 50% of the farm families have an annual gross farm income of less than $2,500. The county had an unemployment rate of 8.6% in 1963.

Measures to be Installed

Works of improvement in this plan consist of a combination of land treatment and structural measures designed to alleviate the dominant watershed problems and contribute to redevelopment of the area. The estimated installation cost is $6,969,800, of which $3,892,100 will be from P.L. 566 funds and $3,077,700 will be from other funds.
Land Treatment Measures

Land treatment measures are needed to achieve the desired level of conservation and for effective operation of the structural measures. Conservation crop rotation, irrigation water management, farm ditch lining, and land leveling on the irrigated land will contribute to improvement of irrigation efficiencies and the conservation of soil and water resources. Renovation of grasslands will provide increases in useable forage and stabilization of soil.

Installation of contour trenches, contour furrows, gully, road, and trail stabilization, seeding, fencing, and fire prevention on the rangeland will stabilize critical sediment and flood source areas. Sagebrush spraying, pinon-juniper control, seeding, water development, fences, and improved grazing management are necessary to the success of the critical area treatment and will arrest active gully erosion, reduce summer flood runoff, and have a widespread effect in halting and reversing the trend of land deterioration.

The total installation cost of all land treatment measures is estimated to be $2,394,300. P.L. 566 funds will provide $876,300 or 37% of this cost and other funds will provide $1,518,000 or 63%. Technical assistance costs for accelerated application of land treatment measures on private and state lands will come from P.L. 566 funds.

Structural Measures

Structural measures are designed to supplement the land treatment measures in solving watershed problems.

The eight debris basins and the multiple purpose Mill Site Reservoir will prevent most of the dominant flood and sediment problems. The multiple purpose Mill Site Reservoir and the irrigation system improvements will provide for regulation and conservation of the irrigation water supply. In addition, plans for the Mill Site Reservoir provide a fish and wildlife conservation pool and recreation facilities. The Willow Lakes and Duck Fork irrigation reservoirs will be converted to fisheries. The estimated installation cost for structural measures is $4,575,500, of which $3,013,800 will be from P.L. 566 funds and $1,561,700 will be from other funds.

Non-Project Measures

The Utah State Department of Fish and Game will improve the existing Ferron irrigation reservoir to provide and maintain a fishery. The cost is estimated to be $9,500.

Benefits, Damage Reductions, and Costs

Annual benefits from structural measures used for project justification are $506,805 with annual costs of $172,975. The over-all benefit-cost ratio for the project is 2.9 to 1.0. Secondary benefits of $53,410 annually are included in benefits above. Annual redevelopment benefits of $51,215 are not used for project justification but are identified to show the impact of the project on the community.
The Mill Site Reservoir and debris basins will have flood prevention benefits of $46,780 annually. Annual flood prevention cost is $36,570. Present flood damages will be reduced by 90%. The debris basins will have $3,440 in annual irrigation benefits. The Mill Site Reservoir and irrigation system improvements will have $327,380 per year in irrigation benefits compared to an annual cost of $103,985. The fish and wildlife conservation pool and the recreation facilities in the Mill Site Reservoir will have annual benefits of $47,745 compared to an annual cost of $23,505. The Duck Fork and Willow Lakes fisheries will have annual benefits of $26,050 per year compared to an annual cost of $8,915.

**Project Installation and Financing**

Sponsoring organizations will acquire necessary land and water rights, execute agreements with owners of private lands for installation of the land treatment measures, and provide the non-federal share of the installation cost for project measures and non-project costs. Sponsoring organizations will contract for construction of the structural measures in the plan. Funds for payment of the non-federal share of the installation costs, including repayment of loans for this purpose, will be provided through assessments of irrigation company stock and contractual arrangement by the sponsors and water users. Legal authority for assessment and contractual arrangement of these local organizations is adequate to meet financial responsibilities.

**Operation, Maintenance, and Replacement**

Annual operation, maintenance, and replacement costs for structural measures are estimated to be $23,080. Structural measures will be operated, maintained, and replaced by the local sponsors. Land treatment on private and state land will be operated and maintained by private land owners and operators. Land treatment measures on federal land will be operated and maintained by the land administering agencies.

**DESCRIPTION OF THE WATERSHED**

The Ferron Watershed is located in central Utah, in western Emery and eastern Sanpete counties. The watershed area, approximately 30 miles long and 10 miles wide, containing 191,000 acres, is all within the San Rafael Soil Conservation District.

The farm owners and operators live mainly in the towns within and adjacent to the watershed. Approximately 275 people live outside of town limits. The town of Ferron, Clawson, and Molen, with populations of 386, 100, and 40 respectively, are in the watershed. Orangeville, with a population of 571, is located just north of the watershed. Castle Dale, the County Seat of Emery County with a population of 617, is located three miles northeast of the watershed. There are 123 farm and ranch units in the watershed.

Ferron and Rock Canyon drainages, with 250 and 50 square miles of drainage area respectively, make up the watershed. It is bounded on the north by the Cottonwood Creek drainage, on the south by Muddy Creek and Molen Seep drainages, on the west by the Wasatch Plateau Summit, and on the east by the San Rafael River.
Elevations range from over 11,000 feet on the Wasatch Summit to 5,600 feet near the San Rafael River. A great erosion escarpment separates the mountainous upper watershed from the lower, which consists of a broad undulating valley. Rough topography, dissected frequently by small drainages, predominates in the mountains. Gentle to severe undulations separated by meander patterns and flood plains of drainages with knolls and ridges throughout characterize the topography of the valley land.

Ferron Creek heads in the Wasatch Plateau at an elevation of over 11,000 feet. This perennial stream flows southeast for approximately 20 miles to the town of Ferron. From Ferron, it turns slightly to the northeast and flows through undulating valley land for about 12 miles to the San Rafael River. Rock Canyon Creek heads on the North Horn Mountain at an elevation of over 9,500 feet. The channel of this intermittent stream flows on a course parallel to Ferron Creek. However, it is about 15 miles shorter.

The great erosion escarpment is drained by many small streams ranging in length from 1-1/2 to 7 miles with drainage areas of from 1/2 to 12 square miles. These small drainages are tributary to Ferron and Rock Canyon creeks and are the source of summer floods which damage the irrigated area.

Ferron Creek, with a median annual yield of 43,000 acre feet, is the principal source of water supply. This water is mostly from snowmelt runoff. Streamflow begins to rise in late April, reaches a peak in late May or early June, and diminishes rapidly to a base by the middle of July. As much as 50% of the yield of the drainage comes in a 15 to 30-day period in May and June.

Rock Canyon Creek has an erratic yield and is not dependable as a source of irrigation water. Ferron Creek and Rock Canyon Creek produce both snowmelt and summer floods.

Principal uses of water include irrigation, culinary, municipal, and livestock.

The Ferron Canal and Reservoir Company serves all of the irrigated land. The company has three small reservoirs located high in the upper watershed. They have a combined capacity of 2,100 acre feet and have been used to store runoff during the peak snowmelt period. Stored water has been released to increase base flow of the Ferron Creek after snowmelt runoff has diminished. The company has also constructed several "seepage" reservoirs which prolong the base flow of the streams. Water is diverted from Ferron Creek at the mouth of Ferron Creek Canyon and at several other points downstream into earth canals to serve the irrigated area. There are approximately 28 miles of main distribution canals in the watershed.

Mean monthly temperatures range from 20° in winter to 70° in summer. Average frost-free period is 158 days. The average growing season is 200 days, April 5 to October 22. Precipitation at higher elevations comes mainly in the form of snow. The valley area receives about 8 inches of precipitation with about one-half coming during the growing season. Precipitation increases with elevation to about 40 inches on the Wasatch Summit. Violent summer thunderstorms occur along the escarpment and upper watershed. Runoff from these storms causes considerable erosion and produces the major floods on the small drainage and Rock Canyon Creek.
Mule deer is the most important game animal. Elk are present in limited numbers. Principal upland game bird species are pheasant, chukar, partridge, dove, and sage and forest grouse. Waterfowl use of the area is light because of habitat limitations. Rainbow trout, planted by the Utah State Department of Fish and Game, are present in the uppermost reaches of Ferron Creek and in the small reservoirs. An occasional cutthroat trout is taken by the angler.

About 28,000 acres of private land is located mainly in the valley portion. Approximately 9,700 acres of state land is interspersed throughout the watershed. Federal lands total about 153,300 acres, of which 41,300 acres are administered by the Bureau of Land Management and are located mainly below the great erosion escarpment in the undulating valley. Approximately 112,000 acres are within the Manti-LaSal National Forest and occupies the upper portion of the watershed.

The irrigated land, 11,335 acres, is made up of the deeper soils located along the streams on fans, and on terraces throughout the valley. Approximately 8,615 acres are in irrigated crops such as alfalafa, small grain, corn, and fruit. Approximately 2,720 acres are in pasture with varying degrees of wetness and slight to moderate amounts of saline salts. A part of the irrigated land is in small isolated parcels because of the steep sided gullies and irregular topography which dissects the landscape.

The remaining portion of the valley is made up of rangeland. Soils are derived from shales, have a low water intake rate, and are subject to accelerated erosion. Plant cover is limited to sparse, semi-desert type vegetation primarily because of moisture and soil deficiencies. This has been further aggravated by past grazing abuse.

The upper watershed is important for range, recreation, and watershed values. The soils are generally deep to moderately deep, and have medium to fine textures. A band of heavier clay soil with nearly impervious strata at shallow depths occurs near the top of the watershed. Both the topsoil and subsoil in these areas are highly erodible. Many of the slopes in the head of the Ferron drainages are results of a series of landslides representing varying ages and degrees of stability. Gullies of recent origin exist here and have cut to depths of 10 feet or more. Sheet erosion from overland flow is widespread and has removed much of the valuable topsoil.

A combination of unstable soils and depletion of vegetation by big game and livestock grazing has contributed to the severe erosion problem.

**Soils**

The soils in the valley are alluvial and residual deposits derived mainly from sandstone, limestones, shales, and siltstones. The materials occur as floodplain, fan, and terrace deposits interspersed with bedrock outcrops in the form of ridges and knolls. Soil materials on the terraces are gravelly, 20 to 48 inches deep, and are underlain by sandstone and shale bedrock. Soils on the alluvial fans are sandy or gravelly and generally deep. The flood plain and residual soils are shallow to deep and have a loam or silty clay loam texture. Some of the floodplain soils are wet and are slightly to severely affected by salts. Slopes of the irrigated soils range from 0 to 6%. 

- 5 -
Rangeland soils are of two types. The upper valley and lower foothill soils are shallow, predominantly fine grained, and underlain by marcos shale bedrock. Slopes range from 0 to 30%. The intermediate and high mountain range-land soils have developed on alluvial and colluvial slopes ranging from 2 to 70%. These soils are deep to moderately deep and generally have medium to fine textures. Bedrock outcrops of sandstone and limestone are common; and shallow, gravelly soils occur on the steeper slopes.

**Economic Data**

A 1960 population of 5,346 persons marked a decline of 12% in the population of Emery County since 1950. During that period, the population of the watershed decreased by 15%. This decline has been largely concentrated in the communities of Ferron, Clawson, and Nolan, with 1960 populations of 386, 100, and 40 respectively.

People of the watershed live mostly in the communities and operate their farms in the adjacent irrigated areas, which is an operation pattern typical of most of Utah's agriculture. About 31% of the 123 farm operators work off the farms, while approximately 15% derive the greater part of their income from off-farm sources. Employment is provided by nearby coal companies and state, county, and federal activities within the area.

A typical operating unit consists of about 200 acres including about 70 acres of irrigated cropland, 20 acres of irrigated permanent pasture, and 110 acres of rangeland. Most of the crops grown are utilized on the farms in the production of beef, mutton, wool, and milk. The chief livestock enterprise is beef production which is largely sold in the Utah and Colorado markets. The dairy producers truck fluid and commercial milk to the Salt Lake City market.

There are 44 beef cattle operators living within the area who hold grazing permits on federal lands. In addition, there are 23 cattle permittees and 56 sheep permittees who graze their livestock within the watershed area, but who live outside its boundaries. Summer grazing is provided on the National Forest or on private pasture and meadow lands. Some stock are grazed part of the winter on public lands. Livestock operators feed supplemental amounts of hay and concentrates during part or all of the winter.

Although the principal production units are a cow-calf type of operation, the people have initiated and expanded an active feeding and herd improvement program. The Emery County Livestock Show is an outgrowth of this activity which annually attracts beef producers and buyers from Utah and adjacent states.

Fruit production is of secondary importance. A few farms near the mouth of Ferron Creek have small acreages in orchards. Principal fruits are peaches, pears, and apples, with lesser amounts of apricots, cherries, and plums. Climatic factors are favorable for an expansion of this enterprise. The eastern Utah area provides an excellent market for quality fruit. A stable water supply is an important factor in fruit production.
There are approximately 27,000 acres of timber type. Of this acreage, about 9,000 are commercial aspen and 11,000 acres are commercial conifer, with the remaining 7,000 acres in noncommercial timber types. Several small sawmills rely heavily on this timber with most of their products being used locally. Principal conifer species are spruce, Alpine fir, and Douglas fir.

A network of state, county, National Forest, and public land roads provide adequate access to all parts of the project area. However, the extreme upper portion of the watershed is normally accessible only from June to October. Utah Highway 10 which connects with U. S. Highways 89, 50, and 6 passes through the towns of Ferron and Clawson. This is an oiled highway which is open during the entire year. Interstate Highway U. S. 70, now under construction, will pass 30 miles to the south of Ferron and will connect with Utah-10. The nearest railhead is 42 miles to the north at Price, Utah.

Recreation facilities developed to date have largely been designed for local use. Water resource improvements for fishing are inadequate. However, picnicking, camping, and fishing use are on the increase, particularly by non-local state and out-of-state people. The area has a high potential for fishing and recreation use. The present level of these activities benefit only a few local businesses.

The following table shows the distribution of farms on the basis of census economic classes.

<table>
<thead>
<tr>
<th>Farms by Economic Classes</th>
<th>Annual Value of Farm Products Sold</th>
<th>Present No. Farms</th>
<th>Percent of Farms in Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Farms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>Over $40,000</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Class 2</td>
<td>$20,000 to 39,999</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Class 3</td>
<td>$10,000 to 19,999</td>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>Class 4</td>
<td>$5,000 to 9,999</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Class 5</td>
<td>$2,500 to 4,999</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Class 6</td>
<td>$1,500 to 2,499</td>
<td>16</td>
<td>13</td>
</tr>
</tbody>
</table>

| Other Farms               |                                   |                   |                          |
| Part Time and Retirement  | $50 to 2,499                      | 45                | 37                       |
| Abnormal                  |                                   | 123               | 100.0                    |
WATERSHED PROBLEMS

The dominant problem is damage from sediment and floodwater to the farm lands; erosion; forage and land deterioration in the upper watershed; and the seasonal pattern of streamflow, providing an unfavorable irrigation water supply. These conditions have prevented the adoption of efficient crop rotation and management practices on the farms. Water distribution difficulties and moderate to severe seepage losses in many areas have tended to limit improvements of irrigation distribution systems.

Opportunity for good fishing and recreation activities are not adequate to meet the needs.

Flood and Erosion Problems

All drainages have produced floods of varying magnitude from summer rainstorms and snowmelt. The location of each drainage with respect to improved areas and the capacity of the channel systems are important determinants in the amount of flood and sediment damage suffered. Most of the flood damages are to crop and pasture land, and to irrigation facilities and property.

Heavy grazing, beginning about 1870 and continuing until about 1910, generally depleted the forage resources of the watershed and caused accelerated erosion and deterioration of the inherently unstable soils. Overuse by livestock and big game for a number of years after 1910 has continued the acceleration of erosion and runoff. Grazing adjustments and improved management practices have slowed down erosion rates and reduced flood runoff to a limited degree. Improved management is the only feasible treatment over much of the watershed and will bring about slow recovery. Critical area treatment where adaptable will produce immediate reductions in erosion and runoff rates.

Summer storms originating in drainages above the proposed Mill Site Reservoir cause considerable erosion and produce small floods which cut channels of the small drainages, damage roads and trails, and deposit, silt, mud, and debris in the larger flatter channels. These floods partially dissipate before reaching the farming area. Moderate amounts of silt and debris are deposited in irrigation systems and in downstream channels. Sediment, mud, and debris deposited in upstream channels are moved out by snowmelt flow the following spring and carried through the distribution systems and onto the farmlands.

Especially intense summer storms which affect a large area sometimes produce floods which deliver peak discharges undiminished, together with sediment and debris, to the farming area. These infrequent floods deposit unusually large amounts of sediment and debris in the irrigation distribution systems, and on the farmlands through the distribution systems with alternate filling and cutting of the downstream Ferron Creek channel. The 1947 flood which resulted in the loss of two lives caused silting of ditches, cutting of farmlands along the channel, washed away bridges and headgates, and inundated the culinary water works of Ferron City. It also damaged roads, trails, and recreation facilities in the upper watershed. The U. S. Geological Survey streamgage was rendered inoperable by this flood. Therefore, no estimate of peak discharge is available.
The summer flood of August 27, 1952, with an estimated peak discharge of 4,180 cubic feet per second, was the largest in the memory of local residents.

Snowmelt runoff from Ferron Creek comes mainly in the months of May and June with as much as 50% of the annual yield of the drainages coming in a 15 to 30 day period. Peak flows often reach flood magnitudes. The rate of flow during the peak flow period, together with the duration of the flow, is sufficient to remove the silt and sediment deposited in the upstream channels by small summer storms the preceding year and to do considerable cutting in the downstream improved areas.

The short drainages heading in the great erosion escarpment west of Ferron produce from one to three floods per year. One drainage may produce as many as three floods in any given year or conversely may not produce a flood for several years. Floods from these small drainages damage crops, cropland, and fixed improvements such as canals, ditches, fences, roads, town lots, and corrals. These floods transport considerable amounts of sterile sediment because of the extensive expanse of saline siltstone and sandstone in the drainages. It is not unusual for the main distribution canal to be filled with this fine sediment for as much as half a mile from the point of intersection with the drainage. Canals are often broken as well as filled and must be cleaned and repaired before delivery of irrigation water can be made.

Many of the floods occur during the hay-grain harvesting period. Serious damages to the partially harvested crops occur and this damage carries over to the next crop because the preceding crop and flood debris cannot be removed immediately. Much of the irrigated land has been damaged by deposition and spreading of unfertile fine textured sediment which lowers soil fertility, reduces water intake rate, and causes surface irregularity. Drainage problems are increased because drains and natural water courses become partially filled with sediment.

Irrigation Problems

The natural streamflow of Ferron Creek, which is the principal source of irrigation water supply, is at a rate in excess of irrigation requirements during May and June and diminishes to a rate below irrigation requirements the middle of July. The flow of the stream is far below irrigation requirements for the remainder of the irrigation season. The flow of the stream in March and early April is not sufficient for pre-plowing and pre-planting irrigations.

The unfavorable distribution of the water supply has not been conducive to the construction of efficient distribution systems, control structures or measuring devices, the establishment of key conservation practices, or the adoption of efficient water management methods. High operations losses in delivery of water and low on-farm irrigation efficiencies result. The natural tendency of the farmer to store as much water as possible in the soil while water is available has contributed to reduced yields, erosion problems in disposal of tailwater, and drainage and salt problems in the lower lying fields.
Seepage losses in canals range from low to moderate. These losses contribute to the drainage problems during periods of high flow and further deplete the water supply during periods of low flow.

The flood and sediment problems detailed in a preceding discussion have compounded the irrigation problems and have further limited the operator's economic ability to install improvements and apply advanced farm technology.

**Grazing and Related Problems**

Ranchers have made efforts in recent years to improve their range by practicing proper range use and establishing such practices as brush control and range seeding. Soil and precipitation conditions at higher elevations favor successful establishment of land treatment measures. These areas are either in federal ownership or federal management. Private lands are located at lower elevations where soil conditions and precipitation limit success of land treatment. Improvements in these areas will be brought about mainly by management.

The federal land administering agencies have recently made some adjustments in grazing permitted on portions of the federal rangeland as a step toward bringing grazing in balance with forage production capacity. Treatment measures outlined in the plan will restore some of the potential capacity for forage production incidental to the stabilization of critical areas and ultimately some of the reductions may be restored. Improved conditions on the irrigated land which will result in an increase in the production of pasture and forage crops will fill part of the need for substitute forage. Other operators will find suitable rangelands outside the area until the range recovers enough for reinstatement of part of the grazing reductions.

**Fish and Wildlife and Recreation Problems**

The infrequency of bodies of water within 50 miles of Ferron town limits the opportunity for fishing and associated recreation. Scofield Reservoir near the head of the Price River, approximately 75 miles by road north of the watershed, and Fish Lake in the Fish Lake Mountains, about 70 miles to the south, are the only existing large bodies of water which support water based recreation other than fishing in this section of the state. The Cleveland, Millers Flat, and Huntington irrigation reservoirs, approximately 20 miles to the north, and the Ferron Reservoir within the watershed, support fisheries for a part of the year. The storage volumes of these reservoirs are needed desperately for irrigation by mid-July leaving a small shallow pool. The Joe's Valley Project of the Bureau of Reclamation on the Cottonwood drainage will provide for fishing and associated recreation at the Joe's Valley Reservoir and Dam. These reservoirs are located at higher elevations and are accessible or useable for only a part of the year because of snow packed roads and frozen water surfaces.

Upper elevations of this and adjacent watersheds are dotted with small natural lakes in pot holes resulting from landslides and glacial action. Seldom do these lakes have sufficient depth, volume, or inflow to carry fish through the winter or to support appreciable numbers of fish.

- 10 -
Fishery resources in the watershed are inadequate to meet current demands. Trout planted by the Utah State Department of Fish and Game in the better natural lakes and irrigation reservoirs quickly disappear in the creels of early season fishermen. Other recreation uses, including camping and hunting are moderately heavy.

The limited amount of winter range for mule deer, inadequate amounts and poor distribution of water and scarcity of suitable food and cover for upland game birds all contribute to mortality and limit game population.

Improved fisheries and recreation improvements are needed to provide a rounded recreation opportunity for users, to increase the frequency of their visits, and prolong their stay. A body of water large enough to meet the fishing and associated recreation needs which will be accessible and open most of the year is needed to improve the economic opportunity of the community.

**Economic Problems**

Mining and livestock agriculture are the main sources of income of Emery County and the watershed. To earn a livelihood, many farm operators depend on part-time employment in the coal mines, located outside the watershed, and on small scale farming. Part-time employment in the mines is possible because the peak production period for coal comes during the winter lull in farming activity.

Although coal mining is still important, there has been a 35% reduction in coal production and a 40% decrease in wage disbursement for coal mining since 1956. Over the same period, employment in non-agricultural and in the agricultural sectors of the economy has decreased as shown below.

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<td>1860</td>
<td>1867</td>
<td>1759</td>
<td>1717</td>
<td>1662</td>
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Although declines in coal production are responsible for a significant proportion of the reduced employment, technological improvements which have increased labor efficiency in mining and farming have added to the problem.

While the level of employment in mining and agriculture has declined, personal income from farming in Emery County has increased by 62% during the 1957-1962 period. This change in farm income has been brought about in part by consolidation of farms into larger and more efficient units. There has been a decrease of 13% in small farms during the 1954-1959 period and a corresponding increase in family size farms. By incorporating small and relatively unproductive units into larger and more efficiently operated family farms, production and income has been increased, in spite of water shortages and other limitations.
Other agricultural changes reflect the impact of mining decline. The percentage of farmers working off their farms has reduced from 78% in 1954 to 31% in 1959. Farm operation and labor efficiency has risen from 71% in 1954 to 80% in 1959, reflecting in part the effect of absorbing small farms into the larger and more efficient farming units. Thus, it can be said that in some ways the stresses set up by the decline in mining activity have accelerated desirable trends in the local agriculture. These trends will probably continue through the next 5 or 6 years, but at a slower rate.

On the other hand, the creation of efficient family farm units through consolidation and reorganization is sharply limited by the deficient water supply and by the need and desire for small part-time farming units. Part-time mining and farming will continue to provide a full livelihood to many persons, and small retirement farms are a desirable aspect of the local social and economic structure. Thus, the opportunity for improvement through consolidation will diminish in future years and the dominant remaining deterrent to improvement will be water supply limitations.

In consideration of the uncertain outlook for mining and industry, it would appear that the most practical solution toward an acceleration of the current stagnant economy of the area lies in achieving more efficient use of the underdeveloped land, water, and recreation resources in the watershed. The plan outlined hereinafter is designed to attain this objective to the most practical degree.

**PROJECTS OF OTHER AGENCIES**

There are no other water resource development projects, existing or contemplated, within the watershed. The Emery Project of the Bureau of Reclamation will provide supplemental water for the irrigated area immediately to the north of the watershed. There is no connection between the service areas of these projects. Jointly, they will both contribute to the over-all development of Emery County and Utah.

Existing soil and water conservation programs of local, state, and federal agencies will be complemented and materially assisted by treatment measures to be installed under this plan.

**BASIS FOR PROJECT FORMULATION**

This plan is a coordinated approach for treatment of all watershed lands.

Measures included in this plan were formulated after watershed problems were studied thoroughly. Objectives of the local people with regard to intensity of treatment and level of protection and experience in solution of similar problems served to guide in selection of the measures.

The overriding objective of the sponsors of this project is to make maximum practical use of available resources consistent with the needs and problems of the area, to increase and stabilize net farm income, and contribute to the economic stability of the watershed and surrounding communities.
Specific objectives of the sponsors are to:

1. Effect significant reductions in damage from sediment and floodwater.

2. Stabilize critical flood and sediment source areas and protect the watershed lands from erosion and summer flood runoff and maintain the productive capacity of the soil.

3. Regulate the yield of Ferron Creek by storage to meet, as nearly as practical, monthly and seasonal requirements for irrigation.

4. Improve and reorganize the irrigation distribution system to reduce seepage and operational losses, and operation and maintenance cost.

5. Develop the water resources to meet demands for fish and wildlife, recreation, and other uses.

**Land Treatment Measures**

The combination of land treatment measures scheduled for installation on private and state lands reflects evaluation of land capabilities, land and water use, cropping patterns and practices, and physical and economic factors which contribute to optimum efficiency in the utilization of watershed resources in the operation of prevailing types of agricultural enterprises. The combination and amounts of measures selected will, when applied, ensure the levels of production and the benefits needed to justify the average annual costs of installing and operating the structural measures.

The land treatment measures to be installed on federal land are designed to meet the treatment needs of critical flood and sediment source areas and to contribute to the creation of conditions which will promote optimum use of the land, water, and recreation resources in the upper watershed. The estimate of kinds and amounts of treatment needed is based on analysis of conditions in specific problem areas and evaluations of the effectiveness of alternative measures in alleviating existing problems.

Measures selected are feasible and will stabilize critical areas, reduce sediment production and summer flood runoff, prevent land deterioration, and contribute to increased forage production and recreational use.

**Structural Measures**

Structural measures were selected from alternatives for both the desired physical effects and benefits. Structural measures included the multiple purpose Mill Site Reservoir Dam and recreation facilities, eight debris basins, improvement to the irrigation distribution systems, and two fish and wildlife water resource improvements.
Mill Site Reservoir and Dam

The need to regulate the irrigation water supply through storage and reduce sediment and flood damages from Ferron Creek is the principal reason for the Mill Site Reservoir. Fish and wildlife capacity and recreation facilities included with this reservoir are based upon present and expected demand and the need to strengthen the economy of the area.

The capacity reserved for sediment accumulation is based on expected sediment rates over the next 100 years. The capacity to be maintained for fish and wildlife development was selected to provide a good fishery and optimum recreation use in consideration of other demands for water. The irrigation capacity selected was based upon the costs and benefits for providing increments of storage for irrigation.

The irrigation capacity is sufficient to store summer floods and reduce the duration and peak discharge of snowmelt floods to a point where downstream channels will accommodate them.

Alternate proposals considered included four dam sites in the vicinity of the Mill Site, off-channel storage sites and diversion works, and a number of debris basins and storage sites in the upstream drainages.

The Mill Site Reservoir and Dam are the most feasible, economically and physically, and will best meet the objectives of the local sponsors.

Recreation Facilities: Recreation facilities at the Mill Site Reservoir were selected to meet anticipated need in the immediate future. The sponsors recognize that additional facilities will be required as use increases in years to come. They have indicated their intention to provide additional facilities when needed.

Debris Basins

Sediment and floodwater, which originates in the short, steep drainages, heading in the great erosion escarpment and damages irrigation canals, cropland, and cultural improvements, are the basis for including the eight debris basins in the work plan. Because of aspect, topography, local relief, and the type of flood producing storms, not all of the short drainages have a significant flood history. Some drainages have deep channels which convey flows through the improved areas.

Interviews with local people, discussions in public meetings, and a thorough reconnaissance of the damage and flood source areas was the basis for selecting the drainages to be controlled by structural measures. Alternative capacities of debris basins which would provide protection from the 25, 50, and 100-year frequency floods immediately downstream from the structure were evaluated, as were proposals for long-term storage of sediment as contrasted to periodic removal of sediment depositions. Capacity to store 100 years of sediment accumulation and to contain the routed 100-year frequency flood was determined to be the most economical in consideration of the benefits received.
Alternatives considered include debris basins at other sites on the drainages and a combination of canal overshots with downstream channel work. Other debris basin sites were eliminated due to high costs or site limitations. Overshots in channels were eliminated because of high costs and because these structures would tend to only shift the problem to another location.

System Improvements

Irrigation structural measures are based on conservation plans developed by the irrigation company and the Soil Conservation District. These improvements were selected to reduce seepage loss and minimize operations problems. Both size and location of present facilities were adjusted, where needed, in view of the stabilized water supply to be provided from the Mill Site Reservoir. Treatment measures to reduce seepage losses include relocation and lining of individual canals and canal sections where seepage loss measurements show the need. Installation of these structures will facilitate the management of water. Where necessary, the system was reorganized to deliver water most effectively under the project conditions.

The kinds and amounts of irrigation system improvement structural measures included herein were selected after evaluation and discussion of each proposal including the amounts of water to be saved, reduction in operation and maintenance costs, installation costs and benefits, cost sharing, and the ability of the company to finance and repay their share of the installation cost.

Fish and Wildlife Water Resource Improvements

The need for dependable fishery resources in the upper watershed is the basis for changing the irrigation reservoirs to fishery use. This need is supported by the use record of the small irrigation reservoirs and natural pot holes in the landslide topography. Because of drawdown of the irrigation reservoirs, shallow depths in the pot holes, associated winter kill, and high restocking cost, the existing reservoirs and lakes do not provide a satisfactory fishery resource.

Fifteen suitable alternatives to meet this need, including existing reservoirs, natural lakes, and reservoir sites, were examined from the benefit-cost standpoint. The sites selected are the most economical and will automatically regulate the 100-year frequency snowmelt runoff and summer floods from the contributing watersheds and give varying degrees of flood protection to stream channels, roads, and other values, in addition to providing a fishery resource.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures included in the plan are in accord with the long-range plans of the San Rafael Soil Conservation District and the federal agencies responsible for the administration of federal lands. They are a key unit in the plan since the achievement of maximum stability in erosion and runoff in the upper watershed is a basic requirement to the efficient functioning of the structural measures and is an essential factor in the
success of the project. As groups of interdependent measures, they are primarily designed to correct the dominant on-site problems of critical flood and sediment source areas. An added and important associated effect of these measures is the ultimate decrease in downstream damages and the reduction in capacity requirements of structures for flood control and irrigation. They will also contribute to the improvement and preservation of upper watershed resources and to their optimum utilization.

Land treatment on the rangeland and upper watershed consists of (1) measures designed to stabilize critical areas and (2) those required to ensure their success and for efficient management of the area. The critical area treatment consists of contour furrowing, plowing, pinon-juniper eradication, roadside erosion control, gully plugs, and seeding. Road improvement, sagebrush spraying, seeding, livestock water developments, and intensified management are needed to ensure successful functioning of the critical area treatment and enable proper use of the rangeland. The primary effect of the combined treatment will be to reduce summer flood peaks, arrest active gully erosion, and reverse the trend in widespread deterioration of the land and plant cover. An important effect will be the increased production of useable forage for livestock and big game. The watering development for livestock and wildlife will enable better distribution of livestock and big game and increase the range of upland game birds.

Land treatment for the irrigated land will include conservation cropping systems, improved irrigation water management, land leveling, structures for water control, on-farm ditch lining, and wildlife plantings. The primary effect of the combined treatment will be an improvement in farm irrigation efficiency. Improved irrigation water management is an important project objective because of its contribution toward improved on-farm irrigation efficiencies. This practice will be given special emphasis through the going and accelerated programs of the District. These measures will also enable more efficient use of water to be developed by structural measures. Reduced labor inputs and improved soil fertility are among additional important secondary effects.

Installation cost for land treatment measures is estimated to be $2,394,300, of which $878,300 or 37% will be from P.L. 566 funds and $1,516,000 or 63% will be from other funds.

The cost of critical area treatment on the Manti-LaSal National Forest, estimated to be $728,400, will be from P.L. 566 funds. Other land treatment costs on the National Forest, estimated to be $1,201,400, will be from regular funds of the Forest Service. The cost of critical area treatment on federal lands administered by the Bureau of Land Management, estimated to be $113,300, will come from P.L. 566 funds. Other land treatment costs on federal lands administered by the Bureau of Land Management, estimated to be $48,600, will come from regular funds of the Bureau. Application cost, estimated to be $246,200, for land treatment measures on private and state land, will be from other funds. Of this cost, $1,000 for wildlife planting will be from Utah State Department of Fish and Game funds. The remaining cost, $245,200, will be furnished by private owners and operators with cost sharing assistance available under other programs at the time of installation. Only the cost of additional technical assistance for accelerating the installation of land treatment measures on private and state lands will come from P.L. 566 funds.
Structural Measures

Structural measures to be installed will supplement the land treatment program in alleviating the principal flood problems of the watershed and in making more efficient use of water supplies. They will solve the outstanding flood problems, provide for an increased water supply for irrigation, and will create much needed water resources for fish and wildlife and recreation opportunity. They will contribute to the economic well being of the community—both agricultural and urban. See Tables 1 and 2 for estimated cost distribution for all structural measures. See the Project Map for location.

The Mill Site Reservoir, Dam, and Recreation Facilities

Reservoir and Dam: This site is located on Ferron Creek about 3 miles west of Ferron, Utah, at the mouth of the canyon. This development provides for irrigation storage regulation, flood prevention, a fish conservation pool, and recreation facilities. The Ferron Canal and Reservoir Company will provide for unrestricted access to and use of the fishery pool and recreation facilities by the general public. The existing road will be relocated to provide access to the reservoir pool and recreation facilities. The irrigation company will acquire title to private and non-federal public lands, and easements and rights-of-way for federal lands for road relocation, recreation facilities, the reservoir pool, and a perimeter strip around the reservoir pool at least two vertical feet above the crest of the emergency spillway. No group or private developments will be allowed which would restrict public access to or use of the recreation facilities or the perimeter of the reservoir at any stage.

The recreation facilities will be made available to the general public on a first come, first serve basis after payment of a use fee. No charges will be made for access to the reservoir.

The total reservoir capacity of 18,000 acre feet will provide 2,000 acre feet for fish conservation, 5,800 acre feet for the expected 100-year sediment accumulation, and 10,200 acre feet for irrigation storage and regulation. Location is shown on Figure 1. Principal features are shown on Figures 3 and 4.

Because of the critical need for irrigation water common to all of Utah and to the project area especially, the initial permanent pool will be set at the 2,500 acre foot level. This will allow for the desired 2,000 acre feet for fishery storage plus the expected sediment accumulation in that pool during the first 10 years of operation. Thereafter, the level of the irrigation outlet will be raised every 10 years to provide the sediment capacity to be required during the next 10 years, approximately 470 acre feet. The remaining capacity of the reservoir will be used for irrigation storage and regulation. The initial capacity for irrigation will be 15,500 acre feet and the final capacity for irrigation at the end of the 100-year period will be 10,200 acre feet, giving an average of 12,850 acre feet.
The surface area of the initial fishery pool of 2,500 acre feet will be 127 acres. At the end of the 100-year period, it will be 236 acres. Surface area of the full reservoir, including the irrigation supply, is 420 acres. Vertical drawdown due to irrigation releases could amount to 58 feet initially decreasing to 34 feet in 100 years. However, the full reservoir area of 420 acres will be available for fishing and recreation purposes early in the season and most of this will be available for a substantial part of the season. Heavy withdrawals of irrigation water will not begin until the latter part of July. The surface area of the reservoir will, in an average year, be approximately 400 acres about July 15, and the minimum pool elevation will not be reached until about September 1.

The reservoir dam will be of zoned earth, 114 feet in height, with a top width of 42 feet, 3:1 slopes downstream, 2-1/2:1 slopes upstream, with a berm of 20 feet. The upstream face of the dam will be protected by riprap. Rock and coarse fill material will be routed to the downstream shell zone, and will provide protection on the downstream slope. Vegetation will not be required for protection. A partial cutoff, a rock and gravel filter drain with pipe, and a relatively impervious blanket three feet in thickness extending some 600 feet upstream from the dam will contribute to stability of the earth fill and limit seepage flow from the reservoir. The emergency spillway will be in rock cut some 1,000 feet in length and terminate in a natural plunge pool. The inlet crest of the spillway will be of reinforced concrete. A deflector bucket will be installed at the outlet end of the spillway and will discharge into the natural plunge pool. Spillway flow will return to Ferron Creek by way of an exit channel excavated to rock.

The irrigation outlet will consist of a ported riser, an outlet conduit with double control gates and dry man well-access shaft, and an inlet conduit with gate for emergency drainage of the reservoir. The riser, the inlet and outlet conduit, and the dry man well-access shaft will be placed on competent bedrock.

Creation of the reservoir will necessitate the relocation of approximately 3.0 miles of road. The County road is the main access route to the upper watershed.

The total estimated installation cost is $3,352,000. Of this total, $2,186,400 will be from P.L. 566 funds and $1,165,600 from other funds. The Utah State Department of Fish and Game will provide the non-federal share of construction cost allocated to fish and wildlife, estimated to be $140,830. The Ferron Canal and Reservoir Company will provide the remaining non-federal share of the cost.

Recruitment Facilities: The recreation facilities will be located as shown on Figure 5 above the maximum water level and under the new road leading to the upper watershed.

The recreation facilities consist of 19 camping units, one picnic shelter, two toilet units, a parking lot, two boat ramps, access roads, culinary and irrigation water systems, electric power and outlets, and landscaping. Two boat ramps will be installed because of the topography of the site and fluctuations in water surface. One ramp, 400 feet in length, will be adjacent to the
parking lot and the other, 200 feet in length, will be located at the end of a road to low water. The boat ramps will be 70 feet wide, surfaced with 4-inch compacted gravel, and a 15-foot travelway of concrete logs on the west side to provide traction. Gravelly slopes nearby are suitable to beach boats.

Each camping unit will consist of a covered picnic table with screen fence and a ring type cooking unit. The stub road will provide parking space for trailers or campers and automobiles. The picnic table will be of wood. The cover will be of wood frame with a corrugated plastic top. See Figure 3 for details. The flush type toilets will be equipped with 4 seats each, 2 basins, a septic tank, and drainage field. The housing will be of wood frame with corrugated steel roof and concrete floors. The picnic shelter, 24 feet by 12 feet, will consist of a 4-inch concrete slab, with tables, a cover, an upright cooking facility, and a campfire ring. The concrete slab will be reinforced with 6 x 6 No. 10 mesh. Footings 6 inches by 1 foot will be poured as part of the slab. The tables and seats will be of wood. The cover will be of corrugated plastic on wood frame. Barriers, consisting alternately of rustic log posts and rails and huge rocks, will be placed to insure best use of the facilities and to protect the aesthetic value of the development. The water system for both culinary and irrigation purposes will take out of the city water line just below the dam. The system will consist of a 42 gallon per minute pump, a 5 horsepower motor, 4,000 feet of 2-inch supply line, a 500 gallon storage tank, 3,000 feet of 2-inch distribution lines to toilets, faucets, and irrigation outlets. Hydrants will be located conveniently throughout the area for culinary water. Five acres will be irrigated by sprinkler methods.

The electric power lines will be brought in from existing lines below the dam. A 20 kilowatt transformer will be installed at the entrance of the development. Overhead lines will deliver the power to the main control switch. Underground cables will deliver power to the camping units, group shelters, and parking lot. Floodlights mounted on poles will be provided throughout the development. Lights are provided for boat ramps at the parking lot.

Garbage receptacles will be located conveniently throughout the area.

The total estimated installation cost for the recreation facilities is $86,400. Of this, $41,700 will be from P.L. 566 funds and $44,700 from other funds.

Debris Basins

Eight debris basins will be installed at locations shown on Figure 1. Principal features are shown on preliminary plans for a typical site on Figure 2. Each structure is to store the sediment volume expected to accumulate at the site over a 100-year period and automatically regulate the runoff from the 100-year storm. The structures will control damaging floods from drainages varying in size from 0.5 to 5.4 square miles. The storage capacity reserved for sediment will range from 58 acre feet to 228 acre feet. Floodwater storage capacity will range from 27 acre feet to 302 acre feet. Additional information concerning capacity, size, areas, and other details may be found in Table 3.
Each structure will consist of a low dam equipped with principal spillway to automatically retard floodwater and an emergency spillway in earth to pass floodwater in excess of the design capacity. The earth dams will be less than 30 feet in height with 2:1 and 3:1 slopes. The principal spillway will consist of a ported riser and outlet conduit designed to limit outflow at a rate non-damaging to downstream channels. The emergency spillways will be excavated in earth and will operate, on the average, not often than once in 100 years. The discharge capacity and other details of each emergency spillway is shown in Table 3.

The total installation cost for the debris basins is estimated to be $493,100. P.L. 566 funds will provide $478,600 and other funds $14,500 of this cost.

System Improvements

Improvements to be installed on the distribution systems include 101,200 feet of concrete canal lining, 3,000 feet of earth lining, 36,325 feet of canal relocation, 3 siphons, 3 flumes, 158 turnouts, 6 regulating reservoirs, 5 drop structures, 1 divider, 4,800 feet of control dike, and 20 acres of phreatophyte control. The lining will be of Portland cement concrete with bottom widths varying from 1.0 to 2.0 feet and depths from 1.0 to 3.0 feet. Capacities for this lining will vary from 5 to 40 cubic feet per second.

Capacities for the relocated canal sections and earth lined sections will vary from 5 to 190 cubic feet per second with bottom widths varying from 1 to 5 feet and depths from 1 to 6 feet. Relocated canals will improve grade and alignment. Earth linings will be machine placed and compacted. The siphons and flumes will be of welded steel pipe with concrete transition structures. The regulating reservoirs with about 20 acre feet capacity will consist of an earth fill dam with irrigation control outlet and emergency spillway. The turnouts will consist of a slide headgate with concrete headwall, and, in some cases, a short stub of pipe. The drop structures and the divider will be of reinforced concrete. The control dike will consist of earth embankment both above and below the south ditch to contain high flows. Phreatophyte control will consist of cutting, spraying, and removal of growth adjacent to the canals.

Principal features of irrigation structures are shown on Figure 6. These structures are designed to reduce seepage losses, enable the orderly and dependable distribution of water, and reduce excessive operation and maintenance costs. The estimated installation cost for these improvements is $387,200. P.L. 566 funds will provide $214,600 and other funds, $172,600 of the total cost.

Fish and Wildlife Water Resource Improvements

The Duck Fork and Willow Lakes irrigation reservoirs will be converted to fishery use. The fisheries are located on the Manti-LaSal National Forest as shown on Figure 1. Plans of the U.S. Forest Service include improvement of existing roads for public access to the reservoirs. Special-use permits for the improvements will require that perimeter access and use of the fishery be maintained for enjoyment of the general public, unrestricted by group or private developments along the shoreline. Principal features of the structures are shown on Figures 7 and 8.
Each structure is designed with a principal spillway and an emergency spillway. The principal spillway consists of a riser and outlet conduit. An appurtenant drainage gate with up-the-slope control will be affixed to the riser and conduit. The emergency spillway will be excavated in earth. The vertical distance between the crest elevations of the principal and emergency spillway and the corresponding surcharge storage volume have been carefully selected to prevent outflow through the emergency spillway for the design-emergency and freeboard hydrographs, as well as the 100-year frequency snowmelt inflow. The emergency spillways will not normally be used.

To convert the Duck Fork Reservoir to fishery use, it will be necessary to install a toe drain along a short section of the back toe of the dam, install a cutoff through a short section of the front slope of the dam, realign and renovate the present earth spillway, install a riser and drainage gate on the existing irrigation outlet, and reinforce the riprap along the exposed front slope of the dam. This will provide a permanent pool of 41 surface acres, 15 feet average depth, and a volume of 610 acre feet.

To create a fishery at the Willow Lakes site and minimize winter kill of fish, it will be necessary to raise the present fill and water surface by approximately 5 feet, install a cutoff at the upstream toe of the dam, install the principal and emergency spillways, and riprap the exposed face of the dam. This will provide a permanent pool with a surface area of 25 acres, an average depth of 10 feet, and give a storage volume of 235 acre feet.

The installation cost for these structures is estimated to be $256,800. P.L. 566 funds will provide $92,500 and other funds, $164,300.

Non-Project Measures

The Utah State Department of Fish and Game will convert and maintain the Ferron Reservoir to fishery use by installing a riser and drainage gate on the existing irrigation outlet. The estimated installation cost for the riser and appurtenances, $9,500, will be from Department funds.

EXPLANATION OF INSTALLATION COST

Costs

Land Treatment Measures

Installation costs for land treatment measures on private and state lands are estimates of all costs associated with establishing the measures. They include the application cost to be borne by individual owners and operators, together with cost sharing assistance as may be available through the Agricultural Stabilization and Conservation program administered by the Agricultural Stabilization and Conservation Service.
Installation costs for treatment measures on federal land includes the cost for establishing the treatment, associated technical services including soil surveys to determine suitability and exact location of the treatment, and overhead supervisory costs. Operation and maintenance costs reflect those needed to maintain the critical area treatment during the installation period for the treatment.

Estimates of quantities and costs for all land treatment measures are based upon surveys of watershed lands and on costs incurred for similar treatment in other projects. Application costs for each measure includes a contingency allowance to insure its establishment. All costs reflect current and local prices for the operations and services and materials involved in each practice. The estimated technical assistance costs for all measures is based upon an analysis of the costs for planning and applying similar measures.

**Structural Measures**

The installation costs shown in Tables 1 and 2 include all costs to be incurred in installing the structural measures. Installation costs include construction, installation services, land and water rights, and contract administration.

Construction costs shown for each structural measure represents a sound estimate for the cost of each contract for installing each measure. Construction costs consist of the engineer's estimated cost for each structural measure increased by 15% to 20% for contingencies. The engineer's estimated cost is a summation of the products of unit costs and the construction quantities included in the bid item schedules for each structural measure.

Installation services cost, based upon 25% of the contract cost, includes all personnel services cost associated with the survey, foundation and borrow investigations, design, preparation of contracts, and supervision of construction. Estimated installation services cost for installation of the recreation facilities include the required consultant engineering and architectural services in addition to installation services required for routine layout, review of designs, contracts, and incidental supervision of construction. Engineering services make up 68% of the installation services cost and other personnel services account for 32%.

Land rights costs consist of the value of the land, easements, or rights-of-way, cost of relocating facilities, and legal, survey, and other costs associated with their acquisition. The costs, $18,000, for relocation of the road around the Mill Site Reservoir and Dam is included. It is expected that the majority of the private land required for the smaller structures will be donated. Land right requirements for the Mill Site Reservoir and Dam include the cropland and farmstead of one farm unit. This farm unit will be purchased. Ferron City and Emery County will donate their interests in lands required for the Mill Site Reservoir and Dam. The irrigation company now owns 10 acres of required land. The recreation facilities will be located or federal land. Other public lands required--city, county, and federal--can be obtained with only legal and survey costs involved.
Costs for water rights for the water resource improvements for fish and wildlife were agreed upon by the Utah State Department of Fish and Game and the Ferron Canal and Reservoir Company.

Contract administration costs include all personnel services, overhead, and cash costs associated with administration of contracts. Contract administration costs shown for each structural measure, based upon the number of contracts and the cost of administering each, represents the experience of local sponsoring organizations in other watersheds where similar measures have been installed.

**Cost Allocation and Cost Sharing**

The installation costs for the Mill Site Reservoir and Dam were allocated to flood prevention, fish and wildlife development, and irrigation by the use of facilities method except that those costs of required lands, easements, and rights-of-way to be purchased for the reservoir allocated to fish and wildlife development were determined by the ratio of the difference between total area required and area required for other purposes to the total area. Approximately 72% of the installation cost of this structure is allocated to irrigation, 17% to flood prevention, and 11% to fish and wildlife development. All costs of the recreation facilities are allocated to the purpose of fish and wildlife development.

The debris basins, irrigation system improvements, and fish and wildlife water resource improvements are single purpose measures and the costs are allocated to the purposes served.

Sharing of project costs between P.L. 566 funds and other funds are in accordance with the provisions of Public Law 566, 83d Congress, 88 Stat. 666, as amended, and the Policy Statement of the Secretary of Agriculture. Project costs are estimated to be $6,969,800. Fifty-six percent or $3,892,100 will be provided from P.L. 566 funds. Other funds will provide $3,077,700 or forty-four percent. Non-project costs, $9,500, will be from other funds.

The following costs will be from P.L. 566 funds:

1. Cost of technical assistance for accelerated land treatment on non-federal land, $36,600.

2. Cost for applying accelerated land treatment measures on federal land, $841,700.

3. Federal share of the construction cost for structural measures as follows:
   a. 50% of the construction cost for the irrigation outlet for the Mill Site Reservoir and Dam, $32,000, and 58.8% of the remaining (joint) construction cost, $1,489,900.
b. 50% of the construction cost for recreation facilities, $33,400.

c. 50% of the construction cost for the system improvements, $143,000.

d. The construction cost of the debris basins, $382,700.

e. 50% of the construction cost for the Duck Fork and Willow Lakes fisheries, $61,600.

4. 33.8% of the cost for about 370 acres of required land to be purchased and road relocation for the Mill Site Reservoir and Dam, $14,500.

5. The cost of installation services for construction of the Mill Site Reservoir Dam, the system improvements, the debris basins, and the Duck Fork and Willow Lakes fisheries, $848,400.

6. 50% of the installation services cost for installation of the recreation facilities, $8,300. This cost includes the value of incidental engineering involved in layout and review of plans and contracts, as well as 50% of the cost for consultant architectural and engineering services.

The following costs will be from other funds:

1. Application cost for installation of land treatment measures on private and state land, estimated to be $246,200. Cost sharing assistance available under other programs at the time of installation will be utilized.

2. Cost of technical assistance for going program for land treatment measures on non-federal land, $18,800.

3. Application cost for land treatment measures to be installed on federal land under going program, $1,251,000.

4. Non-federal share of the construction cost for structural measures as follows:

   a. 50% of the construction cost for the irrigation outlet for the Mill Site Reservoir and Dam, $32,000, and 41.2% of the remaining (joint) construction cost, $1,046,100.

   b. 50% of the construction cost for recreation facilities, $33,400.

   c. 50% of the construction cost for system improvements, $143,000.

   d. 50% of the construction cost for the Duck Fork and Willow Lakes fisheries, $61,600.

5. 50% for consultant engineering and architectural services required for installation of the recreation facilities, $8,300.
6. 66.2% of the cost for 370 acres of required land to be purchased for road relocation for installation of the Mill Site Reservoir and Dam, $28,500, plus 100% of the cost of contiguous and other land which will be acquired, $10,000, and 100% of the survey and legal cost, $1,000, incurred in acquisition.

7. Land rights cost for installation of other structural measures, $21,900.

8. The costs for water rights, $100,000. This includes the cost for transfer of storage and water rights to operate the Duck Fork, Ferron, and Willow Lakes fisheries.

9. Costs for administering contracts for project installation, $75,900.

10. Non-project cost for conversion of the Ferron irrigation reservoir to fishery use, $9,500.

### Schedule for Expenditure of Funds

<table>
<thead>
<tr>
<th>Year</th>
<th>P.L. 566</th>
<th>Other</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>$279,800</td>
<td>$260,900</td>
<td>$540,700</td>
</tr>
<tr>
<td>2</td>
<td>400,600</td>
<td>168,900</td>
<td>569,500</td>
</tr>
<tr>
<td>3</td>
<td>1,054,800</td>
<td>794,900</td>
<td>1,849,700</td>
</tr>
<tr>
<td>4</td>
<td>1,294,000</td>
<td>870,900</td>
<td>2,164,900</td>
</tr>
<tr>
<td>5</td>
<td>214,700</td>
<td>177,900</td>
<td>392,600</td>
</tr>
<tr>
<td>6</td>
<td>374,100</td>
<td>251,200</td>
<td>625,300</td>
</tr>
<tr>
<td>7</td>
<td>156,600</td>
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</tr>
<tr>
<td>10</td>
<td>3,700</td>
<td>27,500</td>
<td>31,200</td>
</tr>
<tr>
<td>Total</td>
<td>$3,892,100</td>
<td>$3,077,700</td>
<td>$6,969,800</td>
</tr>
</tbody>
</table>

### EFFECTS OF WORKS OF IMPROVEMENT

Treatment measures included in this plan are designed to alleviate the principal physical watershed problems and stabilize and improve the economy of the watershed. No additional land will be brought under irrigation or cultivation as a result of this project.
The total area benefited by flood prevention and irrigation measures is 12,125 acres. Of this amount, 6,525 acres of irrigated cropland and 5,600 acres of pasture will receive direct protection from floods. Of the 11,200 acres of cropland, 6,325 acres will be jointly benefited by flood control and irrigation measures and the balance of 4,775 irrigated acres will be benefited solely by irrigation measures.

The irrigation improvement measures will directly benefit 735 persons and the flood prevention measures, 800 individuals. There are 123 farm operating units in the watershed.

Stabilization of critical areas with land treatment measures will curb erosion, reduce floodwater and sediment production, and contribute to the effective operation and extend the useful life of the structural measures. Land treatment measures to be installed on individual farms will contribute to conservation use of water, soil and other farm resources.

The debris basins and the Mill Site Reservoir will virtually eliminate floodwater and sediment damages from the key flood source areas which they control. In addition, the Mill Site Reservoir will provide for effective regulation of flood flows and optimum seasonal distribution of the waters of Ferron Creek for efficient irrigation and enable the creation of a fishery and recreation complex, all of which will contribute materially to economic development and stability of the watershed. The improvements on irrigation company systems will reduce seepage losses and provide for effective and equitable distribution of irrigation water to the farms.

Conversion of the upstream reservoirs to fishery use will provide fish and wildlife water resource improvements to meet the needs of the area. These structures will also provide effective control of summer floods and the 100-year frequency snowmelt runoff from their drainage areas, which will benefit stream channels, roads, and other values in upstream watershed areas.

**Flooding and Sediment Reductions**

Land treatment measures for stabilization of critical areas are an integrated approach toward alleviating flood and sediment damage problems. These measures will reduce flood runoff and sediment production at its source and arrest widespread erosion and land deterioration. Contour trenching and furrowing, pinon-juniper eradication, roadside erosion control, gully plugs, seeding, fencing of treated areas, and increased fire protection measures will stabilize critical sediment and flood source areas, rehabilitate deteriorated sites, and prevent the encroachment of active gullies onto adjacent lands. Fencing, water developments, brush control, plowing, and seedings of less critical areas will facilitate the management of critical areas and adjacent rangelands and distribution of livestock grazing in accordance with the needs and capabilities of the watershed lands.
Upper watershed treatment measures including adjustment of livestock use to the capacity of suitable range and improved management of all resources will contribute materially to the success of the project and the life of structural measures by decreasing flood flows and sediment loads. These reductions will gradually accrue and will reach maximum effectiveness in 40 to 50 years after establishment of the measures. It is estimated that the measures will give an average reduction of 20% in downstream damages. An added and proportionately higher offsite reduction in flood flows and sediment movement will occur throughout the upper watershed at points where flood flows now damage roads, trails, bridges, recreation sites, and grazing resources. It is estimated that average annual reductions of 35% in upstream damages will accrue from this treatment. Additional benefits in increased recreation use due to easier and more consistent access will be a substantial by-product of this treatment.

The debris basins and the Mill Site Reservoir will complement the land treatment program in giving flood protection to the irrigated land, cultural improvements, irrigation distribution systems, roads, and other fixed improvements. The water resource improvements for fish and wildlife will provide a limited amount of flood protection to stream channels, trails, and other values.

The debris basins will give protection from the 100-year frequency summer flood and virtually eliminate damage from sediment originating in their controlled drainage areas. On the flood fans and flood plain of the controlled drainages, 7,200 acres will receive complete protection from floods below the 100-year frequency level and 4,925 acres of fan and flood plain land will receive a high but lesser degree of protection because of the influence of small uncontrolled drainages and runoff below flood prevention structures.

The Mill Site Reservoir will virtually eliminate downstream sediment and flood damages. Sediment and debris which has formerly choked structures and filled channels and canals will be contained in the sediment pool. Summer floods occur at a time when storage capacity will be available in the irrigation pool to accommodate the flood volume. Snowmelt floods will be completely controlled through storage regulation. Reservoir operation, based upon runoff forecasts, will enable control of the larger and less frequent snowmelt floods.

The debris basins and the Mill Site Reservoir will give immediate and a high degree of protection from sediment and floodwater to the irrigated acreage, cultural improvements, and distribution systems. These structures will provide positive control of significant flood source areas. By protection of the irrigation distribution canals, effective and timely distribution of irrigation waters can be ensured. By protection of the irrigated land, key conservation practices may be applied which will increase the efficiency in use of irrigation supplies and contribute to a stable economic agricultural base for the community.
Effects of Irrigation Measures

The combined effects of on-farm land treatment and structural measures for irrigation will be to improve the use of land and water and induce a more efficient use of capital and labor resources. The on-farm land treatment will be applied more or less uniformly over the irrigated land. The improvement in irrigation water supply stemming from the Mill Site Reservoir and the system improvements will affect all of the irrigated land. There will be a shift in cropping pattern on 13% of the irrigated cropland reflecting an improved conservation cropping system and about 475 acres of wet pasture will be improved or upgraded to a more economic use.

Land treatment measures will improve irrigation efficiencies and promote the application of improved farm technology and management. Over-all transportation and farm efficiencies are expected to increase from 28% to 42%. The Mill Site Reservoir, through storage regulation, will affect the distribution of water throughout the irrigation season and permit water deliveries to more nearly coincide with the requirements of the crops. System improvements will reduce water losses and provide for orderly and timely distribution of water to the farm headgate.

Installation of accurate measuring and control devices within the system will permit a more equitable distribution of water among users and will provide a sound basis for improved water management throughout the system and on farms.

The effect of the project will be, through water conservation and storage regulation, to bring the distribution of water supply nearly in line with seasonal water requirements. Under present conditions, 47% of the seasonal water requirement can be met. Under project conditions, 80% of the seasonal water requirement can be met. Net farm income will have more than doubled after the farmers share of project costs have been deducted.

Other Effects

The inclusion of browse in the critical area seedings within key game ranges should increase the winter forage for deer. The direct improvement of forage on deer winter range produced by the establishment of browse and by adjustment of livestock grazing to the capacity of suitable range will induce a widespread improvement in vegetative cover in adjacent areas. Direct benefits to big game from the proposed treatment include increased forage production and improved condition of the deer herd. Effects will include better hunter success and quality game which will result in increased hunter use.

In addition to improvement in quantity and quality of plant cover, the seeded areas will also provide improved habitat for upland game birds. The installation of livestock watering facilities on the rangeland will also provide water for upland game birds and for deer. The watering facilities will extend the range and improve the survival ratio of upland game bird broods. The wildlife plantings in the irrigated area will provide much needed feed and cover.
The water resource improvements at the Mill Site Reservoir Dam and the fish and wildlife water resource improvements in the upper watershed will greatly enhance the fishery resources of the watershed and surrounding communities. It is estimated that the trout fishery to be established at the Mill Site would have an average annual use of about 19,800 angler days. It is estimated that the Willow Lakes and Duck Fork fisheries in the upper watershed would provide for 11,500 angler use days initially and build up to an average of 18,700.

The water resource development at the Mill Site will provide for boating in addition to fishing. The recreation facilities to be installed contiguous to the reservoir will provide a base for use of the reservoir for recreation activities in the surrounding area.

Kinds of use to be provided at the Mill Site Reservoir and the average number of activity days of use expected through the evaluation period are:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Projected Demand</th>
<th>Capacity</th>
<th>Expected Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picnicking</td>
<td>32,925</td>
<td>18,165</td>
<td>18,145 1/</td>
</tr>
<tr>
<td>Camping</td>
<td>9,570</td>
<td>2,270</td>
<td>2,270 1/</td>
</tr>
<tr>
<td>Boating</td>
<td>5,865</td>
<td>8,065</td>
<td>5,865 2/</td>
</tr>
<tr>
<td>Fishing</td>
<td>48,600</td>
<td>19,800</td>
<td>19,800 1/</td>
</tr>
</tbody>
</table>

1/ Limited by capacity
2/ Limited by demand

The reservoir will provide the only fishery and recreation facilities below 7,500 feet (mean sea level) in this part of the state and will be open for use much earlier and later in the season than other reservoirs, existing or proposed.

The base area from which this development will draw support includes Carbon and Emery counties and the Salina area of Sevier County. It is defined as being within the periphery of an area of one and one-fourth hour driving time of the development and has a projected 1980 population of 38,700. It will also provide facilities for tourists from Utah and surrounding states who regularly visit the watershed for camping, fishing, and related activities.

PROJECT BENEFITS

Major economic changes will be produced by the installation of this project in this watershed. With a static or diminishing level of activity in mining, declining range resources and other economic and social limitations which hinder the development of efficient family farm units, the economy of the area and the watershed is stagnant and depressed. This project offers an effective and practical means of rehabilitating the range resource, developing the recreation potential, and raising the income of farming units to levels which will accelerate the development of stable family farms.

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Flood Prevention Benefits

The flood prevention structures are primarily designed to protect the two main irrigation canals and the farmland lying below. They will also give protection to roads, bridges, and farm structures and will insure the delivery of irrigation water to the farms.

Annual damage reduction benefits from the single purpose structural measures for flood prevention will total $27,720. In addition, secondary benefits of $2,325 and water conservation benefits of $3,440 will accrue. An additional $19,060 in flood prevention benefits will be generated by the multiple purpose Mill Site Reservoir.

The group of debris basins protecting the North Ditch will produce $12,315 in annual benefits, including $10,120 in primary flood prevention benefits and secondary and water conservation benefits of $950 and $1,245, respectively. Damages to crops, farmlands, irrigation facilities, roads, bridges, and farm structures will be reduced by 95%. About 55% of these benefits will accrue from reduction in damages to crops and irrigation facilities, 36% to farm structures, farmland, road, and miscellaneous items and 9% in indirect damage.

The debris basins above the South Ditch will give total annual benefits of $21,170, including $17,600 in primary flood prevention benefits, $2,195 in water conservation benefits, and $1,375 in secondary benefits. Reductions in damages to crops, canals, and irrigation structures make up 53% of damage reduction benefits. Reduced damages to farmlands, roads, bridges, irrigation services and miscellaneous items include 39% of the reduction benefits. Reductions in indirect damages account for 8%. The total effect of these structures will be to reduce present damages by about 90%.

The combined effect of the Mill Site Reservoir in containing damaging sediment and in controlling flood flows would be to reduce flood and sediment damages by 83%. Damage reduction benefits total $19,060, and are made up of reductions in sediment deposition in canals, ditches, and farmland and in reductions in streambank cutting, damage to irrigation structures, and to crops. Reduction in sediment deposition damages in canals and on farmlands is 47% of total reductions. Damage reductions in crop, feed, and production materials and facilities make up 34% of the total. Indirect damage is 6% and the balance, 13%, is made up of damage reduction benefits to roads, bridges, farm structures, and miscellaneous items.

Irrigation Benefits

Under present conditions, the median water supply will meet about 47% of seasonal water requirements. With the project, the median water supply will meet about 80% of seasonal needs. This will produce total annual primary benefits of $327,380 and $51,085 in secondary benefits.
The principal benefit derived from the irrigation features of the Mill Site Reservoir will be generated by the storage and controlled release of irrigation water. Controlled release will enhance the value of the entire supply by inducing better irrigation application efficiency. Primary and secondary irrigation benefits of this structure will be $272,705 and $42,830 per year, respectively, after costs of accelerated land treatment have been deducted.

The irrigation system improvements will improve conveyance and operational efficiency and result in total benefits of $62,930 per year. This includes $54,675 in primary benefits and $8,255 in secondary benefits.

Fish and Wildlife and Recreation Benefits

Physical effects of the land treatment program with respect to big game and upland game birds have been detailed previously. These effects were not reduced to monetary benefits.

Water resource improvements for fish and wildlife, Willow Lakes, and Duck Fork Reservoir, in the upper watershed, will have benefits of $28,050 per year.

The water impounded in the Mill Site Reservoir and the picnic, boating, and camping facilities established on the shoreline will be extensively used. It is estimated that the combined total of use will average 32,255 visits per year. Total benefits from this use will be $47,745 per year. This includes $25,225 in annual benefits for the fish and wildlife pool and $22,520 in annual benefits for the recreation facilities.

Secondary Benefits

Local secondary benefits evaluated include those "stemming from" and "induced by" the installation of project measures. Secondary benefits were not evaluated from a national standpoint.

Local secondary benefits produced by reduction in damage to irrigation facilities and farmlands were evaluated at $3,960 annually. These are losses in off-farm returns when flood damages decrease the amount of agricultural products normally processed, transported, and marketed. Other benefits in the "stemming from" category will accrue from the increased livestock production stimulated by the improved water supply. Benefits in the amount of $32,735 per year will be produced by the Mill Site Reservoir and the irrigation system improvements.

Secondary benefits in the amount of $16,715 will be "induced by" the Mill Site Reservoir, the irrigation system improvement, and the land treatment measures. These will result from the increased requirements for production supplies, consumer goods and services arising from the expanded livestock production expected under project conditions.

Total annual secondary benefits "stemming from" and "induced by" is estimated to be $53,410 per year.
Redevelopment Benefits

As previously stated, the two-county, Carbon-Emery area, has a high unemployment rate and has been designated as a distressed area under the Area Redevelopment Administration. This problem is further compounded by a high level of under-employment in the agricultural sector of the economy. The basis for the distressed area classification is an unemployment rate of 8.6% in Emery County and a 31% level of part-time employment in agriculture.

In the watershed, the unemployment rate is lower (6.5%) but the level of under-employment closely parallels the condition in the county. On the 123 operating units in the watershed, it is estimated that the scale of operations limited by the present water supply provides for no more than about 87 man years of full employment annually. With the anticipated level of agricultural technology which can be expected in the future, and the increased operating efficiencies which will result, a reduction in this level of labor requirement is a likely prospect.

The installation of the project will provide an immediate stimulus to the local economy and will provide an improved production base which will return benefits far into the future. Since much of the required construction labor will be recruited from the local work force, installation of the structures will have a quick impact on the local economy. This will initiate a chain of secondary economic activities which will stimulate business throughout the watershed and the surrounding area.

It is estimated that installation of the structural measures and land treatment will generate local employment benefits of $681,625 over the 10 year installation period. When reduced to annual equivalents over a 100 year period, the benefit would be $23,755 per year.

The increased livestock production and the accelerated application of farm technology stimulated by project improvements will have a long and sustained effect in furnishing full farm employment and in raising the level of income on family farms. Marginal economic units will be strengthened and the current trend toward the development of larger and more efficient operating units will be accelerated. The increased labor inputs required to achieve project production levels are estimated to be at least 87,000 man hours per year. With an initial annual dollar value of $109,970, the benefit reduces to $30,510 per year when appropriately limited and adjusted.

After deducting the value of labor inputs, $3,050, counted as secondary benefits, total net redevelopment benefits from all sources are estimated to be $51,215 per year. These benefits are not used for project justification, but were defined and calculated so as to show the full scope of project effects.

The following table shows the change in farm income expected as a result of the project.
### Farms by Economic Classes - Ferron Watershed

<table>
<thead>
<tr>
<th>Value - Farm Products Sold</th>
<th>Economic Class</th>
<th>W/O Project 1/</th>
<th>With Project 1/</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 50 - $ 2,499</td>
<td>6</td>
<td>51</td>
<td>45</td>
</tr>
<tr>
<td>2,500 - 4,999</td>
<td>5</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>5,000 - 9,999</td>
<td>4</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>10,000 - 19,999</td>
<td>3</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>20,000 - 39,999</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>40,000+</td>
<td>1</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>114 2/</td>
<td>100</td>
<td>102 2/</td>
</tr>
</tbody>
</table>

1/ Projected.
2/ Reflects trend toward larger and fewer farms.

### Benefits from Upper Watershed Treatment

Downstream damage reduction benefits from upper watershed land treatment will be $5,365 per year. None of these benefits are used for project justification.

### COMPARISON OF BENEFITS AND COSTS

The over-all benefit-cost ratio for the project is 2.9 to 1.0 with annual benefits of $506,805 and annual costs of $172,975. The annual benefits are made up of $453,395 in primary benefits and $53,410 in secondary benefits. Without the inclusion of secondary benefits, the benefit-cost ratio is 2.6 to 1.0.

In addition, redevelopment benefits of $51,215 per year have been identified and evaluated but are not used in project justification.

The annual benefits, annual costs, and benefit-cost ratios for individual structures and groups of measures are shown in Table 6.

### PROJECT INST

This plan will be carried out as a joint effort of federal, state, and local interests.

Non-federal interests include individuals, local, state, and federal agencies. Non-federal interests include individuals, the San Rafael Soil Conservation District, Emery County, the State Department of Fish and Game, Utah State Department of Forestry and Fire Control, Utah State Land Board, Utah Water and Power Board, and the Utah Cooperative Extension Service.

Participating federal agencies include the Soil Conservation Service, Forest Service, Bureau of Land Management, Farmers Home Administration, and the State and County Agricultural Stabilization and Conservation Committees.

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Sponsoring organizations will acquire necessary lands, easements, and rights-of-way, execute agreements with owners of private lands for installation of the land treatment measures, provide the non-federal share of the installation cost of structural measures, and cooperate with other local, state, and federal agencies concerned with the project. Local sponsoring organizations will contract for construction of the structural measures in the work plan.

Sponsors will secure the necessary lands, easements, and rights-of-way by negotiation or will use their right of eminent domain. Necessary lands, easements, rights-of-way, and water rights will be secured for one or more construction units before federal financial assistance is made available for construction of any structural measures in the designated construction unit.

The San Rafael Soil Conservation District is empowered to enter into agreements and contracts, to sue and be sued, carry out soil and water conservation operations, and apply soil conservation treatment within the boundaries of the District.

Emery County Water Conservancy District has powers of eminent domain, may levy assessments, hold election for loan or bond authorization, make annual levies to retire these obligations, is empowered to enter into agreements and contracts, and may sue and be sued.

The Ferron Canal and Reservoir Company, legally organized under state laws, has powers of eminent domain, can accept contributions, and levy assessments against its stock for repayment of obligations and operation and maintenance costs.

Ferron City, incorporated under state laws of Utah, has powers of taxation, eminent domain, can accept contributions, levy assessments, hold elections for loan or bond authorization, make annual levies to retire these obligations, and enter into special-use agreements with land administering agencies for construction and maintenance of improvements.

Emery County has powers of taxation, eminent domain, can levy assessments, hold election for loan or bond authorization, make annual levies to retire these obligations, and enter into special-use agreements with land administering agencies for construction and maintenance of improvements.

The federal land administering agencies have concurred in the provisions of the work plan.

Responsibilities for Installation

In order to coordinate the installation of the accelerated land treatment and structural measures provided for in the plan and the going conservation programs within the watershed, close cooperation and specific responsibilities are required of private interests, the sponsors, local, state, and federal agencies assisting in this project.
San Rafael Soil Conservation District will:

1. Provide local leadership and direction which will continue the going program of the District at the rate which existed prior to development of this work plan.

2. Provide local leadership to insure the scheduled installation of the accelerated land treatment measures on private and state lands.

Ferron Canal and Reservoir Company will:

1. Confirm and keep their water rights for the project current.

2. Survey and acquire all needed lands, easements, and rights-of-way and record legal documents for installation of the debris basins, the Mill Site Reservoir and Dam and recreation facilities, and improvements on the company systems and on group systems serviced by the company.

3. Act as local contracting organization for the construction of these measures and furnish the non-federal share of the construction cost. By agreement with the company, the Utah State Department of Fish and Game will participate in the cost allocated to fish and wildlife in the Mill Site Reservoir.

4. Provide leadership, encourage and assist water users under their system to attain more efficient use of available water supplies through application of the scheduled land treatment measures and better water management practices.

5. By agreement with the Utah State Department of Fish and Game, transfer storage and water rights needed to establish and maintain fisheries at the Duck Fork, Willow Lakes, and Ferron Reservoir.

Utah State Department of Fish and Game will:

1. Acquire special-use permits and special-use permits and Duck Fork, Willow Lakes, and Ferron Fork for use in the construction cost for these fishery facilities.

2. Act as local contracting organization for the construction cost for these fishery facilities.

3. Participate with the irrigation, fish and wildlife storage in fishery potential of the Mill Site Reservoir, and maintain the construction costs and construction facilities.

4. Cooperate with local, state, and federal, range and vegetation studies involving forage use, the project area within the eco-continue big game harvesting projects in balance with game forage production.
5. Develop upland game habitat on private land under the regular Department program in cooperation with the program of the San Rafael Soil Conservation District.

6. Maintain close liaison with sponsors and other agencies and groups participating in the project and assist in appropriate revisions of the work plan.

The Department will also install a riser with needed appurtenances to convert and maintain the Ferron irrigation reservoir to fishery use as a non-project measure.

The Emery County Water Conservancy District will:

1. Provide leadership, encouragement, and assistance to the Ferron Canal and Reservoir Company in meeting their responsibilities as outlined in this work plan.

2. Assist the irrigation company in procurement of necessary lands, easements, and rights-of-way for installation of the improvements.

3. Provide leadership and encouragement to the water users to obtain more efficient use of irrigation water and the accelerated application of related management practices.

Ferron City will:

1. Contribute their interests in lands and improvements which are valued at $7,500 as required for construction of the Mill Site Reservoir and Dam, the debris basins, and the system improvements.

2. Participate with the Soil Conservation Service and the irrigation company in construction schedules and manage the diversion of culinary water supply to facilitate construction of the Mill Site Reservoir Dam.

3. Provide the service of the city staff and the city-owned equipment, as available, in relocation of the road around the Mill Site Reservoir and Dam and in administering contracts.

Emery County will:

1. Provide leadership, encouragement, and assistance to the Ferron Canal and Reservoir Company in meeting their responsibilities as outlined in this work plan.

2. Contribute their interest in lands required for structural measures.

3. Assist the irrigation company in procurement of other lands, easements, and rights-of-way needed for installation of the structural improvements.
4. Provide leadership and encouragement to the water users to obtain more efficient use of irrigation water and the accelerated application of related management practices.

5. Cooperate in the surfacing of the relocated road serving the area.

The Soil Conservation Service will:

1. Furnish technical assistance through the San Rafael Soil Conservation District to private landowners for installation of land treatment measures on non-federal lands.

2. Furnish the installation services for engineering surveys, designs, construction plans and specifications, and construction supervision for installation of the Mill Site Reservoir and Dam, the system improvements, the debris basins, and the Duck Fork and Willow Lakes fisheries.

3. Furnish not more than 50% of the cost for required consultant engineering and architectural services and incidental engineering and other services involved in layout and review of plans and contracts for installation of the recreation facilities at the Mill Site Reservoir.

4. Provide construction funds for the project in accordance with the cost sharing and time schedules set forth herein or as revised by mutual agreement and in accordance with national priorities.

5. Maintain liaison with sponsors and state and federal agencies participating in the project to the end that unified effort and coordinated action will produce the most effective results. Consult with and assist the sponsoring organizations, local, state, and federal agencies, in making desirable revisions or amendments of this plan if and when circumstances dictate.

The U. S. Forest Service will:

1. Install the land treatment measures on National Forest land in accordance with the program outlined in Table 1.

2. Coordinate the treatment, use, and management of National Forest lands contiguous to other federal land to effect minimum treatment cost and optimum utilization by big game and livestock.

3. Furnish technical assistance for planning and application of practices under its Departmental responsibility for technical adequacy for woodland planning. This will be done in cooperation with the Utah State Department of Forestry and Fire Control.

4. Authorize access roads, borrow areas, and other land occupancy by special use permits. These special use permits will be issued and administered in accordance with established policies and procedures.
The Bureau of Land Management will:

1. Install the land treatment measures on federal land administered by the Bureau of Land Management in accordance with the program outlined in Table 1.

2. Coordinate the treatment, use, and management of treated areas contiguous to treatment areas of the National Forest to effect the least treatment cost and optimum utilization by livestock and big game.

3. Determine the suitable time for renewal of grazing use of the treatment areas.

4. Authorize access roads, borrow areas, and grant easements and rights-of-way in accordance with Bureau of Land Management policy and procedure for installation of the structural measures.

The following agencies, by agreement with the sponsors, will participate as shown:

**Utah State Department of Forestry and Fire Control will:**

1. Arrange for adequate fire prevention and suppression with the local sponsors and provide fire suppression equipment as needed through its regular program.

**Utah State Land Board will:**

1. Participate with permittees and the San Rafael Soil Conservation District in the proper management of the grazing resources on the state land.

**Utah Water and Power Board will:**

1. To the extent permitted by state law, availability of funds, and Utah Water and Power Board regulations, make financial assistance available to the sponsors or water users.

**The Utah Cooperative Extension Service will:**

1. Give high priority in carrying out an effective education and information program in cooperation with the sponsors of this project.

**The Agricultural Stabilization and Conservation Committees, State and County, will:**

1. Give high priority to scheduling Agricultural Conservation Program funds to expedite the land treatment on private and state lands.
The Farmers Home Administration will:

1. Provide information and guidance to the local organizations regarding the requirements for Farmers Home Administration loans.

2. Make loan funds or advancements to local organizations desiring to use loan provisions of the Act to finance the local share of installation costs for works of improvement included in the plan.

3. Cooperate and collaborate with the Soil Conservation Service, the Soil Conservation District, and recipients of watershed loans in setting up inspection and operation and maintenance procedures for works to be installed with loans authorized under Section 8 of the Act.

4. Maintain close liaison with sponsors, agencies, and groups participating in this project and assist with appropriate revisions of the work plan.

Schedules for Installation

Going conservation programs of the San Rafael Soil Conservation District and federal and state agencies cooperating in this project are an integral part of this plan and will continue at least at the same rate that existed prior to development of the watershed work plan.

Installation of accelerated land treatment measures which have measurable effects in flood prevention will begin during the first year of the project and be completed during a 10-year project period. Treatment and adjustment in use will be made in accordance with the schedule for the installation of the structural measures. The effect on normal farm and ranch operation was considered in developing the schedules for installation and will be considered in any adjustments in scheduling during the installation period.

The installation of accelerated land treatment measures which have a measurable effect in reducing water losses and increasing on-farm irrigation efficiencies will begin in the first year of the project and be completed during a 10-year installation period. The systematic installation of the on-farm measures concurrently with the Mill Site Reservoir and Dam and irrigation system improvement structural measures is essential to the successful application of the provisions of this plan. Accordingly, the scheduled assistance for the installation of structural measures for irrigation will depend on substantial year-by-year progress in the installation of the on-farm measures.

The installation of the structural program for flood prevention is scheduled concurrently with or after the installation of required land treatment above the structures. The installation of the structural irrigation measures is scheduled concurrently with the installation of the on-farm land treatment measures.

The proposed installation schedule follows:
Federal Land (BLM)

1st year
Install treatment, 1,119 acres: Herring Flat--contour furrow 731 acres; Salt Wash--contour furrow 388 acres, construct 1 large gully plug, and construct 2 miles of fence.

2nd year
Install treatment, 1,039 acres: N. W. Ferron--contour furrow 925 acres, construct gully plugs 114 acres, construct 8 large gully plugs and 6 stockwater reservoirs. Maintain previously installed treatment.

3rd year

4th year

5th year

6th year
Install treatment, 1,433 acres: N. E. Ferron--contour furrow 1,433 acres and construct 2 miles of protective fence. Maintain previously installed treatment.

7th year
Install treatment, 1,618 acres: N. E. Ferron--contour furrow 1,618 acres. Maintain previously installed treatment.

Manti-LaSal National Forest (FS)

1st year
Install treatment on 3,620 acres: McEwan Flat--contour furrow 520 acres, spray sagebrush 307 acres, construct 1 mile of fence and close 1 mile of irrigation ditch; Black Dragon--contour trench 235 acres, contour furrow 303 acres, chain 610 acres of pinon-juniper, and stabilize 8 miles of road erosion; Kitchen--contour trench 105 acres, contour furrow 378 acres, spray 160 acres of sagebrush, and stabilize 1.5 miles of road erosion; Lower Bear Creek--contour trench 212 acres, contour furrow 195 acres, spray 115 acres of sagebrush, construct 2 miles of fence, and stabilize 0.5 miles of road erosion; Biddlecome Ridge--contour furrow 180 acres and chain 500 acres of pinon-juniper. Construct 7 miles of common use segregation fence and install the wildlife water developments on Nelson and Dry Mountains and in Dry Wash.
2nd year
Install treatment on 1,184 acres: Buck Ridge--contour trench 205 acres and construct 1.1 miles of gully stabilization; Little Bear Creek--contour trench 418 acres, contour furrow 80 acres, and construct 0.6 miles of gully stabilization; Big Bear Creek--contour trench 353 acres, contour furrow 128 acres, and stabilize 1.6 miles of gully erosion; North Side of Ferron Mountain--construct 12 miles of unit cattle fence. Maintain previously installed treatment.

3rd year
Install treatment on 770 acres: Lake Mountain and Cove Mountain--contour trench 200 acres, contour furrow 325 acres, stabilize 3 miles of road erosion and construct 0.7 miles of gully stabilization; Trail Ridge--contour trench 180 acres, contour furrow 65 acres, and stabilize 1.1 miles of gully erosion. Construct 5.0 miles of Ferron-Mayfield road. Maintain previously installed treatment.

4th year
Install treatment on 6,125 acres: Dairy Creek and Stevens Creek--contour trench 805 acres, contour furrow 1,992 acres, plow and seed 373 acres, aerial seed (aspen type) 2,500 acres, chain 390 acres of pinon-juniper, stabilize 12 miles of road erosion, construct 0.2 miles of gully stabilization, and construct 4 miles of fence; South Horn Mountain--contour trench 395 acres, contour furrow 1,277 acres, spray 820 acres of sagebrush, construct 1.0 mile of gully stabilization, stabilize 2 miles of road erosion, and construct 3 tank type water developments. Construct 5.0 miles of Ferron-Mayfield road. Maintain previously installed treatment.

5th year
Install treatment on 550 acres: George's Fork, Lake Fork, Duck Fork, and Indian Creek--contour trench 270 acres, contour furrow 280 acres, stabilize 10 miles of road erosion, and construct 2.5 miles of gully stabilization. Maintain previously installed treatment.

6th year

7th year
Install treatment on 628 acres: Buck Flat and Ferron Mountain--contour trench 183 acres, contour furrow 440 acres, spray 15 acres of sagebrush, stabilize 2 miles of road erosion, and construct 2.3 miles of gully stabilization. Maintain previously installed treatment.

8th year
Install treatment on 756 acres: Wrigley Creek and Dry Wash--contour trench 318 acres, contour furrow 375 acres, plow and seed 63 acres, stabilize 2 miles of road erosion, and construct 0.3 miles of gully stabilization. Construct 6.0 miles of Skyline Drive road. Maintain previously installed treatment.
Utah State Department of Fish and Game

1st year
Acquire water rights and submit application for special-use permits for the fisheries. Survey and prepare designs and contract for the Duck Fork fishery. Survey and make needed investigations at the Willow Lakes site.

2nd year
Prepare designs and contract for the Willow Lakes fishery. Construct the Duck Fork fishery.

3rd year
Construct the Willow Lakes fishery and maintain and operate the Duck Fork fishery.

Ferron Canal and Reservoir Company

1st year
Make surveys and acquire lands, easements, and rights-of-way for the Mill Site Reservoir Dam and for 1/6 of the group irrigation system improvements. Investigate the Mill Site Reservoir Dam.

2nd year
Make surveys and acquire lands, easements, and rights-of-way for the canals, debris basins, and 1/6 of the group irrigation system improvements. Investigate the debris basin sites. Prepare designs and contracts for the Mill Site Dam and the group irrigation system improvements.

3rd year
Construct 1/6 of the group irrigation system improvements and 1/2 of the Mill Site Reservoir Dam. Make surveys, and acquire lands, easements, and rights-of-way for 1/6 of the group irrigation system improvements. Prepare designs and contracts for the debris basins and irrigation company system improvements.

4th year
Complete construction of the Mill Site Reservoir Dam. Construct the Diversion Hollow and Indian Hollow debris basins, 1/5 of the irrigation company system improvements and 1/6 of the group irrigation system improvements. Make surveys and acquire lands, easements, and rights-of-way for 1/6 of the group irrigation system improvements.

5th year
Construct the Mill Site Reservoir recreation facilities. Construct the Eli Hollow and Jewkes Hollow debris basins, 1/5 of the irrigation company system improvements, and 1/6 of the group irrigation system improvements. Make surveys and acquire lands, easements, and rights-of-way for 1/6 of the group irrigation system improvements.
6th year
Construct the Herring Flat-Zwahlen Wash and Straight Hollow debris basins, 1/5 of the irrigation company system improvements, and 1/6 of the group irrigation system improvements. Make surveys and acquire lands, easements, and rights-of-way for 1/6 of the group irrigation system improvements.

7th year
Construct the Dutch Flat debris basin, 1/5 of the irrigation company system improvements, and 1/6 of the group irrigation system improvements.

8th year
Construct the remaining irrigation company system improvements and the group irrigation system improvements.

FINANCING PROJECT INSTALLATION

Sponsoring local organizations are legally organized under state laws and are empowered and qualified to install, operate, and maintain project measures included herein. They have reviewed the program costs outlined in Tables 1 and 2 and have participated in cost-sharing decisions. They have given the Soil Conservation Service adequate assurance that their share of the installation cost will be available at the time and in the amounts required.

None of the sponsors has a history of delinquency.

Installation costs allocated to P.L. 566 funds will be from funds appropriated under the authority of Public Law 566, 83d Congress, 68 Stat. 666, as amended. This work plan does not constitute a financial document for obligation of federal funds, and financial or other assistance by the Soil Conservation Service is contingent upon the appropriation of funds for this purpose.

Cost sharing and other assistance currently available through going conservation programs of the San Rafael Soil Conservation District, the Agricultural Conservation Program, and other federal and state agencies cooperating in this project are an integral part of this plan and will be expected to be available at least in the amounts and rates that existed prior to the development of this work plan.

Land Treatment Measures

The cost for applying land treatment measures on private and state land will be from individual landowners, operators, and lessees utilizing cost-sharing assistance available through the Agricultural Conservation Program.

The County and State Agricultural Stabilization and Conservation Committees have reviewed land treatment needs for private and state lands and will endeavor to provide the funds required for accelerating the installation of these measures.
Technical assistance will be provided through the going program of the San Rafael Soil Conservation District at the current rate for installation of the going program on private and state lands. P.L. 566 funds will be provided for technical assistance needed for installation of the accelerated land treatment program on private and state lands.

Accelerated land treatment measures on federal land will be financed jointly from P.L. 566 funds and from regular funds of the land administering agencies. The going program for federal lands will be financed from funds of the land administering agencies, subject to their availability.

**Structural Measures**

The structural measures are located on federal, non-federal-public, and private lands. Land rights required for installation of structural measures on federal land administered by the Bureau of Land Management may be obtained by filing a right-of-way application with the Bureau. Land rights required on federal land administered by the Forest Service may be obtained by filing an application for special-use permit. In either case, only a small cost, including legal, survey, and other incidental costs, will be involved. Non-federal-public lands required for installation of structural measures can be obtained with only legal, survey, and other incidental costs involved. Most of the private land required for the flood prevention and system improvement measures will be donated. Remaining private lands required will be acquired by purchase. Contracts will be administered by the officers or regular employees of the irrigation company with material assistance from the regular staffs of Emery County, Ferron City, and Emery County Water Conservancy District.

The Ferron Canal and Reservoir Company intends to use loan provisions of Section 8 of the Act to help finance their share of the installation cost for measures which they sponsor. The company has filed a letter of intent with the State Director of the Farmers Home Administration outlining the need for credit in the amount of $1,175,000. Negotiations and investigations are underway to insure that needed credit will be available at the time and in the amount required.

**Repayment of the loan contracts with water**

The Utah State Department of the Interior will acquire water and supply it in the construction cost of the recreation facility. They will finance their share of project costs with a portion of the revenues of the Division.
PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures to be installed on private and leased state lands will be operated and maintained by private owners and operators through private initiative and conservation plans with the San Rafael Soil Conservation District.

Land treatment measures on federal land will be operated and maintained by the land administering agency. Operation and maintenance costs for critical area treatment on federal land will be from P.L. 566 funds as shown on Table 1, during the installation period for these measures, and thereafter from regular funds of the land administering agency. Operation and maintenance costs for other land treatment measures on federal land will be from regular funds of the land administering agency.

Structural Measures

Representatives of the Soil Conservation Service and the local sponsoring organizations will inspect all structural measures annually and after all floods. Required maintenance will be determined at this time. The responsible local organization will perform the needed maintenance work.

Specific operation and maintenance agreements between the sponsoring local organizations and the Service covering all phases of operation and maintenance will be executed prior to the issuance of invitations to bid.

Mill Site Reservoir

The Ferron Canal and Reservoir Company will be responsible for operation and maintenance of the Mill Site Reservoir and Dam.

The irrigation company is operated according to the requirements of Paragraph 1 of the Reservoir Facilities. Measures to ensure that the structure and fish conservation in irrigation company will operate the fishery pool as described in the Reservoir Keith Park. The irrigation outlet works and the ditch in any way without the consent of the State and its principal use will be responsible for operation, maintenance, and replacement of the reservoir. Replacement costs of the reservoir facilities to be $4,000 annually.

Recreation

The Ferron Reservoir Company and Ferron City will be responsible for operation, maintenance, and replacement of the recreation facilities.
Preventive maintenance and replacement will be performed on an annual basis. Minor repairs will be made as required.

Operation of the installation will include the servicing of comfort stations and sanitary receptacles, irrigation of grass and shrubs, and the collection of charges.

The company will provide a caretaker to operate the installation. The company and Ferron city will provide jointly for manpower and equipment needed for servicing and maintaining the installation.

Annual operation and maintenance costs are estimated to be $5,000. Annual replacement costs are estimated to be $2,500.

An estimated charge of $0.75 will be made for each automobile fee to the picnic and camping facilities. An entrance fee will be made for use of the boat ramp. No charges are expected for these services. It is expected that these charges will meet the needs for operation and maintenance of the local sponsors over the life of the project. The entrance fee is estimated to be about $8.75.

Debris Basins

The Ferron Canal and Reservoir Company is responsible for maintenance of the debris basins. The company is also responsible for replacement of appurtenances in years. Emery County and Ferron city will provide funds in the amounts available at the time maintenance is required.

The irrigation company will take steps necessary to ensure that the structures function in the manner for which they were designed and in accordance with applicable state laws. The principal and emergency spillways for the debris basins will not be altered in any manner but the consent of the Soil Conservation Service.

Principal or removal of principal structures will be performed by an employee of the company at no charge to the installation. Equipment costs for manpower and equipment needed for servicing and maintaining the installation.

Total annual cost is estimated to be $1,030.

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System Improvement Measures

The Ferron Canal and Reservoir Company will be responsible for operation, maintenance, and replacement of all system improvement measures. Respective segments of the company membership will operate, maintain, and replace specific improvements in accordance with supplemental agreements with the irrigation company with approval of the Soil Conservation Service.

The irrigation company will take steps necessary to insure that the planned measures are operated and maintained for the purpose and in the manner intended. The planned measures will be operated to distribute reservoir and natural flow irrigation water. Maintenance of the system improvements will consist primarily of keeping all facilities in satisfactory operating condition by making any necessary repairs to linings, berms, and appurtenances, removing of trash and obstructions, and replacing elements of the facilities at the end of their useful life. The average physical life of the system improvement is estimated to be 25 years. Annual operation, maintenance, and replacement costs for these measures are estimated to be $39,050.

Duck Fork and Willow Lakes Water Resource Improvements

The Utah State Department of Fish and Game will operate and maintain these facilities and replace elements of the structures at the end of their physical life in accordance with agreements with the Soil Conservation Service and within the provisions of the special-use permits issued by the U. S. Forest Service.

The Department will take steps necessary to insure that the structures are operated in a manner to serve the purpose intended.

Principal items of maintenance will include, but not be limited to, the removal of trash and rubbish from the perimeter, surface area, and principal spillway periodically, and maintenance of the fill, principal and emergency spillways, and riprap in a good state of repair. The Department will operate the reservoirs to maintain a satisfactory fishery. The principal spillways, including outlet conduit, riser, trash rack and fish screen, and drainage gate will be replaced when needed. Annual operation, maintenance, and replacement costs are estimated to be $500.
**TABLE 1 - EXHIBIT D: PROJECT INFEEDING Cost**

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
<th>Rest</th>
<th>Total</th>
<th>Total</th>
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<td>Land Acquisition</td>
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<td>Cost</td>
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### TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Ferron Watershed, Utah

<table>
<thead>
<tr>
<th>Measures</th>
<th>Unit</th>
<th>Applied to Date</th>
<th>Total Cost (Dollars) 1/</th>
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<tbody>
<tr>
<td><strong>LAND TREATMENT</strong></td>
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<tr>
<td>Soil Conservation Service</td>
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<td>Irrigated Land</td>
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<td>Ditch Lining</td>
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<td>Land Leveling</td>
<td>Acres</td>
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<tr>
<td>Small Structures</td>
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<td>Farm Ponds</td>
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<td>Regulating Reservoirs</td>
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<tr>
<td>Pasture Planting</td>
<td>Acres</td>
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<td>Forest Service - Manti-LaSal National Forest</td>
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<tr>
<td>Revegetation of Critical Areas</td>
<td>Acres</td>
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<td>Fencing</td>
<td>Miles</td>
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<td>Stockwater Development</td>
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<td>Resource Management</td>
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<td>Ditch and Canal Lining</td>
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<td>Canal Realignment</td>
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<td><strong>TOTAL</strong></td>
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1/ Price base 1964

January 1965
### Table 2: Estimated Structural Cost Distribution

<table>
<thead>
<tr>
<th>Structure Site No. or Name</th>
<th>Construction P.L. Funds</th>
<th>Installation Service P.L. Funds</th>
<th>Other</th>
<th>Administration and R/W Funds</th>
<th>Total Install. Cost</th>
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<tr>
<td>Mill Site Reservoir</td>
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<tr>
<td>Total Cost</td>
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<td>442,000</td>
<td>208,000</td>
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<td>Joint Cost</td>
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<td>(442,000)</td>
<td>(208,000)</td>
<td>(16,500)</td>
<td>(1,186,400)</td>
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<td>Irrigation Outlet</td>
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<td>(32,000)</td>
<td>(32,000)</td>
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<td>Recreation Facilities</td>
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<td>8,200</td>
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**Grand Total**

\[
\begin{align*}
\text{I. Construction} & = 2,142,400 \\
\text{II. Installation Service} & = 573,700 \\
\text{III. Other} & = 283,500 \\
\text{IV. Administration and R/W} & = 14,500 \\
\text{V. Total Cost} & = 3,013,800 \\
\text{VI. January} & = 2017 \\
\end{align*}
\]

\[\text{January 1965}\]

**Notes:**
- Data as of 1964.
- Total cost includes construction, installation, and other costs, and is based on 270 acres of required land and road relocation.
- Costs are rounded to the nearest thousand.
- Additional costs include:
  - Engineering and R/W:
    - Total Construction: $14,500
    - Installation Service: $2,300
    - Other: $3,300
  - Survey and other costs: $1,000
  - Total: $19,000

**Administrative Costs: $15,000**
# TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Ferron Watershed, Utah

(Dollars) 1/

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<tr>
<th>Purpose</th>
<th>Item</th>
<th>Prevention</th>
<th>Irrigation</th>
<th>Development</th>
<th>Improvement</th>
<th>Total</th>
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<td>$474,400</td>
<td>$256,800</td>
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<th>Item</th>
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<th>Other</th>
<th>P.L. 566</th>
<th>Other</th>
<th>TOTAL</th>
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</tr>
<tr>
<td></td>
<td>Reservoir Dam</td>
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1/ Price base 1964

January 1965
### TABLE 2B - ESTIMATED CONSTRUCTION COST

**RECREATION FACILITIES**

*Ferron Watershed, Utah*

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<tr>
<th>Item</th>
<th>Unit</th>
<th>No.</th>
<th>Construction Cost (Dollars)</th>
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<td>Roads - Access and Interior</td>
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<td>Camping Units</td>
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<td>8,900</td>
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<td>Group Picnic Shelter</td>
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<tr>
<td>Comfort Stations</td>
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<td>Barriers</td>
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<td>Water System (culinary and irrigation)</td>
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1/ Price base 1964

January 1965
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<th>ITEM</th>
<th>Water Supply</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
<th>Straight</th>
<th>Straight</th>
<th>Fall</th>
<th>Winter</th>
<th>Straight</th>
<th>Straight</th>
<th>Fall</th>
<th>Winter</th>
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<tr>
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<tr>
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<tr>
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Legend:
- Elevation on assumed datum.
- 2% flow over spillway by rating, except as shown.
- Maximum during passage of river graph.
<table>
<thead>
<tr>
<th>Evaluation Unit</th>
<th>Amortization of Installation Cost</th>
<th>Operation, Maintenance, and Replacement Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir and Dam</td>
<td>109,810</td>
<td>4,000</td>
<td>113,810</td>
</tr>
<tr>
<td>Basic Facilities</td>
<td>2,830</td>
<td>7,500</td>
<td>10,330</td>
</tr>
<tr>
<td>North Ditch Debris Basins Four Structures</td>
<td>7,175</td>
<td>475</td>
<td>7,650</td>
</tr>
<tr>
<td>South Ditch Debris Basins Four Structures</td>
<td>8,980</td>
<td>555</td>
<td>9,535</td>
</tr>
<tr>
<td>Irrigation System Improvements</td>
<td>12,685</td>
<td>10,050</td>
<td>22,735</td>
</tr>
<tr>
<td>Fish and Wildlife Water Resource Improvements</td>
<td>8,415</td>
<td>500</td>
<td>8,915</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td><strong>149,895</strong></td>
<td><strong>23,080</strong></td>
<td><strong>172,975</strong></td>
</tr>
</tbody>
</table>

1/ Installation cost based upon 1964 prices, amortized over 100 years at 3-1/8% interest. Replacement cost adjusted for long-term prices, reduced to present value, and amortized over 100 years at 3-1/8% interest. Operation and maintenance cost adjusted for long-term prices.
### TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Ferron Watershed, Utah

(Dollars) 1/

<table>
<thead>
<tr>
<th>Item</th>
<th>Without Project</th>
<th>With Project</th>
<th>Damage Reduction Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floodwater</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structures - Farm and Home</td>
<td>$1,410</td>
<td>$140</td>
<td>$1,270</td>
</tr>
<tr>
<td>Road and Bridge Damage</td>
<td>2,290</td>
<td>170</td>
<td>2,120</td>
</tr>
<tr>
<td>Feed, Materials, Cleanup</td>
<td>2,205</td>
<td>45</td>
<td>2,160</td>
</tr>
<tr>
<td>Canals - Irrigation Facilities</td>
<td>3,740</td>
<td>255</td>
<td>3,485</td>
</tr>
<tr>
<td>Crop and Pasture Damage</td>
<td>6,450</td>
<td>590</td>
<td>5,860</td>
</tr>
<tr>
<td>Land Damage</td>
<td>4,950</td>
<td>330</td>
<td>4,620</td>
</tr>
<tr>
<td>Interruption to Irrigation Services</td>
<td>1,660</td>
<td>60</td>
<td>1,600</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$22,705</td>
<td>$1,590</td>
<td>$21,115</td>
</tr>
<tr>
<td><strong>Sediment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structures - Farm and Home</td>
<td>$830</td>
<td>50</td>
<td>780</td>
</tr>
<tr>
<td>Road and Bridge Damage</td>
<td>1,290</td>
<td>135</td>
<td>1,155</td>
</tr>
<tr>
<td>Feed, Materials, Cleanup</td>
<td>5,640</td>
<td>45</td>
<td>5,595</td>
</tr>
<tr>
<td>Canals - Irrigation Facilities</td>
<td>5,250</td>
<td>455</td>
<td>4,795</td>
</tr>
<tr>
<td>Crop and Pasture Damage</td>
<td>6,605</td>
<td>310</td>
<td>6,295</td>
</tr>
<tr>
<td>Land Damage</td>
<td>5,560</td>
<td>1,030</td>
<td>4,530</td>
</tr>
<tr>
<td>Interruption to Irrigation Services</td>
<td>3,880</td>
<td>50</td>
<td>3,830</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$29,055</td>
<td>$2,075</td>
<td>$26,980</td>
</tr>
<tr>
<td><strong>Indirect Damage</strong></td>
<td>$4,330</td>
<td>$280</td>
<td>$4,050</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$56,090</td>
<td>$3,945</td>
<td>$52,145</td>
</tr>
</tbody>
</table>

---

1/ Long-term prices and costs.

January 1966
TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Ferron Watershed, Utah

<table>
<thead>
<tr>
<th>Evaluation Unit</th>
<th>AVERAGE ANNUAL BENEFITS</th>
<th>(Dollars) £/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir Dam and Basic Facilities</td>
<td>$19,060</td>
<td>$272,705</td>
</tr>
<tr>
<td>North Ditch Debris Basins</td>
<td>$10,120</td>
<td>$1,245</td>
</tr>
<tr>
<td>South Ditch Debris Basins</td>
<td>17,600</td>
<td>2,195</td>
</tr>
<tr>
<td>Irrigation System Improvements</td>
<td>54,675</td>
<td>8,255</td>
</tr>
<tr>
<td>Fish and Wildlife Water Resource Improvements</td>
<td>28,050</td>
<td>28,050</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>$46,780</td>
<td>$3,440</td>
</tr>
</tbody>
</table>

January 1965

1/ Installation cost based on 1964 prices and amortized over 100 years @ 3-1/8% interest. Replacement costs adjusted to long-term costs and prices, reduced to present values, and amortized over 100 years @ 3-1/8% interest. Operation and maintenance costs and benefits adjusted to long-term values.

2/ In addition to $5,365 downstream damage reduction from upper watershed land treatment.
### TABLE 7 - CONSTRUCTION UNITS

Ferron Watershed, Utah

(Dollars) 1/

<table>
<thead>
<tr>
<th>Measures in Construction Units</th>
<th>Annual Benefits</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Ditch Debris Basins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four Structures</td>
<td>$12,315</td>
<td>$7,650</td>
</tr>
<tr>
<td>South Ditch Debris Basins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four Structures</td>
<td>21,170</td>
<td>9,535</td>
</tr>
<tr>
<td>Mill Site Reservoir and Dam</td>
<td>359,820</td>
<td>113,810</td>
</tr>
<tr>
<td>Irrigation System Improvement</td>
<td>62,930</td>
<td>22,735</td>
</tr>
<tr>
<td>Recreation Facilities</td>
<td>22,520</td>
<td>10,330</td>
</tr>
<tr>
<td>Duck Fork and Willow Lakes Fisheries</td>
<td>28,050</td>
<td>8,915</td>
</tr>
</tbody>
</table>

January 1965

1/ Long-term prices and costs for costs and benefits accruing in the future. Installation costs based on current (1964) prices.
PROJECT FORMULATION

Each watershed problem was clearly defined through discussion with the local sponsors and through investigation. Investigations were planned jointly by the participating agencies and carried out to determine feasible solutions to the problems and the effects of the land treatment and structural program.

The sponsors and participating agencies determined areas requiring accelerated land treatment measures. The land administering agencies outlined land treatment measures on federal land. The Soil Conservation Service, sponsors, and ranchers outlined the treatment program for private and state land. The sponsors and participating agencies formulated the land treatment program from proposals developed. The Soil Conservation Service and sponsors jointly investigated alternative proposals for structural treatment and formulated the program.

Land Treatment Measures

Land treatment measures were outlined where investigations showed a need for treatment. The going program is based upon a projection of current application rates with adjustments to reflect trend. The accelerated program is based upon needed accelerations of the going program adjusted to the application rate expected with the project.

Structural Measures

Areas of the watershed experiencing significant flood and sediment damage were determined by a map reconnaissance of the watershed with the sponsors. Reconnaissance surveys were made in the field to determine the magnitude of the flood problems where local sponsors and historical information indicated flood damage. Damage surveys were made for each independent drainage where reconnaissance surveys indicated a need. The kinds, frequency, and extent of damage from historic floods were thus established. This flood damage information served as the basis for calculating present annual damage and made up the base from which projected future damage reductions could be estimated.

Alternative measures including the multipurpose Mill Site Reservoir were outlined where reconnaissance surveys indicated a need for flood prevention structures. Engineering, hydraulic, hydrologic, and economic investigations and data required to plan these measures and define their effect on flood problems were determined. Available information and data pertinent to the proposed structures were collected from the files of the Soil Conservation Service and other federal, state, and local agencies. Needed additional surveys and investigations were planned and carried out.

A water measurement program was carried out during the 1962 and 1963 irrigation seasons on representative sections of canals and laterals serving two or more irrigators. Measurements were made at selected locations with the Falling Head Seepage Meter during the 1963 irrigation season. This information was the basis for determining conveyance efficiency of the irrigation distribution system and selection of canal sections needing lining.
A sample farm inventory was conducted, including 14 irrigated farms—about 10% of the irrigated area. This data served as the basis for defining the principal irrigation problems and for evaluating present conditions.

Water requirements were determined by month and one-half month periods at the Ferron Creek stream gage for the irrigated area based upon soils, cropping pattern, on-farm irrigation efficiencies and conveyance efficiencies under present conditions and with each increment of the proposed program. This data provided information needed to evaluate water conservation benefits from system improvements and for reservoir operations studies.

The active capacity of the multipurpose Mill Site Reservoir was determined by reservoir operations studies utilizing 30 years of streamflow record for the Ferron drainage. The active capacity was designed to regulate the waters of Ferron Creek to coincide as nearly as practical with the requirements of the irrigated crops. Summer floods come at a time when water has been drawn down and reservoir capacity is available to accommodate the flood volume. Downstream channels will accommodate snowmelt runoff in excess of reservoir capacity after removal of sediment and debris, and reduction in duration and volume of flow through storage. The reservoir operation, based upon runoff forecasts, will enable control of snowmelt floods above the 20% chance frequency annual yield. The sediment capacity required to store sediment accumulation expected over the next 100 years was designed to eliminate downstream sediment damage. Fish and wildlife capacity in the Mill Site Reservoir was selected to provide a suitable trout fishery. The recreation facilities, kinds and amounts, are based upon expected use. The expected use was determined by analysis of use records and secondary data concerning similar areas in the state adjusted to local conditions.

Use records of small reservoirs in a setting similar to the Duck Fork and Willow Lakes reservoirs were collected and evaluated. These data were used to determine the need for water resource improvements in higher elevations of the watershed. The reservoirs—area, depth, and volume—were designed to carry fish through the winter and to provide a suitable resource.

Alternative Structural Measures Considered

Four dam sites in the vicinity of the Mill Site, off-channel storage sites, and a system of reservoirs in the upstream drainage pattern were considered as alternative proposals to the multipurpose Mill Site Reservoir and Dam. Preliminary designs and cost estimates were made for each of the structures considered feasible. The Mill Site was selected on the basis of relative cost and because for physical reasons it would most nearly meet project requirements.

Several alternate debris basin sites were considered on each drainage. The best site was selected based upon apparent differences in cost and optimum effectiveness.

Diversion dikes and overshots were considered as alternatives to the debris basins above the canals. These structures were eliminated from consideration because of high cost and because they would shift the flood problem to another location downstream.
Structural measures for improvement of irrigation systems have been selected over the years from possible alternatives and included in group irrigation plans. Each of the proposals included in the plans were examined from a benefit-cost standpoint and reviewed with the sponsors. The sponsors selected the structural measures for improvement to their system after reviewing the effects on the operation of their system, as well as the benefits and costs.

Numerous reservoir sites, small existing reservoirs, and natural lakes in the upper watershed were examined for water resource improvements for fish and wildlife. The Willow Lakes and Duck Fork sites were selected because they will best serve project objectives with the least cost.

SOILS

The soils inventory and land capability information for private and state land was obtained from existing Soil Conservation Service records. Soils were given Management Capability class ratings on the basis of slope, physical characteristics of the soil, and climatic conditions. Soils information for the federal land was obtained from the files of the land administering agencies.

RANGE

Federal Range Land

Investigations and studies on federal range land were conducted by the responsible land administering agency. Vegetative and soil resources, type and extent of erosion, areas producing floodwater and sediment (critical areas), range conditions and trends were established and range sites identified. Land treatment measures needed to stabilize critical areas, arrest land deterioration, and provide a balance between forage production and grazing were outlined. Technicians of the land administering agencies worked closely with the Soil Conservation Service in selecting feasible measures.

Private and State Range Land

Private and state range areas were classified into range sites. These sites were further classified as to their present and potential condition, plant composition and density, and forage production. In general, the private and state range land soils are derived from shales, have a low water intake rate, are subject to accelerated erosion and support a sparse, semi-desert type vegetation because of soil and moisture deficiencies. These range lands are interspersed with the Bureau of Land Management lands and among the irrigated lands, and are grazed in conjunction with these areas. Feasible treatment measures are incident to management and include short sections of fence, a few stockwater ponds, proper use, and distribution of livestock.
GEOLOGY

Mill Site Storage Reservoir

Foundation Investigations

Investigations consisted of core drilling, permeability testing, seismograph surveying, and test pit excavations. Soil samples were collected and classified by laboratory analysis and visual inspection. The soils are described as sandy silts, silty sands and gravels, well graded gravels, and sandy silty clays of low plasticity. Laboratory tests and analyses consisted of triaxial shear, permeability, dissolvable solids, atterberg limits, and grain size distribution.

The soil materials in the foundation and in the borrow areas consist of recent floodplain deposits, colluvial and residual deposits, and older terrace deposits. The floodplain and terrace deposits are highly stratified, moderate to highly permeable, slightly saline, loose and dry. The colluvial and residual deposits are moderately to slowly permeable, slightly compact, moderately saline, and moist to dry. The soil materials were all derived from sedimentary rocks--mainly sandstones, limestones, and shales.

The bedrock in the abutments consists of irregular-bedded, massive to thin-bedded, calcareous, silty sandstones. These rocks contain some soluble salts and are slightly weathered and fractured at the surface.

The proposed structure is in site group I and will have capacity to store the expected 100-year sediment yield. The dam will be a zoned fill structure with an upstream blanket and a partial cutoff core to prevent possible dam failure and excessive water losses. The spillway will be excavated in sandstone rock and will have a concrete control section. The outlet end of the spillway channel will be protected with concrete to prevent erosion and undercutting at the overpour.

Investigations and studies of site conditions indicate that the dam can be constructed as planned. However, before final designs are completed, additional subsurface investigations will be made to more accurately determine the character and extent of the materials in the foundation, abutments and emergency spillway. The proposed borrow areas will be outlined in detail and additional samples will be obtained for testing.

Fish and Wildlife Structures

Foundation Investigations

Investigations consisted of core drilling, permeability testing, and test pit excavations at the Duck Fork Reservoir. Surficial examinations and auger borings were made at Willow Lakes. Soil samples were collected and the materials were classified by laboratory analysis and visual inspection. The soils are described as silty gravels, clayey sands and gravels, poorly graded gravels and sands, and silty clays of low to high plasticity. Some peat materials were found at the Duck Fork Reservoir in the dam foundation below the downstream toe of the dam. However, these materials are not extensive and they present no
particular problem. Laboratory tests and analyses of samples obtained at the
Duck Fork dam included triaxial shear, compaction, permeability, consolidation,
dissolvable solids, atterberg limits, and grain size distribution.

The soil materials in the area were derived from sedimentary rocks—mainly
shales, sandstones, and limestones. Soil materials at the Duck Fork Reservoir
consist of glacial deposits and colluvium. Soil materials at the Willow Lakes
consist of landslide deposits and colluvium.

The Duck Fork Reservoir dam is in site group I. The dam is a homogeneous fill
with 3:1 upstream and 2:1 downstream slopes. The reservoir was not used for
irrigation storage in 1964 because of erosion in the earth spillway, which
occurred in 1963. Repairs planned for this structure consist of an upstream
cutoff trench, a foundation drain, additional riprap protection on the face of
the dam, and relocation of the earth spillway outlet channel. A riser will be
installed on the existing outlet pipe and the water level will be stabilized 8
feet below the present earth spillway crest.

The Willow Lakes Reservoir dam is in site group II. The existing dam is a
homogeneous fill with 3:1 upstream and 2:1 downstream slopes. Renovation and
enlargement of this structure will consist of raising the dam 5 feet and
installing a cutoff trench at the upstream toe of the dam. A riser will be
installed and a permanent pool will be established at an elevation 5 feet above
the present high water level.

Studies and investigations of site conditions indicate that these dams can be
constructed as planned. However, before final designs are completed, additional
investigations will be made to accurately determine the subsurface conditions
at the Willow Lakes and the exact location of the emergency spillway will be
determined. The proposed borrow areas will be outlined in detail and samples
will be obtained for laboratory analysis and testing.

Debris Basins

Foundation Investigations

Investigations consisted of auger borings and surficial examinations. Soil
samples were collected and classified by visual inspection and limited testing.
The soils are described as silty sands and gravels, well graded and poorly
graded gravels, sandy silts, and silty clays of low plasticity.

The soil materials in the foundation and borrow areas consist of floodplain and
alluvial fan deposits, colluvial and residual deposits, and terrace deposits.
The floodplain, alluvial fan and terrace deposits are highly stratified, moder-
ate to highly permeable, slightly saline, loose and dry. The colluvial and
residual deposits are moderate to slowly permeable, slightly compact, moder-
ately saline, and dry.

Most of the sites have bedrock abutments consisting of sandstone, siltstone,
and mudstone. All of these rocks contain some soluble salts.
Structure data for the proposed flood control sites follows:

<table>
<thead>
<tr>
<th>Structure Site</th>
<th>Site Group</th>
<th>Structure Class</th>
<th>Height of Fill</th>
<th>Type of Fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Straight Hollow - S.</td>
<td>II</td>
<td>a</td>
<td>23</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>2. Straight Hollow - N.</td>
<td>II</td>
<td>a</td>
<td>23</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>3. Herring Flat-Zwahlen Wash</td>
<td>II</td>
<td>a</td>
<td>17</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>4. Diversion Hollow</td>
<td>II</td>
<td>a</td>
<td>11</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>5. Indian Hollow</td>
<td>I</td>
<td>b</td>
<td>22</td>
<td>Zoned</td>
</tr>
<tr>
<td>6. Eli Hollow</td>
<td>II</td>
<td>a</td>
<td>18</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>7. Jewkes Hollow</td>
<td>II</td>
<td>a</td>
<td>23</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>8. Dutch Flats</td>
<td>II</td>
<td>a</td>
<td>18</td>
<td>Homogeneous</td>
</tr>
</tbody>
</table>

All of the proposed dams except Diversion Hollow are designed with a cutoff trench to reduce the danger of piping. The Diversion Hollow dam will have an upstream blanket to prevent piping and possible failure of the dam. The emergency spillways will be excavated in alluvium or rather soft bedrock which will be quite easily eroded. The structures will have sufficient capacity to store the expected 100-year sediment yield.

Studies already made indicate that these dams can be constructed as planned. However, before final designs are completed, subsurface investigations will be made at each site to accurately determine the character of the materials in the foundation, abutments, and emergency spillways. The proposed borrow areas will be outlined in detail and samples will be obtained for testing.

SEDIMENTATION

Sediment investigations have been made in the general area by other government agencies. The U. S. Geological Survey has published sedimentation data for the small reservoirs located in the San Rafael Swell and the U. S. Bureau of Reclamation has made studies on Cottonwood Creek, an adjacent drainage to the north. Sediment investigations and analyses made to develop this plan consisted of:

1. Sampling suspended load material in Ferron Creek during the 1963 water year.

2. Measuring pond, reservoir, and fan deposits in the Ferron Watershed.

3. Measuring gully voids in the upper watershed area.

4. Transposing sediment rates from adjacent, similar watersheds.
5. Studying plant cover-condition and soils inventory data.

6. Mapping sediment and erosion damages in the lower watershed area.

Sediment concentration (by weight) varied from 0.1 to 40.0% in Ferron Creek during the summer cloudburst storm period—July and August. The sediment concentration during the snowmelt runoff period ranged from 0.1 to 2.3%. Sediment rates could not be predicted from the suspended load measurements because of the short period of record.

A reconnaissance survey was made of the Duck Fork Reservoir to determine sediment rates in the upper watershed area. Alluvial fan deposits and deposits in an old stock pond were measured in the lower watershed to determine sediment rates for areas of Mancos shale. These measurements plus measurements of gully voids in the intermediate area of the watershed provided most of the data used to calculate sediment rates at the proposed Mill Site Reservoir. Sediment rates for the debris basin sites were computed by supplementing these data with information available from other watersheds having similar soils, geology, and cover.

Reductions in sediment rates are based on studied watersheds and estimated future watershed conditions as indicated by the plant cover-condition and soils inventory. A reduction of 20% was assumed after a period of 20 years.

Some cropland and pasture land has been destroyed by gully voiding. The cropland soils are quite unstable and are susceptible to piping. Headcutting and bankcutting are active in most of the tributaries which drain the agricultural lands. Based on samples of gully voiding mapped within the cropland and pasture land area, land losses are as follows:

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Land Loss During Last 50 Years (Acres)</th>
<th>Estimated Land Loss During Next 50 Years (Acres)</th>
<th>Reduction Due to Watershed Treatment (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland</td>
<td>242</td>
<td>141</td>
<td>42</td>
</tr>
<tr>
<td>Pasture Land</td>
<td>79</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>321</td>
<td>191</td>
<td></td>
</tr>
</tbody>
</table>

Sediments damage lands, crops, irrigation systems, roads, fences, and many other improvements and watershed resources. Deposition on the irrigated land causes surface irregularity and increases the need for leveling. Some irrigated lands are also damaged by swampming because sediment deposits restrict natural drainage channels and outlets.

The volume of sediment depositing on irrigated lands and in irrigation systems was obtained by estimating a percentage of the total sediment yield. In order to evaluate land damage caused by surface irregularity, an estimate was made of the amount of sediment which would need to be moved during land leveling operations.
The sediment volume associated with the various flood events was obtained by plotting a sediment-frequency curve parallel to the peak flow-frequency curve. The position of the sediment-frequency curve was adjusted so that the total volume delivered from all flood events equaled the 50-year sediment yield determined from measurements. The sediment volume in each storm frequency was added to the floodwater volume to estimate inundation damages and damage to irrigation facilities.

Erosion is severe on the lower portions of the watershed because of steep topography, bare to sparsely vegetated slopes, and rather unstable soils. The Mancos shale formation crops out on about 20 percent of the lower foothill area. This sandy, silty material produces soils which are rather unfertile because of their high salt content and low infiltration capacity. Sheet and gully erosion in the lower portion of the watershed produces about 50 percent of the total sediment yield. The sparse plant cover in the foothill area consists mainly of pinon-juniper, brush and annual weeds.

Erosion is moderate to severe at the intermediate elevations because of variable soil conditions and topography. High erosion rates exist in some areas because of bare shaly exposures; steep slopes; loose, moderately deep soils; and sparse vegetative cover. Other areas have moderate erosion rates because of resistant sandstone outcrops, gentle slopes, shallow soils, and fair vegetative cover. The main plant cover types are pinon-juniper, brush, and grass.

The upper watershed area has low to moderate erosion rates because of fair vegetative cover, cohesive soils, and moderate slopes. Many small, closed basins exist because of extensive areas of glacial and landslide topography. The principal plant cover types are pine, spruce, fir, quaking aspen, grass, and brush.

Ferron Creek and Rock Canyon are the only drainages which yield significant quantities of sediment during the snowmelt runoff period. Part of the sediment deposited in Ferron Creek channel by the summer storms is picked up by the snowmelt runoff and transported to the damage area. Most of the small drainages flow only during the summer cloudburst type storms.
Sediment data for the proposed structures follows:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir</td>
<td>157.20</td>
<td>7,237</td>
<td>20</td>
<td>95</td>
<td>5,800</td>
</tr>
<tr>
<td>Straight Hollow South</td>
<td>2.10</td>
<td>161</td>
<td>20</td>
<td>85</td>
<td>109</td>
</tr>
<tr>
<td>Straight Hollow North</td>
<td>0.44</td>
<td>81</td>
<td>20</td>
<td>90</td>
<td>58</td>
</tr>
<tr>
<td>Herring Flat-Zwahlen Wash</td>
<td>5.20</td>
<td>355</td>
<td>30</td>
<td>90</td>
<td>223</td>
</tr>
<tr>
<td>Diversion Hollow</td>
<td>1.29</td>
<td>130</td>
<td>30</td>
<td>85</td>
<td>78</td>
</tr>
<tr>
<td>Indian Hollow</td>
<td>2.18</td>
<td>165</td>
<td>30</td>
<td>85</td>
<td>98</td>
</tr>
<tr>
<td>Eli Hollow</td>
<td>1.38</td>
<td>134</td>
<td>20</td>
<td>95</td>
<td>102</td>
</tr>
<tr>
<td>Jewkes Hollow</td>
<td>1.19</td>
<td>126</td>
<td>20</td>
<td>90</td>
<td>91</td>
</tr>
<tr>
<td>Dutch Flats</td>
<td>1.04</td>
<td>120</td>
<td>20</td>
<td>85</td>
<td>82</td>
</tr>
</tbody>
</table>

**ENGINEERING**

**Multipurpose Structure**

Mill Site Reservoir and Dam

Surveys and investigations of record for this site date back to 1933. Several alternative dam sites were considered, all within the vicinity of the dam site selected. Existing information and data concerning previous investigations, surveys, and designs were gathered and reviewed.

A detailed topographic map covering most of the reservoir area and fifteen minute U.S.G.S. topographic maps of the vicinity were the basis for the storage curve. Detailed topographic maps were made covering the alternative embankment sites and spillway locations. Foundation and borrow investigations detailed under "Geology" were carried out to establish a base for design of the structure. Preliminary designs and cost estimates were completed for each alternative embankment site. The Mill Dam Site was selected because it is best from the physical standpoint and can likely be constructed at the least cost.
Designs for this earth fill structure were developed using a detailed topographic map of the site, results of soil materials tests, and standard design procedure outlined in the U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook. A description of the structure may be found under "Works of Improvement to be Installed." Preliminary plans are shown on Figures 3 and 4. Capacity, size, etc., are shown on Table 3.

The emergency spillway cut in rock, bottom width 100 feet, 1:1 slopes, and length of 1,000 feet, is designed to pass the design hydrographs for the site as detailed under "Hydrology." It will remain stable under prolonged snowmelt runoff conditions. The alluvium which fills the valley to be used for the exit channel will be excavated to bedrock for fill. The lateral stream channel is already on bedrock for a distance above its confluence with Ferron Creek and prominent rock ledges are uncovered at intervals up the valley. Available fill material will also be excavated from the area of the plunge pool. Large boulders on the surface and throughout the alluvial fill will serve to line the plunge pool.

Preliminary investigations and soil materials testing indicate that this dam can be constructed without difficulty from foundation or construction materials standpoint. Fill materials will need to be selected carefully and is available in the vicinity of the site. Intensive foundation, borrow investigations, and testing should be completed and a complete topographic map made before construction designs are initiated.

Recreation facilities were planned with the assistance of recreation specialists after a complete reconnaissance of the site. A schematic layout, including number and kinds of facilities, was made on photographic enlargements of the site. Standard designs and costs were utilized where applicable. The preliminary plan shown on Figure 5 provides for the recreation facilities considered necessary to meet current demands with provisions for expansion. The local sponsors have reviewed the plans on the site, together with cost, cost sharing, operation, maintenance, and replacement responsibilities.

Before construction plans are developed for the recreation facilities, a detailed topographic map showing existing plants and physical features will be needed.

Single Purpose Structures

Debris Basins

Alternative sites for debris basins were selected after reconnaissance of the watershed. Preliminary designs and cost estimates were based upon fifteen minute U.S.G.S. topographic maps, level observations on the site, and detailed surveys available in local files. Selection of alternatives included in the plan were based upon preliminary costs and relative effectiveness of the structures in solving watershed problems.

Topographic surveys were either available or made for six of the alternative sites selected. Profile surveys and level observations were made for the other sites where uniform gentle topography prevails. Work plan designs and costs were based upon these surveys.
Principal features of the debris basins are illustrated on the typical plan, Figure 2. Descriptions may be found under "Works of Improvement to be Installed." Size, capacity, etc., are outlined in Table 3.

Generally, each debris basin will consist of a low earth embankment, principal spillway, and earth emergency spillway. Each earth fill will be provided with a cutoff according to the requirements of the site. It will be necessary to blanket the front face of the Diversion Hollow embankment because of the scarcity of fine fill material and the configuration of the site. Each principal spillway will consist of a restricted flow riser and pipe outlet conduit. The outflow of each principal spillway will be limited to the capacity of downstream channels.

Temporary storage is provided in each debris basin to accommodate the 100-year frequency flood runoff. The emergency spillways are designed in accordance with Engineering Memo SCS-31 and Technical Release No. 2, Supplement A, "Earth Spillways." The emergency spillway hydrographs for the seven class "a" structures will pass through the principal spillways with water surface elevations below the crests of the emergency spillways. The emergency spillway for the class "b" structure will accommodate the emergency spillway hydrograph at a safe velocity for the site. Each spillway is proportioned to pass the freeboard hydrograph with water surface elevation at or below the settled height of the dam.

Investigations indicate no particular difficulty in final design or construction. Salt content of the fill material should be checked carefully and if found detrimental to concrete, either specially designed concrete or corrugated metal should be used for the principal spillways.

Water Resource Improvements for Fish and Wildlife

Suitable alternative sites included existing irrigation reservoirs, pot holes in landslide topography, and virgin sites on the drainages. Available topographic maps were collected and needed additional surveys and investigations were planned and carried out. Preliminary designs and estimated costs were developed for each site. The best sites were selected based upon a comparison of construction cost and relative value of each site as a fishery. Preliminary plans for these structures are shown on Figures 7 and 8.

Each structure is designed with a principal spillway, crest elevation at permanent pool level, and an emergency spillway. Each principal spillway consists of an outlet pipe conduit with pipe riser or equal. The outlet pipe is provided with a stilling basin. The riser will be equipped with antivortex device or fish screen, with appurtenant drainage gate and up-the-slope control. The emergency and freeboard hydrographs, class "b" criteria, and the 100-year frequency snowmelt inflow will pass through surcharge storage and principal spillway with water surface below the crest of the emergency spillway. The emergency spillways were proportioned in accordance with criteria outlined in Engineering Memorandum SCS-31 and Technical Release No. 2, Supplement A, "Earth Spillways."
To provide the required permanent pool at the Willow Lakes, it will be necessary to raise the existing fill by 5.0 feet, install a cutoff, a principal spillway, an emergency spillway, and riprap the front slope of the dam. A channel spillway located near the south end of the present dam should be considered in the design stage as an alternate to the location shown on the preliminary plan.

The existing Ferron-Mayfield road is routed over a short section of fill by the northern edge of the Willow Lakes. The present fill and road will be raised by approximately five feet, lengthening this section of road over fill to about 1,200 feet. This will provide for replacement road about equal to the existing facility.

Three hundred feet of log and block fence must be moved and reconstructed near the southeast end of the proposed fill.

The requirements for the permanent pool at the Duck Fork site will enable the crest of the principal spillway to be set some 8 feet below the crest of the existing earth spillway. This principal spillway will consist of a 48-inch pipe or equal affixed to a 24-inch existing outlet conduit. Recent erosion in the earth spillway has uncovered lenticular lake deposits near the down-stream toe of the dam which may affect the stability of the fill. The maximum height of the dam is 40 feet. To render the dam stable, a rock toe drain with a gravity drain and a cutoff will be needed. The riprap on the front slope is thin in spots and will need reinforcement. The existing fill is otherwise adequate.

The existing emergency earth spillway will need extensive reorganization. The crest will be approximately at the same elevation and location. A straight exit channel will be excavated and the old exit channel filled. The emergency spillway will be protected with grouted rock and riprap as required.

Irrigation System Improvements

Conservation plans for the irrigation company and informal groups and engineering plans for specific structures have been developed with the irrigation companies and individuals cooperating with the San Rafael Soil Conservation District. Additional field surveys were made and designs and cost estimates adjusted to reflect current construction technique, material, procedure, and cost. Designs and costs were also made for alternative proposals.

Improvements included in the work plan were selected after a careful study of water conservation benefits and reductions in operation and maintenance costs. Designs for measures included in the plan are based upon standard procedures of the Soil Conservation Service used in the local Soil Conservation District program.

Land Treatment Measures

The going program of the San Rafael Soil Conservation District was analyzed to determine the accelerated land treatment program needed. Engineering phases included the determination of size, extent, and unit cost of treatment measures.
Costs

Preliminary designs and cost estimates were prepared for alternative structural measures. The most economical designs and measures were selected which most nearly meet the requirements of the project. Quantities of construction material were computed for the structures selected.

Estimated costs were based upon construction quantities and unit costs. Unit costs were taken from bid item schedules for work recently completed under contract in the vicinity modified by differences in site conditions. These differences include location, topography, geologic characteristics, size of construction bid items, and availability and accessibility of materials.

Designs and cost estimates for the water resource improvements for fish and wildlife were prepared by the Soil Conservation Service and the Utah State Department of Fish and Game. The Forest Service has reviewed the plans and site locations for the fisheries on the National Forest and has concurred in the preliminary designs.

Estimated costs--construction and other--to be provided by the Utah State Department of Fish and Game for fish and wildlife are detailed below.

1. Construction Cost

   Willow Lakes                                $ 34,000
   Duck Fork                                   27,600
   Mill Site Reservoir (Fish and Wildlife pool) 140,800

   Subtotal                                    $202,400

2. Water and Storage Rights for Duck Fork, Ferron, and Willow Lakes $100,000

3. Contract Administration Cost $ 2,000

4. Land, Easement, and Rights-of-way Cost

   Obtain Special-Use Permits $ 400
   Replace Log and Block Fence at Willow Lakes          300

   Subtotal Other                                   $102,700

   Total Project Cost                               $305,100

5. Non-Project Cost (at Ferron Reservoir)         9,500

GRAND TOTAL, ESTIMATED FISH AND GAME COST        $314,600
Cost Allocation and Cost Sharing

Installation costs for structural measures included in this plan are allocated to the purpose(s) served by each measure. Cost allocated to each purpose is shared between P.L. 566 and other funds in accordance with Public Law 566 as amended and the Policy Statement of the Secretary of Agriculture.

Mill Site Reservoir and Dam:

This structure serves the purposes of flood prevention, irrigation, and fish and wildlife development. Installation costs for the reservoir and dam are allocated to the purposes served by the use of facilities method. Land, easements, and rights-of-way costs eligible for cost sharing are allocated to fish and wildlife development. Remaining land, easements, and rights-of-way cost are allocated between flood prevention and irrigation as determined by the use of facilities method.

1. Allocation of Cost

   A. Determination of land, easements, and rights-of-way cost eligible for cost sharing

The total land required for the reservoir and recreation facilities is 638 acres--570 acres for the reservoir and dam, 18 acres for relocation of the road, and 50 acres for the recreation facilities. This acreage includes 240 acres of federal land administered by the Bureau of Land Management, 28 acres of non-federal public land, and 370 acres of private land.

The non-federal public land, to be donated, and the federal land can be acquired with only legal and survey costs. To acquire the 370 acres of private land required, one farm ownership consisting of 620 acres must be purchased. The irrigated land and farmstead which make up the principal value of the ownership are included in the 370 acres. The remaining 250 acres are made up of steep escarpments and side hills and have little value.

Three miles of road relocation are required for the reservoir and dam.

(1) Estimated Costs

<table>
<thead>
<tr>
<th>Eligible for Cost Sharing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost for 370 acres of private land</td>
<td>$25,000</td>
</tr>
<tr>
<td>Construction cost - 3.0 miles of road relocation</td>
<td>$43,000</td>
</tr>
</tbody>
</table>

- 72 -
Not Eligible for Cost Sharing

Value lands to be donated $ 9,000
Cost 250 acres private land 1,000
Legal, survey and other costs (includes all land rights costs for recreation facilities) 1,000
Total Estimated Cost $54,000

(2) Cost Eligible for Cost Sharing

Total area required for the dam and reservoir 570 acres
Area of fish and wildlife pool 236 acres
Area of irrigation pool 420 acres
Area for purposes other than fish and wildlife (420 - 236) 184 acres

\[
\frac{570 - 184}{570} = 67.7\% \text{ of required land and road relocation cost eligible for cost sharing.}
\]

\[
67.7\% \times 43,000 = \$29,000 \text{ land, easements, and rights-of-way cost eligible for 50-50 cost sharing.}
\]

\[
54,000 - 29,000 = \$25,000 \text{ ineligible for cost sharing.}
\]

B. Basis for Allocation of Construction Cost for Reservoir Dam

Capacity

Sediment Capacity 5,800 A.F.
Fishery 2,000 A.F.
Irrigation 10,200 A.F.
Total 18,000 A.F.
Initially, the permanent pool will be set at 2,500 A.F. which will provide the desired fishery volume plus the expected sediment deposition in that pool during the first 10 years of operation. Thereafter, the level of the irrigation outlet will be raised every 10 years to provide the sediment capacity to be required during the following 10 years, approximately 470 acre feet. The remaining capacity of the reservoir will be used jointly for sediment storage and irrigation storage regulation. The basis for allocation of costs follows:

<table>
<thead>
<tr>
<th>Storage</th>
<th>Capacity</th>
<th>Flood Prevention</th>
<th>Wildlife Development</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Fishery</td>
<td>2,000</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Sediment</td>
<td>500</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Sediment and Irrigation</td>
<td>5,300</td>
<td>2,650</td>
<td></td>
<td>2,650</td>
</tr>
<tr>
<td>For Irrigation</td>
<td>10,200</td>
<td></td>
<td></td>
<td>10,200</td>
</tr>
<tr>
<td>Total Storage</td>
<td>18,000</td>
<td>3,150</td>
<td>2,000</td>
<td>12,850</td>
</tr>
<tr>
<td>Percentage</td>
<td>100%</td>
<td>17.5%</td>
<td>11.1%</td>
<td>71.4%</td>
</tr>
</tbody>
</table>

C. Cost Allocation, All Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Total Cost</th>
<th>Flood Prevention</th>
<th>Wildlife Development</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint Cost</td>
<td>$2,536,000</td>
<td>$443,800</td>
<td>$281,600</td>
<td>$1,810,600</td>
</tr>
<tr>
<td>Specific Cost (Irrigation Outlet)</td>
<td>64,000</td>
<td></td>
<td></td>
<td>64,000</td>
</tr>
<tr>
<td>Installation Services</td>
<td>650,000</td>
<td>113,800</td>
<td>72,100</td>
<td>464,100</td>
</tr>
<tr>
<td>Lands, Easements, and R/W</td>
<td>54,000</td>
<td>4,900</td>
<td>29,000</td>
<td>20,100</td>
</tr>
<tr>
<td>Contract Administration</td>
<td>48,000</td>
<td>8,400</td>
<td>5,300</td>
<td>34,300</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$3,352,000</td>
<td>$570,900</td>
<td>$388,000</td>
<td>$2,393,100</td>
</tr>
</tbody>
</table>

1/ Land, easements, and rights-of-way cost eligible for cost sharing.
2/ Land, easements, and rights-of-way cost ineligible for cost sharing assigned to flood prevention and irrigation on basis of relative capacities.
3/ Construction cost for dry man well access shaft, control gates, and associated appurtenances.
2. Cost Sharing Summary

<table>
<thead>
<tr>
<th></th>
<th>P.L. 566</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Joint) (Specific-Irrigation Outlet) 3/</td>
<td>$1,489,900</td>
<td>$1,046,100</td>
<td>$2,536,000</td>
</tr>
<tr>
<td>Installation Services</td>
<td>32,000</td>
<td>32,000</td>
<td>64,000</td>
</tr>
<tr>
<td>Lands, Easements, and R/W</td>
<td>650,000</td>
<td></td>
<td>650,000</td>
</tr>
<tr>
<td>Contract Administration</td>
<td>14,500</td>
<td>39,500</td>
<td>54,000</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$2,186,400</td>
<td>$1,165,600</td>
<td>$3,352,000</td>
</tr>
</tbody>
</table>

3/ Construction cost for dry man well access shaft, control gate, and associated appurtenances.

Recreation Facilities:

These facilities will be installed adjacent to the Mill Site Reservoir. The installation costs are allocated to fish and wildlife development.

Cost Sharing:

<table>
<thead>
<tr>
<th></th>
<th>P.L. 566</th>
<th>Local</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architectural and Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Services 3/</td>
<td>8,300</td>
<td>-8,300</td>
<td>16,600</td>
</tr>
<tr>
<td>Contract Administration</td>
<td></td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$41,700</td>
<td>$44,700</td>
<td>$86,400</td>
</tr>
</tbody>
</table>

3/ The local sponsoring organization doesn’t have an engineering or architectural staff.

Note: The facilities are to be installed on federal land administered by the Bureau of Land Management. Legal, survey, and other costs associated with acquiring rights are included in cost for the Mill Site Reservoir.
**Debris Basins:**

Installation costs for these eight single purpose structures are allocated to flood prevention. Cost sharing follows:

<table>
<thead>
<tr>
<th></th>
<th>P.L. 566</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td>$382,700</td>
<td></td>
<td>$382,700</td>
</tr>
<tr>
<td>Installation Services</td>
<td>95,900</td>
<td></td>
<td>95,900</td>
</tr>
<tr>
<td>Other Costs</td>
<td></td>
<td>$14,500</td>
<td>14,500</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$478,600</td>
<td>$14,500</td>
<td>$493,100</td>
</tr>
</tbody>
</table>

**System Improvements:**

Installation costs for these single purpose irrigation structures are allocated to irrigation. Cost sharing follows:

<table>
<thead>
<tr>
<th></th>
<th>P.L. 566</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td>$143,000</td>
<td>$143,000</td>
<td>$286,000</td>
</tr>
<tr>
<td>Installation Services</td>
<td>71,600</td>
<td></td>
<td>71,600</td>
</tr>
<tr>
<td>Other Costs</td>
<td></td>
<td>29,600</td>
<td>29,600</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$214,600</td>
<td>$172,600</td>
<td>$387,200</td>
</tr>
</tbody>
</table>

**Fish and Wildlife Water Resource Improvements:**

Installation costs for the Willow Lakes and Duck Fork fisheries are allocated to fish and wildlife. Cost sharing follows:

<table>
<thead>
<tr>
<th></th>
<th>P.L. 566</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Cost</td>
<td>$61,600</td>
<td>$61,600</td>
<td>$123,200</td>
</tr>
<tr>
<td>Installation Services</td>
<td>30,900</td>
<td></td>
<td>30,900</td>
</tr>
<tr>
<td>Water Rights</td>
<td></td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Other Costs</td>
<td></td>
<td>2,700</td>
<td>2,700</td>
</tr>
<tr>
<td>Total Installation Cost</td>
<td>$92,500</td>
<td>$164,300</td>
<td>$256,800</td>
</tr>
</tbody>
</table>
HYDROLOGY

Hydrologic studies were primarily concerned with (1) determining the present and future peak flow-runoff series for use in developing area-inundated frequency relationships, (2) evaluating the effects of the land treatment measures, (3) computing volume-duration-frequency relationships for design of debris basins and the Mill Site Reservoir, (4) computing emergency spillway design hydrographs and flood routings for structural design, and (5) making a frequency analysis of the yield of Ferron Creek.

Other investigations concerning hydrology are detailed under the section entitled "Irrigation Investigations."

Basic Data Available

Climatological Data

The one U. S. Weather Bureau Station (elevation 5,925) in the watershed is located 0.5 mile south of the Ferron Post Office. This station has 19 years of temperature and precipitation records.

The rain gage is a standard non-recording type and temperature is read from a maximum-minimum thermometer. In addition, a class A evaporation pan was maintained from March 1948 till December 1950.

The three snow courses in the watershed have records dating back to 1955 and 1956. These courses are located on the western edge of the watershed at elevations of 9,000 to 9,800 feet. The course at Buck Flat has storage-gage precipitation data available.

Rainfall intensity frequency values, available from Weather Bureau Technical Paper No. 40 (May 1961), were increased to the amounts shown below to better reflect records of past storm events.

<table>
<thead>
<tr>
<th>Frequency of Occurrence - Yrs.</th>
<th>100</th>
<th>50</th>
<th>25</th>
<th>10</th>
<th>5</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Rainfall (short-duration) - In.</td>
<td>1.9</td>
<td>1.7</td>
<td>1.5</td>
<td>1.2</td>
<td>1.0</td>
<td>.71</td>
</tr>
</tbody>
</table>

Streamflow Data

There are several U. S. Geological Survey streamgaging stations on the San Rafael River and its tributaries. These discharge records, the earliest of which began in 1909, were analyzed as the basis for project surface water supply.

Local Flood Reports

Newspaper accounts and pictures, Soil Conservation Service flood reports, reports of the U. S. Forest Service, Weather Bureau, and Geological Survey concerning severe local storms and damaging flood runoff were available and used. Field reconnaissance surveys were made to outline the problem areas.
Hydrologic Condition Data

The U. S. Forest Service made detailed hydrologic condition surveys and analyses on the National Forest land. U. S. Bureau of Land Management Forage Inventory Field Writeup Sheets covering the principal areas of low elevation rangeland were available and used. Range site and condition surveys were made by the Soil Conservation Service on representative areas of the watershed as a supplement to this data.

Investigations

Watershed Hydrologic Conditions

Hydrologic conditions on National Forest land were determined from detailed field surveys and analyses by the U. S. Forest Service. Field reconnaissance and correlation with records of the Bureau of Land Management provided the basis for determining the hydrologic condition of rangeland outside the National Forest boundaries. Cooperative field studies between the Soil Conservation Service, Bureau of Land Management, U. S. Forest Service, and Utah State Department of Fish and Game were made to determine range condition and land treatment needs.

Field surveys of existing channels provided a basis for estimating time of concentration for use in computing peak rates of runoff.

Runoff curve numbers were assigned to each soil-cover complex, based on its land use and treatment, hydrologic condition, and soils data. An average antecedent moisture condition (II) was used in all runoff determinations.

Estimation of Volumes and Peak Rates of Runoff

A synthetic evaluation series of volumes and peak rates of runoff was developed for various frequencies for each drainage area where land treatment or structural measures were proposed. Runoff volumes were computed for modified rainfall amounts obtained from U. S. Weather Bureau T. P. 40 (see rainfall tabulation under "Climatological Data") and runoff curve numbers developed for the area. The procedure followed is described in Parts 3.7, 3.8, 3.9, 3.10, 3.15, and 3.16 of Supplement A, Section 4, Soil Conservation Service, National Engineering Handbook.

Peak rates of runoff were computed using procedures established from data obtained from Agricultural Research Service experimental watersheds located in the southwestern United States and methods described in Part 3.16 of Supplement A, Section 4, Soil Conservation Service, National Engineering Handbook.

Evaluation of Land Treatment

The reduction between the estimated runoff under present conditions and future conditions with proper range use was the basis for evaluation of the management practices. The reduction between the estimated runoff under future conditions with proper range use and with proper use plus mechanical treatment measures was the basis for evaluation of the mechanical treatment measures.
Hydrologic Design

Floodwater storage capacity provided in each debris basin is in accordance with Engineering Memorandum SCS-27 and Technical Release No. 10.

Design hydrographs for all debris basins and reservoirs were developed in accordance with Soil Conservation Service standards set forth in Engineering Memorandum SCS-27 and in Part 3.21 of Supplement A, Section 4, Soil Conservation Service, National Engineering Handbook.

The Mill Site Reservoir is a class "c" structure. Seven of the debris basins are class "a" structures and one is class "b". The water resource improvements for fish and wildlife are class "a" structures.

To insure infrequent operation of emergency spillways, floodwater storage capacity is provided in each debris basin to contain the 100-year frequency midterm storm runoff volume as outlined in Technical Release No. 10.

Rainfall depths used to develop the Emergency and Freeboard hydrographs are from maps accompanying Advisory Notice W-2018.

Routing of the Emergency and Freeboard hydrographs, by the storage indication method, beginning at the crest of the emergency spillway, is the basis for design proportions of the emergency spillway and selection of the settled height of dam for the Mill Site Reservoir Dam. Selection of emergency spillway dimensions and the settled height of dam for each debris basin was based upon Engineering Memorandum SCS-31. The spillway design hydrographs for each debris basin were routed by the improved coefficient method with routing beginning at the top of the level sediment pool.

The emergency spillway proportions and the settled height of dam for each fishery was based upon Engineering Memorandum SCS-31. Surcharge storage between the crest of the principal spillway and the emergency spillway was carefully selected to store the Emergency and Freeboard hydrographs (developed by "b" criteria) and to store and pass the 100-year frequency snowmelt inflow without operation of the emergency spillway. This conservative hydrologic design will ensure that the earth spillways for these structures located high in the National Forest will not operate except under very extreme runoff conditions.

A detailed reservoir operations study of the Mill Site Reservoir, with inflow modified to take into account the past operation of Ferron, Willow Lakes, and Duck Fork reservoirs, was used to determine the effects of the reservoir on both snowmelt and summer flood peaks and volumes as well as on water supply for the irrigated fields.

Reservoir operations studies, based upon runoff forecasting, were also used to determine the effect of the Mill Site Reservoir on the larger, less frequent snowmelt floods.
IRRIGATION INVESTIGATIONS

General

All of the 11,335 acres of presently irrigated land in the watershed will be benefited by the measures proposed. There are approximately 8,040 acres of cropland, 360 acres of improved pasture, and 2,955 acres of unimproved pasture now under irrigation. This entire acreage is under the Ferron Canal and Reservoir Company.

It is anticipated that the cropland acreage will increase about 6%, the improved pasture acreage about 200%, and the unimproved pasture acreage will decrease about 76% under project conditions.

Basic Data Available

Soils

Soils in the irrigated area are divided into three treatment groups:

Group 1--Predominantly well drained, deep (usually over 60 inches), medium textured, non-saline soils with small areas of imperfectly drained, moderately saline soils due mainly to position. About 15% are moderately deep (20 inches) over gravel and cobbles. Slopes range from 0-6%. Moisture holding capacity is from 1.5 to 2.0 inches per foot of soil except 0.6 to 1.0 inches per foot in the gravelly layer. L.C.U. - IIc1, IIc20, IIc23, IIe25, IIe26, IIe27, IIw20, IIw21, IIe23, IIIc24, IIIa27, IIIa28, and IIIe21; about 8,300 acres.

Group 2--Poorly drained, slightly to strongly saline, moderately deep, medium to fine textured soils with moisture holding capacity of 1.5 to 2.0 inches per foot. Slopes range from 0-6%. L.C.U. - IVw1, Vw1, VIw1, and VIIw1; about 3,000 acres.

Group 3--Predominantly well drained, shallow to moderately deep, fine textured soils on slopes of 0-6%. Moisture holding capacity is about 2.0 inches per foot. L.C.U. - IIIa25, IVe23, IVe24, IVw26; about 60 acres.

Climatological Data

The irrigated area ranges in elevation between 6,050 and 5,700 feet, and has a mean latitude of approximately 39°-06'N. Mean frost-free periods, (1948-1962) at Ferron, are as follows:

<table>
<thead>
<tr>
<th>Threshold Temperature °F</th>
<th>Mean Date of Occurrence</th>
<th>Mean No. of Days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>32</td>
<td>May 14</td>
<td>Oct. 19</td>
</tr>
<tr>
<td>28</td>
<td>April 26 1/</td>
<td>Oct. 22</td>
</tr>
<tr>
<td>24</td>
<td>April 19 1/</td>
<td>Oct. 30</td>
</tr>
</tbody>
</table>

1/ Interpolated from data on Emery station.
Temperature and precipitation data at the Ferron station, elevation 5,925, for the growing season are as follows:

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean Monthly Temperature (°F)</th>
<th>Median Monthly Precipitation (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>47.6</td>
<td>0.35</td>
</tr>
<tr>
<td>May</td>
<td>56.0</td>
<td>0.54</td>
</tr>
<tr>
<td>June</td>
<td>66.4</td>
<td>0.40</td>
</tr>
<tr>
<td>July</td>
<td>72.5</td>
<td>0.54</td>
</tr>
<tr>
<td>August</td>
<td>69.6</td>
<td>1.04</td>
</tr>
<tr>
<td>September</td>
<td>64.3</td>
<td>0.78</td>
</tr>
<tr>
<td>October</td>
<td>50.8</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Cropping Pattern**

The accompanying table gives present and expected future cropping patterns for the irrigated lands in the watershed.

<table>
<thead>
<tr>
<th>Crops</th>
<th>Present</th>
<th>Future W/Land Treatment Only</th>
<th>Future W/Land Treatment and Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>59</td>
<td>61</td>
<td>52</td>
</tr>
<tr>
<td>Grass Pasture (improved)</td>
<td>3</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Grass Pasture (unimproved)</td>
<td>26</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Small Grains and Corn Silage</td>
<td>12</td>
<td>15</td>
<td>24</td>
</tr>
</tbody>
</table>

**Water Supply**

Streamflow records for Ferron Creek (upper station) near Ferron, extended by correlation with Cottonwood Creek near Orangeville, are the basis for estimating the available water supply for the irrigated acreage.
Investigations

Irrigation Requirements

Monthly consumptive-use was computed by the modified Blaney-Criddle method using a local percent of daylight hours, mean monthly temperatures, a climatic coefficient, and a variable monthly crop coefficient. Since sufficient moisture to replace any soil moisture deficiency will be available from precipitation and irrigation during the non-growing season, an end-of-season soil moisture depletion of 2.0 inches was allowed in determining the net irrigation requirements. Median monthly precipitation at the Ferron station based on the 1948-1962 period and extended to a 30-year period by correlation with the Amery station record, was also deducted from the monthly consumptive-use amounts to obtain the net irrigation requirements.

The accompanying table gives the monthly net irrigation requirement in inches for the crops grown locally.

<table>
<thead>
<tr>
<th>Crop</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>0.51</td>
<td>3.39</td>
<td>5.76</td>
<td>7.12</td>
<td>5.29</td>
<td>2.54</td>
<td>0.00*</td>
<td>24.61*</td>
</tr>
<tr>
<td>Grass Pasture</td>
<td>1.29</td>
<td>2.73</td>
<td>4.69</td>
<td>5.83</td>
<td>4.35</td>
<td>1.93</td>
<td>0.00*</td>
<td>20.82*</td>
</tr>
<tr>
<td>Small Grain</td>
<td>0.09</td>
<td>1.86</td>
<td>8.17</td>
<td>3.85</td>
<td>0.00*</td>
<td>-----</td>
<td>-----</td>
<td>13.97*</td>
</tr>
<tr>
<td>Corn Silage</td>
<td>-----</td>
<td>0.44</td>
<td>3.27</td>
<td>8.41</td>
<td>4.01</td>
<td>0.00*</td>
<td>-----</td>
<td>16.13*</td>
</tr>
</tbody>
</table>

* Soil moisture depletion of 2.0 inches deducted at end of season.

Contributions to consumptive-use from the water table is considered negligible on areas other than unimproved pasture. It was assumed that no irrigation water was applied to unimproved pasture during July, August, and September.

Irrigation Supply

The monthly and seasonal water supply from Ferron Creek was determined from the U. S. Geological Survey streamflow records. The Ferron Creek values were extended by correlation with Cottonwood Creek near Orangeville to give a 30-year period of record (1933-1963) which is the basis for present water supply. A reservoir operations study on the Mill Site Reservoir using this 30-year record is the basis for future water supply.

The present and future median monthly diversion supply is estimated in the following table:

- 82 -
### Median Diversion Supply 1/

<table>
<thead>
<tr>
<th>Month</th>
<th>Present 2/</th>
<th>Future 3/</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>0.23</td>
<td>0.12</td>
</tr>
<tr>
<td>May</td>
<td>1.23</td>
<td>0.54</td>
</tr>
<tr>
<td>June</td>
<td>1.21</td>
<td>1.12</td>
</tr>
<tr>
<td>July</td>
<td>0.35</td>
<td>1.13</td>
</tr>
<tr>
<td>August</td>
<td>0.21</td>
<td>0.42</td>
</tr>
<tr>
<td>September</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.35</strong></td>
<td><strong>3.43</strong></td>
</tr>
</tbody>
</table>

1/ One-half of the time, for example 14 years out of 28, the irrigation supply at the diversion for the months shown above has been equal to or greater than the amount shown. During the remainder of the time, the diversion supply has been less than this. (Units are in acre feet per acre.)

2/ Natural streamflow.

3/ Reflects storage regulation.

### Irrigation Efficiencies

Estimates of present on-farm irrigation efficiencies were determined by the experience and judgment of the local Soil Conservation Service technicians and from efficiency checks in this and other areas having similar soils, slopes, and irrigation methods and management. Improvement in the average level of efficiencies are expected to be accomplished by the on-farm land treatment program to be installed by the additional technical and educational assistance to be made available and by the improved irrigation supply resulting from the irrigation system improvement measures, and the Mill Site Reservoir.

The following ranges in on-farm irrigation efficiencies were estimated and used in the analysis:

<table>
<thead>
<tr>
<th>Project Increment</th>
<th>Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present (non-project)</td>
<td>33</td>
</tr>
<tr>
<td>Future (10 years, with project)</td>
<td>46</td>
</tr>
</tbody>
</table>

The principal methods of irrigation are the use of corrugations and wild flooding. Wild flooding is practiced mainly on alfalfa and grass pasture.
Conveyance and Operational Losses

Inflow-outflow measurements on the majority of the main canals and laterals during the 1962 and 1963 irrigation seasons supplemented by several measurements with the "Falling Head Seepage Meter" indicate that the present over-all conveyance and operational losses are in the magnitude of 15 percent of the diverted flows.

With the proposed improvements to the irrigation system including canal and lateral lining, new diversions, water control structures, and measuring devices, it is expected that future over-all conveyance and operational losses will be reduced to a magnitude of about 8 percent of the diverted flows.

System Capacity Requirements

Delivery of water to the individual water users will be changed from the existing continuous flow system to a modified demand system.

Design capacities of the canal lining will be in accordance with the optimum standard of having capacity sufficient to meet peak period irrigation requirements. Peak period irrigation requirements were based on the weighted peak period consumptive use. Rates range from 0.26 on the deeper valley soils to 0.27 on the shallower benchland soils. These rates, when adjusted for the on-farm and conveyance efficiencies were the basis for determining the minimum design capacity of the canal lining.

ECONOMICS

Initial examination of the watershed with sponsor groups and the Service gave an over-all picture of watershed problems. Further examination with the planning technicians provided material for a preliminary feasibility report and a work outline. A study outline was made up to define major study items and to establish survey and fact collecting procedures.

Evaluation units were determined jointly by the hydrologist, sedimentationist, engineer, and economist. They included:

1. Twelve flood damage evaluation units

2. One irrigation evaluation unit

The flood damage evaluation units were single drainages debouching onto separate flood damage areas. The irrigation evaluation unit was the total service area of the Perron Canal and Reservoir Company, which is the only irrigation company in the watershed.

For purposes of economic evaluation and project formulation, the economic studies included:
1. **Basic Economic Data.** The economy of the watershed is dominated by livestock agriculture with non-farm employment in coal mining occupying a secondary but important position. Basic information was collected on livestock and crop production, crop yields, size distribution of farming units, farming, livestock and irrigation practices, type of farming enterprises, non-agricultural employment, and other general economic information. This information was secured from ranch operators in the watershed, from census reports, the Emery County ASC office, irrigation company records, records of other federal and state agencies, University reports, and other secondary sources.

2. **Flood Damage Investigations**
   
a. Damage investigations included determination of the nature and distribution of croplands, structures, improvements, and facilities subject to damage by flood runoff in each flood evaluation unit. All areas and structures, including farm and commercial buildings and residences, were located and considered in reference to their susceptibility to damage by flood flows from each flood source area.

   b. Interviews were carried out with individuals to obtain information on (1) frequency of flood occurrences, (2) areas of flood damage, (3) kind and amount of damage, (4) estimates of relative flood size, and (5) flood sources. In all, interviews concerning flood occurrences and damage were had with 36 individuals. In addition, flood reports by Soil Conservation Service personnel and other reports were studied and pertinent information used.

   c. During the period of study, the summer months of 1963 and 1964, small floods affecting most of the evaluation units were observed. Resultant damages formed the basis of special damage appraisals and flood reports. Since such small floods are typical of floods which occur on an average of every year in this area, these occurrences furnished valuable first-hand information on agricultural and other damages. Cross sections of flows in the flood channels were taken, the flows were correlated with the observed damages and utilized as part of the basic data in the flood series analysis. As stated, floods from most of the drainages of each evaluation unit are a yearly occurrence and some type of damage results with each occurrence. Since they were small and frequent, recent historical occurrences were considered representative of floods ranging from the annual to the 5-year frequency. The selection of this frequency range was further substantiated by farmer experience in the damage area.

   d. The information gathered through surveys, interviews and examination of the flood damage areas formed the basis for establishing an annual damage base for each evaluation unit. In general, most of the item-by-item flood damage estimates were developed by projecting inventoried damages from floods reported by ranchers or others. Frequencies of damage occurrence by item were determined by farmer estimates and by observation of the damage items in reference to their position in the
damage area. Discharge-frequency flood series developed by the hydrologist were used in projecting the inventoried damages to reflect item damages for larger or smaller floods in the series. The annual damage base for each item was converted to long-term prices and costs, using conversion factors reflecting the item(s) involved. The total annual damage base for each evaluation unit was the sum of the individual damage items.

e. Of the twelve damage evaluation units studied, nine units were found to have annual damages of a magnitude such as to constitute a significant flood problem. The itemized estimates of the damage bases, residual damages, reductions from land treatment (where installed) and water conservation benefits are shown in the table which follows.
## FRENCH WATERSHED

### Damage Base - Damage Reductions

<table>
<thead>
<tr>
<th>Evaluation Unit</th>
<th>Source</th>
<th>Damage Category</th>
<th>Reduction Type</th>
<th>Reduction Quantity</th>
<th>Total Damage Reduction</th>
<th>Total Damages Due to Reduction</th>
<th>Total Damages Due to Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Ditch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversion Hollow</td>
<td>230</td>
<td>480</td>
<td>680</td>
<td>915</td>
<td>1,235</td>
<td>1,235</td>
<td>1,235</td>
</tr>
<tr>
<td>Indian Hollow</td>
<td>620</td>
<td>150</td>
<td>545</td>
<td>1,545</td>
<td>2,090</td>
<td>2,090</td>
<td>2,090</td>
</tr>
<tr>
<td>Jordan Hollow</td>
<td>160</td>
<td>740</td>
<td>210</td>
<td>3,235</td>
<td>1,235</td>
<td>1,235</td>
<td>1,235</td>
</tr>
<tr>
<td>South Ditch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Creek</td>
<td>490</td>
<td>575</td>
<td>1,075</td>
<td>1,090</td>
<td>1,090</td>
<td>1,090</td>
<td>1,090</td>
</tr>
<tr>
<td>Straight Hollow (S)</td>
<td>165</td>
<td>775</td>
<td>1,955</td>
<td>1,965</td>
<td>1,965</td>
<td>1,965</td>
<td>1,965</td>
</tr>
<tr>
<td>Straight Hollow (O)</td>
<td>425</td>
<td>575</td>
<td>1,075</td>
<td>1,090</td>
<td>1,090</td>
<td>1,090</td>
<td>1,090</td>
</tr>
<tr>
<td>Dutch Flat</td>
<td>65</td>
<td>65</td>
<td>120</td>
<td>1,240</td>
<td>1,240</td>
<td>1,240</td>
<td>1,240</td>
</tr>
<tr>
<td>Southwell South Ditch</td>
<td>1,150</td>
<td>1,150</td>
<td>1,150</td>
<td>1,150</td>
<td>1,150</td>
<td>1,150</td>
<td>1,150</td>
</tr>
<tr>
<td>Perimeter Creek</td>
<td>3,010</td>
<td>535</td>
<td>5,885</td>
<td>3,355</td>
<td>2,035</td>
<td>2,035</td>
<td>2,035</td>
</tr>
<tr>
<td>Ollie Creek Reservoir</td>
<td>593</td>
<td>5,885</td>
<td>3,355</td>
<td>2,035</td>
<td>2,035</td>
<td>2,035</td>
<td>2,035</td>
</tr>
<tr>
<td>TOTALS</td>
<td>12,240</td>
<td>3,580</td>
<td>7,845</td>
<td>8,990</td>
<td>13,050</td>
<td>10,430</td>
<td>5,620</td>
</tr>
</tbody>
</table>

### Benefits

<table>
<thead>
<tr>
<th>Evaluation Unit</th>
<th>Benefit</th>
<th>Description</th>
<th>Annual Damage Base - Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Ditch</td>
<td>1.235</td>
<td>Soil</td>
<td>2,090</td>
</tr>
<tr>
<td>Jordan Hollow</td>
<td>1.235</td>
<td>Water</td>
<td>2,090</td>
</tr>
<tr>
<td>Subtotal North Ditch</td>
<td>7,285</td>
<td>Soil, Water</td>
<td>7,285</td>
</tr>
<tr>
<td>South Ditch</td>
<td>1.090</td>
<td>Soil</td>
<td>1,090</td>
</tr>
<tr>
<td>Straight Hollow (S)</td>
<td>1.090</td>
<td>Soil</td>
<td>1,090</td>
</tr>
<tr>
<td>Straight Hollow (O)</td>
<td>1.090</td>
<td>Water</td>
<td>1,090</td>
</tr>
<tr>
<td>Dutch Flat</td>
<td>1.240</td>
<td>Soil</td>
<td>1,240</td>
</tr>
<tr>
<td>Southwell South Ditch</td>
<td>1.150</td>
<td>Soil, Water</td>
<td>1,150</td>
</tr>
<tr>
<td>Perimeter Creek</td>
<td>2,035</td>
<td>Soil</td>
<td>2,035</td>
</tr>
<tr>
<td>Ollie Creek Reservoir</td>
<td>2,035</td>
<td>Soil</td>
<td>2,035</td>
</tr>
<tr>
<td>TOTALS</td>
<td>5,620</td>
<td>Soil, Water</td>
<td>5,620</td>
</tr>
</tbody>
</table>
f. The estimates shown for Ferron Creek (Mill Site Reservoir) are based on a 70% sample of all lands lying along the creek in the reach below the Mill Site Reservoir. Item damages recorded were discriminate projected to reflect damages to the entire reaches in accordance with the amount and distribution of the item involved in the uninveteried part of the reach.

The evaluation of the damage base for Ferron Creek also includes the item of widespread distribution of damaging sediment throughout the irrigated area which originates from the Ferron Creek drainage and is distributed through canals and ditches and onto the land. This type of damage is independent of the sediment deposited on irrigated lands by floods from the small drainages which make up the other evaluation units. Furthermore, the sediment from Ferron Creek is distributed over a wider area. These estimates were developed through information obtained from sedimentation studies.

g. Residual damages are largely based on estimates of suspended sediment which will be discharged through the spillways of the structures and from runoff from small uncontrolled areas.

h. Water conservation benefits assigned to the debris basins originate from the impoundment of the flood flows in the structures and their slow release into the canals. With no control, as at present, no beneficial use is made of the water. Average annual volumes were calculated from the flood series developed by the hydrologist for each evaluation unit. Unit values of $15 per acre foot were used to obtain total water conservation benefits.

i. Damage reductions from upper watershed land treatment were based on the full reductions in flood runoff expected from the improvement in vegetative conditions, discounted for a 50-year lag in full accrual.

Irrigation Analysis

Information on average crop yields, irrigation practices and per acre yields of crops at various levels of water supply was secured on 17 farms in the watershed. These surveys covered the principal crops—alfalfa, small grain, corn silage, and irrigated pasture. Average full supply yields were established for each crop. Because the 17 farm samples had been stratified and weighted among the not too variable soil groups, average full supply yields reflected production throughout the irrigation evaluation unit. Yields under future conditions without the project and with the project were projected from present yields and reflect the beneficial influence of the land treatment, reservoir and lining on water supply, improved crop rotation, fertilizer use and other improved practices. The table on the following page outlines full supply yields used in the analysis.
Table 1. Crop Yields - Various Project Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Alfalfa (tons)</th>
<th>Barley (Bu.)</th>
<th>Corn Silage (tons)</th>
<th>Irrigated Pasture (AUM's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>3.5</td>
<td>51</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Future w/going land treatment</td>
<td>3.7</td>
<td>53</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Future w/all land treatment</td>
<td>3.7</td>
<td>53</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>With land treatment, reservoir, and lining</td>
<td>4.0</td>
<td>59</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

A 30-year record of the streamflow gave a basis for determining the present median semi-monthly water supply. The benefits from the going and accelerated land treatment program were measured as improvements in irrigation efficiency. It was estimated that the diversion point over-all efficiency would move from 28% to 31% with the going land treatment program and that the accelerated land treatment program would raise diversion point efficiencies to 39%. It was taken that the lining would raise over-all diversion efficiency to 42%.

Analysis was made of each level of efficiency or water supply and the total yields of each crop calculated. These yields are shown below.

Table 2. Average Yields Under Various Project Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Alfalfa (tons)</th>
<th>Small Grain (Bu.)</th>
<th>Corn Silage (tons)</th>
<th>Irrigated Pasture (AUM's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>1.60</td>
<td>51</td>
<td>13</td>
<td>1.22</td>
</tr>
<tr>
<td>Future w/going land treatment</td>
<td>1.67</td>
<td>55</td>
<td>14</td>
<td>2.00</td>
</tr>
<tr>
<td>Future w/all land treatment</td>
<td>1.84</td>
<td>57</td>
<td>14</td>
<td>2.21</td>
</tr>
<tr>
<td>With land treatment, reservoir, and lining</td>
<td>3.48</td>
<td>59</td>
<td>16</td>
<td>3.75</td>
</tr>
</tbody>
</table>
A ranch survey was also conducted on \( \frac{1}{4} \) of the sample farms. This included 11 beef ranches and 3 dairy farms. Information gathered in this study includes data on numbers and age classes of livestock, marketing practices, feeding and grazing schedules, dry feed rates, source of grazing by private range, National Forest and National Reserve and other pertinent information. This information was tabulated and organized and was used in conjunction with the crop production information and crop budgets to make up ranch budgets reflecting present conditions, future conditions without a project, and future conditions with a project. The significant elements of this analysis are shown below:

<table>
<thead>
<tr>
<th>Table 3. Crop and Livestock Production - Three Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Irrigated Acres Model Ranch</td>
</tr>
<tr>
<td>Crop Production</td>
</tr>
<tr>
<td>Alfalfa (tons)</td>
</tr>
<tr>
<td>Small Grain (bushel)</td>
</tr>
<tr>
<td>Corn Silage (tons)</td>
</tr>
<tr>
<td>Irrigated Pasture (aum)</td>
</tr>
<tr>
<td>Aftermath-Public and Private Grazing</td>
</tr>
<tr>
<td>Total AUM's</td>
</tr>
</tbody>
</table>

Animal Units Per Ranch

<table>
<thead>
<tr>
<th>Beef</th>
<th>No. Ranches</th>
<th>Dairy</th>
<th>No. Ranches</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>111</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>52</td>
<td>87</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>106</td>
<td>75</td>
<td>53</td>
<td>27</td>
</tr>
</tbody>
</table>

\( /1 \) Reflects adjustments in public grazing permits.

This analysis points up the impact of decreasing grazing resources and the limited potential for improvement under going (future without project) programs.

Using the levels of crop production for the three analysis conditions and the various kinds of feed resources available for the model ranch typical of each condition, ranch budgets were formulated. These included both beef and dairy budgets. On the cost side, the budgets included all out-of-pocket costs plus interest charges on land, buildings, and livestock. Livestock and livestock products sold were valued at long-term prices adjusted to local levels.
Aggregate gross benefits to project effects were calculated as differences between total ranch returns at the going program level and the total net returns with all project measures installed. These were reduced to net project benefits reflecting project effects as shown below.

### Summary - Project Benefits

<table>
<thead>
<tr>
<th></th>
<th>Non-Project</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Returns - Beef Enterprise</td>
<td>$57,420</td>
<td>$303,750</td>
</tr>
<tr>
<td>Net Returns - Dairy Enterprises</td>
<td>$82,350</td>
<td>$201,690</td>
</tr>
<tr>
<td>Total Net Returns - Livestock</td>
<td>$139,770</td>
<td>$505,440</td>
</tr>
<tr>
<td>Average Net Return Per Farm</td>
<td>1,225</td>
<td>4,955</td>
</tr>
<tr>
<td>(114)</td>
<td>(102)</td>
<td></td>
</tr>
<tr>
<td>Gross Project Benefits Based on Livestock</td>
<td>---</td>
<td>$365,670</td>
</tr>
<tr>
<td>Less Annual Associated Land Treatment Cost (Accelerated Land Treatment)</td>
<td>7,780</td>
<td></td>
</tr>
<tr>
<td>Primary Benefits Residual to Labor and Project Effects</td>
<td>$357,890</td>
<td></td>
</tr>
</tbody>
</table>

### Adjusted Irrigation Benefits

Under the livestock budget method of analysis, the net ranch income is a residual to labor and management. In calculating benefits via the difference between the project and non-project conditions, the increased labor inputs required to achieve the increased production are included in primary benefits. If increased labor inputs are to be defined as redevelopment benefits, they must be separated from the primary irrigation benefits and they (the primary benefits) must be adjusted to a net value.

Adjustment:

- Total Primary Benefits: $357,890
- Annual Adjusted Value-Increased Labor Inputs: 30,510
- Total Net Adjusted Primary Irrigation Benefits: $327,380

### Redevelopment Benefits

Although redevelopment benefits were not used for project justification, they were defined and calculated so as to give a better perspective of the project impact. Calculated redevelopment benefits arising from increased farm labor inputs associated with increased project production were used to reduce primary irrigation benefits to a net annual value as previously shown. Other redevelopment benefits were associated with construction of structures, land treatment,
and recreation. The installation period costs assignable to local labor were reduced to annual costs limited to 20 years, and distributed over a 100-year period, in accordance with prescribed procedure. The summary of these benefits is shown below.

### Summary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>$16,745</td>
</tr>
<tr>
<td>Land Treatment</td>
<td>5,585</td>
</tr>
<tr>
<td>Increased Labor Inputs</td>
<td>30,510</td>
</tr>
<tr>
<td>Recreation</td>
<td>1,425</td>
</tr>
<tr>
<td><strong>Total Redevelopment Benefits</strong></td>
<td><strong>$54,265</strong></td>
</tr>
<tr>
<td>Less 10% increased labor inputs counted as secondary benefits</td>
<td>$3,050</td>
</tr>
<tr>
<td><strong>Net Adjusted Total Redevelopment Benefits</strong></td>
<td><strong>$51,215</strong></td>
</tr>
</tbody>
</table>

### Secondary Benefits

Secondary benefits were based on (1) 10% of the net flood prevention benefits after land damage and indirect benefits were deducted from the total, (2) 10% of net primary irrigation benefits, and (3) 10% of the increased production costs required to produce the primary irrigation benefits. The manner in which the estimates were made are shown below.

### Flood Prevention 1/

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Benefits</strong></td>
<td><strong>Benefits Excluding</strong></td>
<td><strong>Benefits Stemming From</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Land Damages</strong> and Indirect</td>
<td>(10%)</td>
</tr>
<tr>
<td>Mill Site Reservoir</td>
<td>21,735</td>
<td>16,365</td>
</tr>
<tr>
<td>Debris Basins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>11,350</td>
<td>9,510</td>
</tr>
<tr>
<td>South</td>
<td>19,060</td>
<td>13,760</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,360</td>
</tr>
</tbody>
</table>

1/ No "induced by" calculated because flood damage requires purchase of materials and services which cancel out loss of trade involving production losses.
"Induced by" Secondary Benefits

Production Costs - Livestock Basis

<table>
<thead>
<tr>
<th></th>
<th>Without Project</th>
<th>With Project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beef</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost Base for &quot;Induced&quot; Benefits (per unit)</td>
<td>$ 2,955</td>
<td>$ 4,060</td>
</tr>
<tr>
<td>Number of Beef Units</td>
<td>87</td>
<td>75</td>
</tr>
<tr>
<td>Total Beef Production Costs</td>
<td>$257,085</td>
<td>$304,500</td>
</tr>
<tr>
<td><strong>Dairy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost Base for &quot;Induced&quot; Benefits (per unit)</td>
<td>$ 6,465</td>
<td>$ 10,900</td>
</tr>
<tr>
<td>Number of Dairy Units</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Total Dairy Production Costs</td>
<td>$174,555</td>
<td>$294,300</td>
</tr>
</tbody>
</table>

Total All Livestock Costs: $431,640 $598,800

Secondary Benefits @ 10%: $43,165 $59,880

Induced Secondary Benefits Produced by Project: $16,715

**Irrigation Measures**

<table>
<thead>
<tr>
<th></th>
<th>Primary Benefits</th>
<th>&quot;Stemming From&quot;</th>
<th>Induced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Site Reservoir</td>
<td>272,705</td>
<td>27,270</td>
<td>13,925</td>
</tr>
<tr>
<td>System Improvement</td>
<td>54,675</td>
<td>5,465</td>
<td>2,790</td>
</tr>
<tr>
<td></td>
<td>327,380</td>
<td>32,735</td>
<td>16,715</td>
</tr>
</tbody>
</table>
Summary

<table>
<thead>
<tr>
<th>Mill Site Reservoir:</th>
<th>Stemming</th>
<th>Induced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Prevention</td>
<td>$1,635</td>
<td>--------</td>
<td>$1,635</td>
</tr>
<tr>
<td>Irrigation</td>
<td>$27,270</td>
<td>$13,925</td>
<td>$41,195</td>
</tr>
<tr>
<td>System Improvements:</td>
<td>5,465</td>
<td>2,790</td>
<td>8,255</td>
</tr>
<tr>
<td>Total Secondary Irrigation Benefits</td>
<td>$34,370</td>
<td>$16,715</td>
<td>$51,085</td>
</tr>
<tr>
<td>From Flood Prevention Structures</td>
<td></td>
<td></td>
<td>2,325</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>$53,410</td>
</tr>
</tbody>
</table>

Fish and Wildlife and Recreation Benefits

The evaluation of recreation benefits is based on (1) delineation of the primary demand area, (2) projection from the present population of the primary demand area to a population for 1980, (3) an estimate of tourist and non-local travel through the watershed and the proportion of such travel which would use project facilities, (4) the participation rates of the primary demand area population for the types of recreation afforded by the project, (5) the peak and average capacity of the facilities, and (6) adjustment of estimated "activity" days of use to "visitor" days by applying a factor of .70 to the number of activity days. Unit values per visitor day ranged from $.50 to $1.50 in accordance with the criteria set forth in Supplement No. 1, Evaluation Standards for Primary Outdoor Recreation Benefits. The estimated demands, capacities, visitor days, and benefits are shown below.

Water resource improvements for fish and wildlife in the upper watershed have been evaluated. Estimates made by Utah State Department of Fish and Game specialists indicate the average level of fishing use will be 18,700 angler days per year. Converted to monetary benefits @ $1.50 per angler day, this would give benefits of $28,050 per year.

<table>
<thead>
<tr>
<th>Use Adjusted from Activity Days to Visitor Days</th>
<th>Adjusted Activity Days</th>
<th>Adjustment Factor</th>
<th>Visitor Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picnicking</td>
<td>18,145</td>
<td>.70</td>
<td>12,700</td>
</tr>
<tr>
<td>Overnight Camping</td>
<td>2,270</td>
<td>.70</td>
<td>1,590</td>
</tr>
<tr>
<td>Boating</td>
<td>5,865</td>
<td>.70</td>
<td>4,105</td>
</tr>
<tr>
<td>Fishing</td>
<td>19,800</td>
<td>.70</td>
<td>13,860</td>
</tr>
</tbody>
</table>

1/ Use adjusted to reflect participation in more than one activity per visit.
### Benefits - Recreation Facilities and Reservoir

<table>
<thead>
<tr>
<th>Activity</th>
<th>Unit Value</th>
<th>Days</th>
<th>Total Value</th>
<th>Value</th>
<th>Days</th>
<th>Total Value</th>
<th>Value</th>
<th>Days</th>
<th>Total Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picnicking</td>
<td>.50</td>
<td>100</td>
<td>50</td>
<td>.50</td>
<td>180</td>
<td>90</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
</tr>
<tr>
<td>Overnight Camping</td>
<td>1.50</td>
<td>12,700</td>
<td>19,050</td>
<td>1.50</td>
<td>1,590</td>
<td>2,385</td>
<td>1.50</td>
<td>4,105</td>
<td>6,160</td>
<td>1.50</td>
</tr>
<tr>
<td>Boating</td>
<td>1.50</td>
<td>12,700</td>
<td>19,050</td>
<td>1.50</td>
<td>1,590</td>
<td>2,385</td>
<td>1.50</td>
<td>4,105</td>
<td>6,160</td>
<td>1.50</td>
</tr>
<tr>
<td>Fishing</td>
<td>1.00</td>
<td>500</td>
<td>500</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.00</td>
<td>500</td>
<td>500</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total Benefits</strong></td>
<td><strong>19,000</strong></td>
<td><strong>2,295</strong></td>
<td><strong>6,160</strong></td>
<td><strong>20,200</strong></td>
<td><strong>$47,745</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TYPICAL CANAL SECTION

TRAPEZODAL CHECK GATE

ROUND CAST IRON SCREW GATE

TRAPEZODAL SLIDE GATE

RECTANGULAR SLIDE GATE

TYPICAL TURNOUT STRUCTURES