

CHAPTER 2

The Alternatives Considered, Including the Proposed Action Alternative

2.0 INTRODUCTION

As the lead Federal agency for this EIS, Reclamation's action under review is whether or not to approve SWCD's application for a SRPA loan and request for use of withdrawn lands to construct and operate the Narrows Project. The USACE and USDA Forest Service also must make decisions based on this EIS. To fully explore the effects of the proposed action and possible alternate courses of action, the Sanpete Water Conservancy District, working with Reclamation and the other cooperating agencies, developed an array of alternatives to answer the issues raised in chapter 1. In chapter 2, you will find:

- ◆ A description of the Proposed Action and the other alternatives that were analyzed.
- ◆ A comparison of how the alternatives would achieve the purpose of and need for the action.
- ◆ A comparison of how the alternatives address the issues identified in chapter 1.

2.1 THE PROCESS USED TO DEVELOP THE ALTERNATIVES

The National Environmental Policy Act requires all agencies to write a detailed statement for major Federal actions having a significant effect on the environment, which must include a discussion of alternatives to the proposed action (see section 102(2)(c) of the Act). In addition, all Federal agencies

must study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources. To be considered reasonable, each alternative in the array (except "no action") must meet the proposal objectives (chapter 1) and the environmental standards (selection criteria).

Reclamation, as the lead agency, formed an interdisciplinary team that consisted of various Federal and State agencies and the SWCD. This team was formed to develop a set of selection criteria that could be used to formulate alternatives to the Narrows Project that would meet the purpose of and need for the proposed project. The selection criteria are:

1. The project must include an agricultural and municipal irrigation water supply as a project purpose and provide expected project benefits for at least the duration of the loan repayment period.
2. The project must provide an additional water supply to north Sanpete County during the season when it is needed.
3. The project must comply with all statutory and regulatory requirements and guidelines including Section 404 of the Clean Water Act, the National Historic Preservation Act, and the Endangered Species Act.
4. The project must satisfy Small Reclamation Project Act requirements. The SRPA requires that a project be technically and financially feasible and in

compliance with environmental requirements. To be considered financially feasible, the following would apply:

- ◆ The project sponsor should pay a minimum of 25% of the project costs at the time of construction.
- ◆ Loan repayment must use 100% of the project's irrigation amortization capacity (with certain exceptions), and repayment must be completed in 40 years or less. The amortization capacity is a measure of farmers' and ranchers' ability to repay.
- ◆ The loan factor (a measure of Federal interest subsidy) for the project must be 0.5 or less.

SRPA allows some flexibility in meeting the financial feasibility requirement. In some situations, the irrigation amortization capacity may result in a repayment period extending beyond 40 years or a loan factor that exceeds 0.5. The sponsor, at its discretion, may use other financial assets to either increase the annual payment or increase the upfront cost share to reduce the amount of the loan. Either, or a combination, of these options may reduce the repayment period and the loan factor to acceptable levels. In other words, the sponsor may contribute funds in excess of its ability to pay, relying then on a "willingness to pay" to ensure financial feasibility.

This willingness to pay component recognizes the limitations placed by Reclamation on computing the agricultural benefits component of the

farm budget.¹ The farm budget limitations may underestimate the sponsor's irrigation amortization capacity, suggesting that the farmer's ability to repay the loan may be less than is actually the case. Willingness to pay also allows the sponsor to consider other intrinsic values of the water that normally would not be considered or would be difficult to consider in an economic evaluation (benefit-cost analysis). The sponsor is responsible to determine if the value of the water benefits justifies its cost. In SRPA cases, where Reclamation's involvement is limited to making a loan, use of willingness to pay is an appropriate approach. The SRPA requires the sponsor to demonstrate only that additional financial assets exist and that the sponsor commits to the use of these assets for the project.

5. The project must divert and store water under legal claim of right and priority in full compliance with State law.

2.2 DETAILED DESCRIPTION OF ALTERNATIVES

2.2.1 No Action Alternative

The No Action Alternative represents the conditions of the affected area if Reclamation does not approve the SRPA loan and use of withdrawn lands by SWCD for the Narrows Project (figure 2-1). It establishes the baseline for evaluating the environmental impacts of providing a supplemental water supply to north Sanpete County. It also establishes anticipated conditions in the affected areas without further development and assumes that irrigation operations would continue according to historic use.

¹ The farm budget is used to compute the irrigation amortization capacity.

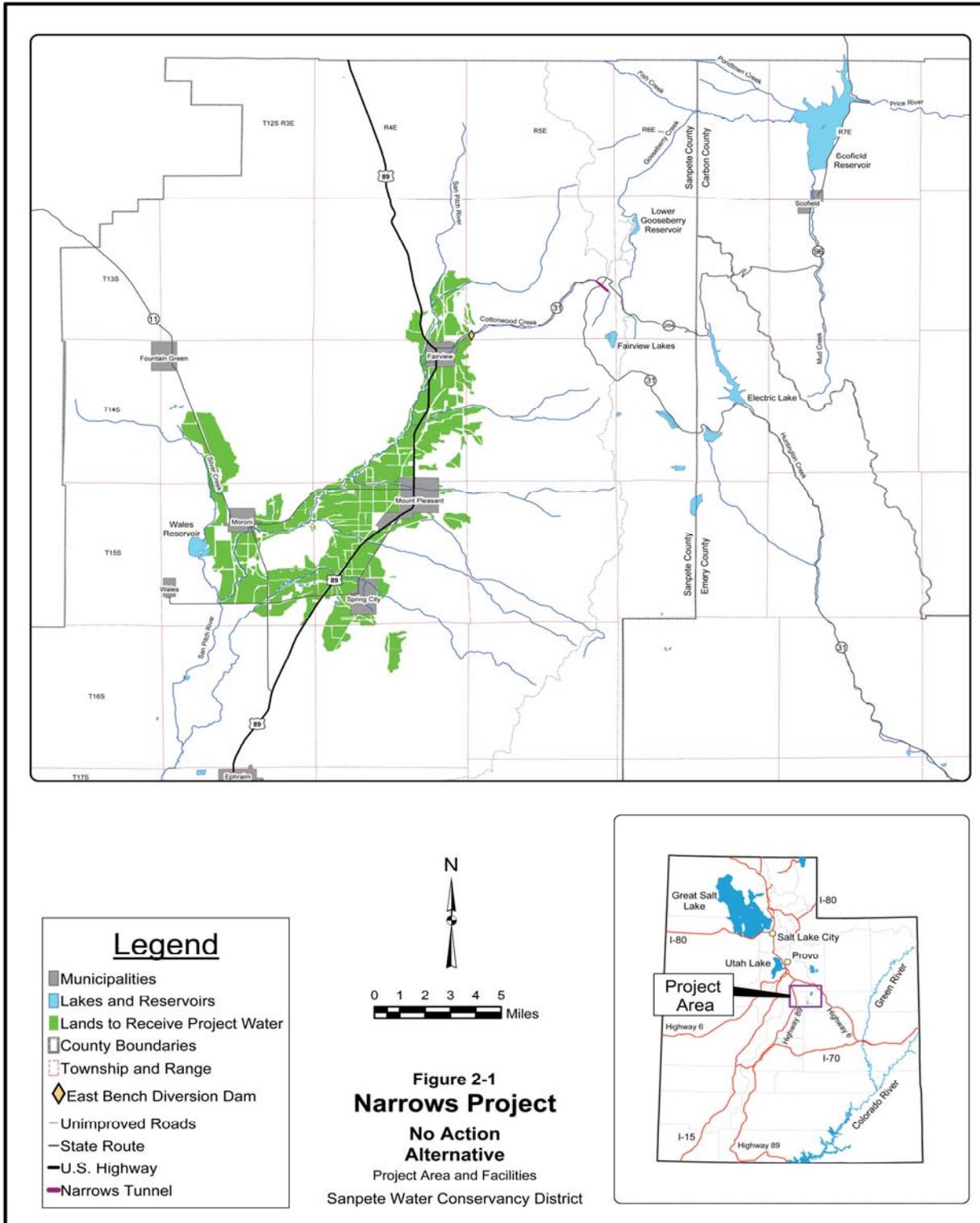


Figure 2-1.—Narrows Project, No Action Alternative, Project Area and Facilities.

Under this alternative, the Narrows Dam and Reservoir would not be constructed. Without the dam construction, there would be no need to relocate SR-264; and there would be no recreational facilities constructed at the reservoir site. The East Bench, Oak Creek, and Upper Cottonwood Creek Pipelines would not be built. The existing Narrows Tunnel would be rehabilitated at some future date and with other funding. The Cottonwood Creek Irrigation Company could not risk complete collapse and failure of the tunnel. If the tunnel were to collapse, the Cottonwood Creek Irrigation Company would have to acquire some type of emergency funding and would be required to repair it. The demand on municipal water supplies in Fairview, Mount Pleasant, Spring City, and Moroni would continue to increase as supplies for outdoor municipal uses run short and as the population increased. Most likely, there would be a conversion of agricultural water to municipal use as the demand for municipal water increased with a growing population.

Water conservation measures would continue to be implemented. These conservation measures would reduce average shortages on irrigated farmland to about 29.5% or about 15,250 acre-feet per year. Implementing new conservation measures most likely would reduce irrigation return flows now supplying wetlands, aquatic habitat, and downstream users by an estimated 3,500 acre-feet per year.

There would be no wetlands, wildlife, or fisheries mitigation measures implemented under the No Action Alternative because there would be no impact to existing wetlands and wildlife habitat. Streamflows in Gooseberry and Fish Creeks would remain unaltered from their present state. Under this plan, no flatwater fishery would be developed in the proposed reservoir basin.

2.2.2 Proposed Action Alternative

If Reclamation approves the SRPA loan and Congress appropriates the necessary funds and lands, a supplemental water supply would be developed for municipal water users and agricultural use in north Sanpete County under the Proposed Action. This additional water supply would satisfy the 1984 Compromise Agreement.

The Proposed Action would provide north Sanpete County an average annual supply of 4,281 acre-feet of supplemental irrigation water for 15,420 acres of presently irrigated farmland and 855 acre-feet of water for municipal use. The project would include construction of the 17,000 acre-foot Narrows Dam and Reservoir on Gooseberry Creek, pipelines to deliver the water to existing water distribution systems, rehabilitation of the existing 3,100 foot Narrows Tunnel, and relocation of 2.9 miles of State Road (SR) 264. The dam would be 120 feet high with a crest length of 550 feet and crest width of 30 feet.

The Narrows portion of the Gooseberry Project Plan would include a transmountain diversion of water from the Gooseberry Creek drainage of the Price-Green-Colorado River Basins to the San Pitch-Sevier River of the Great Basin. Geographically, the project facilities are located in close proximity to the drainage divide between the Price River system and the San Pitch River system. The general location is shown on the location map at the front of this document.

The Price River flows southeast to the Green River, a tributary of the Colorado River. The San Pitch River flows southwest to the Sevier River, which is completely consumed in the Bonneville Basin, a part of the arid Great Basin. The county line dividing Sanpete County and Carbon County is located more than 6 miles downstream

from and about 3 miles east of the proposed Narrows damsite on Gooseberry Creek.

The proposed damsite, the transmountain Narrows Tunnel, and the project water distribution facilities are all located in Sanpete County. The source of the project water supply generally arises in Sanpete County and naturally flows into Carbon County and the Price River system, unless the flows are captured and diverted transmountain to Sanpete County. The service area of the Narrows Project would be situated in the San Pitch River drainage.

A dam and reservoir would be constructed on Gooseberry Creek, and water would be diverted through an existing tunnel to Cottonwood Creek. Pipelines would be constructed to deliver the water to existing water distribution systems located near Fairview, Utah. Recreation facilities would be developed at the reservoir, and a 2,500-acre-foot minimum pool for fish habitat would be maintained.

Mitigation measures would be implemented to offset adverse impacts to wetlands, terrestrial wildlife, and stream fisheries. In addition to mitigation measures to offset project impacts, other measures would be included to enhance or improve fish and wildlife habitat. Additional water conservation measures would be required independent of the Proposed Action. However, only those water users who have implemented or would agree to implement water conservation measures would be eligible to receive project water. These practices would include improved water conveyances such as lined canals, pipelines, or improved irrigation practices such as sprinklers or gated pipe.

2.2.2.1 Water Supply and Use

The project water supply would come from Upper Gooseberry Creek and its tributaries.

The Upper Gooseberry Creek drainage (including Fairview Lakes) has an average inflow of about 9,200 acre-feet of water. Of that amount, 2,300 acre-feet are diverted transmountain through the existing Narrows Tunnel by the Cottonwood-Gooseberry Irrigation Company (CGIC). This diversion consists of 1,900 acre-feet from Gooseberry Creek and 400 acre-feet from Boulger Canyon. The Fairview Lakes water (2,300 acre-feet) is not considered part of the Narrows Project water. The majority of the flow in Upper Gooseberry Creek comes from direct snowmelt. Peak flows in May and June are several times greater than flow during the remainder of the year.

Under existing water rights agreements, a maximum of 5,400 acre-feet per year of project water would be released through the Narrows Tunnel. The reservoir would provide long-term carryover storage for consecutive drought years. With the long-term carryover storage, the Proposed Action would produce an annual average yield of 5,136 acre-feet per year. Table 2-1, Water Allocation and Use for the Narrows Project, shows the allocation of project yield between irrigation and M&I uses.

Table 2-1.—Water Allocation and Use for the Narrows Project

Water Source or Use	Acre-feet
Gooseberry Creek drainage	5,136
M&I ¹	855
Irrigation ¹	4,281

¹ It is estimated that the balance between M&I and irrigation water will change as the demand for M&I use increases (M&I use will increase, and irrigation use will decrease).

A review of the Loan Application Report showed references to both 480 and 500 acre-feet of municipal water supply being provided by the proposed project. For consistency, all references to municipal supplies have been changed to 500 acre-feet per year for the initial M&I allotment. Further, the Loan

Application Report shows M&I deliveries increasing from 500 to 1,070 acre-feet per year by the end of the 30-year repayment period. Under this plan, the average annual M&I delivery would be 855 acre-feet per year. This and subsequent analyses in the FEIS will use 855 acre-feet per year for the M&I allotment, whereas the DEIS and earlier documents used 480 or 500 acre-feet per year. Of the 5,136-acre-foot average annual project yield, 855 acre-feet would be used for the M&I allotment and the remaining 4,281 acre-feet for the irrigation allotment.

Project irrigation supplies, along with present irrigation supplies, are expected to be used primarily for production of crops such as alfalfa and grass hay to support beef and dairy enterprises. Project water supplies would be used primarily in the latter part of the growing season when existing water shortages are the most critical. In addition, a total of 500 acre-feet per year of project water would be used initially in Fairview, Mount Pleasant, Spring City, and Moroni. This water would be used to supplement existing water supplies for irrigation of lawns and gardens through secondary irrigation systems, preserving high quality culinary water for indoor use. Future requirements for additional municipal water could be as high as 2,800 acre-feet per year.

Treatment facilities would not be required for the initial 500 acre-feet of water because this water would replace potable water currently being used for outdoor use. Appropriate treatment facilities may need to be built to treat the additional 570 acre-feet of water that ultimately would be produced by the Proposed Action, unless the new water would replace additional potable water used for outdoor use or the new water would be exchanged for ground water requiring no treatment.

Figure 2-2 shows how the proposed project's water supply would be used to augment existing local agricultural supplies. Curve 1 (crop consumptive use) shows the net irrigation requirement (crop water needs) for the project-eligible lands. This is the same as Curve 1 in figure 1-2. Curve 2 (diversion demand with efficiency improvements) shows the diversion demand that would result after implementing the planned efficiency improvements. (See Curve 3 in figure 1-2.) Curve 3 (local supply) shows the local supply, and Curve 4 (local and project supply) shows the local supply augmented by the project supply. Curves 5 (needs met local supply) and 6 (needs met local and project supply) show how the crop water needs would be satisfied by local supplies and local supplies augmented by project supplies. (Curve 5 is the same as Curve 6 in figure 1-2.)

As noted in section 1.4.2, under implementation of the Narrows Project, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand, assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early-season water needs. With the project water, the annual average shortage could be reduced to about 10,969 acre-feet per year or 21.1% of the diversion demand. With below average precipitation, the remaining shortage would be about 29,698 acre-feet per year or about 57.5%. In either case, the remaining shortage still would be considerably greater than the optimal 5% used for a planning target. Likewise, Curve 6 shows that even though project supplies would provide additional water, significant soil moisture deficits would still be a serious concern. The remaining shortage is great enough to warrant the pursuit of other measures to further improve irrigation efficiencies or augment water supplies.

Demand and Supplies Proposed Action

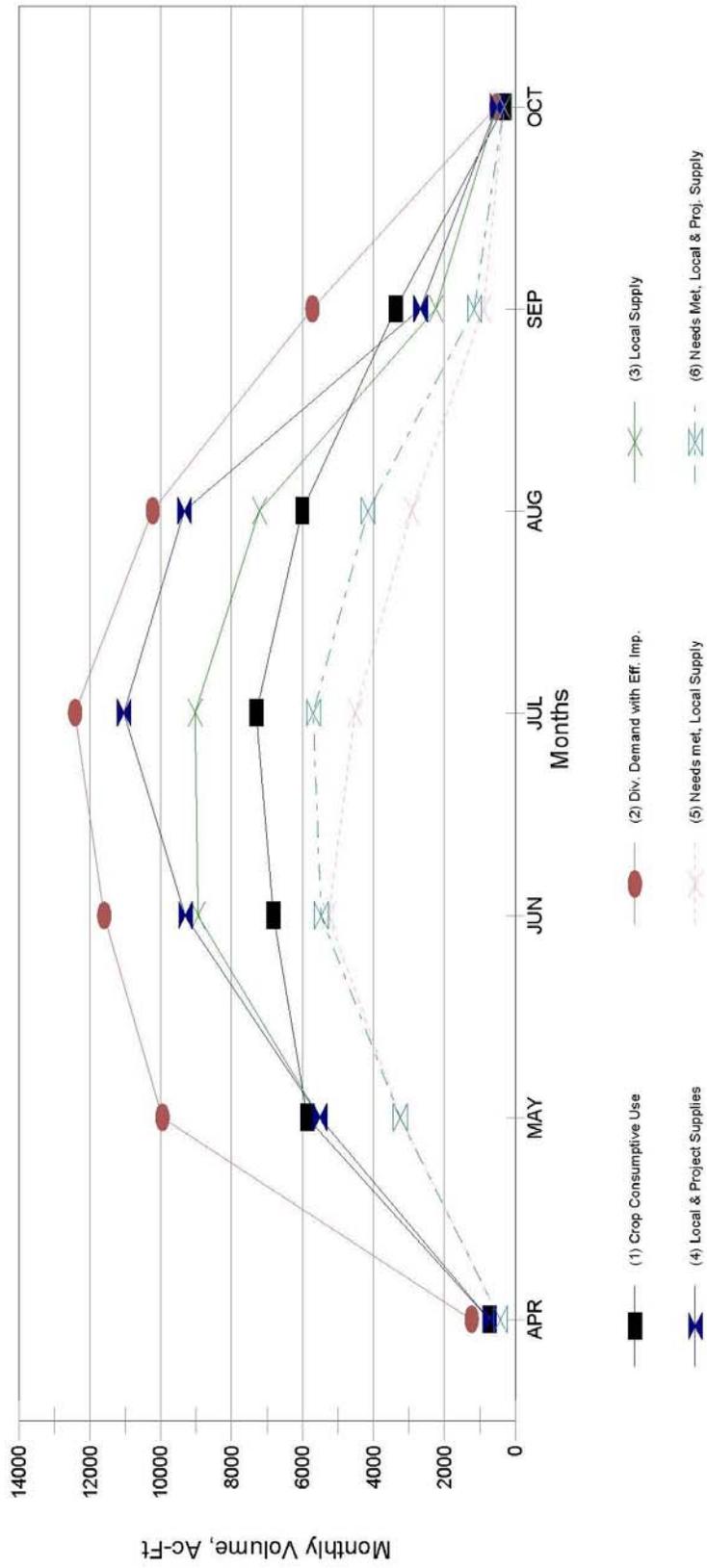


Figure 2-2.—Demand and Supplies, Proposed Action.

Section 1.4.2 discusses how implementing efficiency improvements would reduce the amount of irrigation water losses. The efficiency improvements would be expected to reduce water available to wetlands, aquatic habitat, and downstream users by up to 3,500 acre-feet per year. However, inefficiencies in project water would offset the 3,500-acre-foot-per-year reduction by about 1,820 acre-feet per year. This would result in a net loss to wetlands, aquatic habitat, and downstream users of about 1,680 acre-feet per year.

2.2.2.2 Construction Features and Project Operations

2.2.2.2.1 General

The principal construction features of the Narrows Project would consist of one reservoir and three pipelines. Narrows Dam and Reservoir (figure 2-3) would be constructed on Gooseberry Creek and would provide storage for the project water supply. Oak Creek Pipeline would convey water from an existing diversion dam located on Cottonwood Creek northward to the Oak Creek Irrigation Company, north of the community of Fairview. The East Bench Pipeline would convey project water from the same existing diversion dam on Cottonwood Creek southward to areas of use along the east bench. Upper Cottonwood Creek Pipeline would carry project water from the Narrows Tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork to protect the stream channel above that point from increased flows that would occur without the pipeline.

Other important features of the project would include rehabilitating the existing Narrows Tunnel; relocating SR-264; modifying parts of Forest Development Road (FDR) Nos. 50124, 50150, and 50225;

and modifying the snowmobile parking area along FDR No. 50150. Recreation facilities, primarily for boating, fishing, camping, and picnicking, would be provided at Narrows Reservoir to help satisfy projected recreation needs in the area. Title to the dam and appurtenant water facilities would be in the name of SWCD. Title to the land underlying those facilities and associated recreation facilities would remain in the name of the United States and under Reclamation management.

Specific proposed fish and wildlife mitigation measures include the following:

- ◆ Restoring year-round flows in two small tributaries to Gooseberry Creek (above the proposed Narrows Reservoir); providing minimum instream flows of 1.0 cubic feet per second (cfs) in Gooseberry Creek below Narrows Dam.
- ◆ Providing a multiple-level outlet at Narrows Dam to regulate the temperature of releases to Gooseberry Creek from Narrows Reservoir.
- ◆ Modifying and/or stabilizing streambanks and associated riparian zones along Middle Gooseberry Creek.
- ◆ Providing releases from the Narrows Reservoir into Gooseberry Creek for flushing flows and for fish habitat during critical periods.
- ◆ Acquiring and/or improving stream channel for fish habitat (Middle Gooseberry Creek).
- ◆ Providing winter releases to Cottonwood Creek.
- ◆ Providing summer flows in lower Cottonwood Creek.

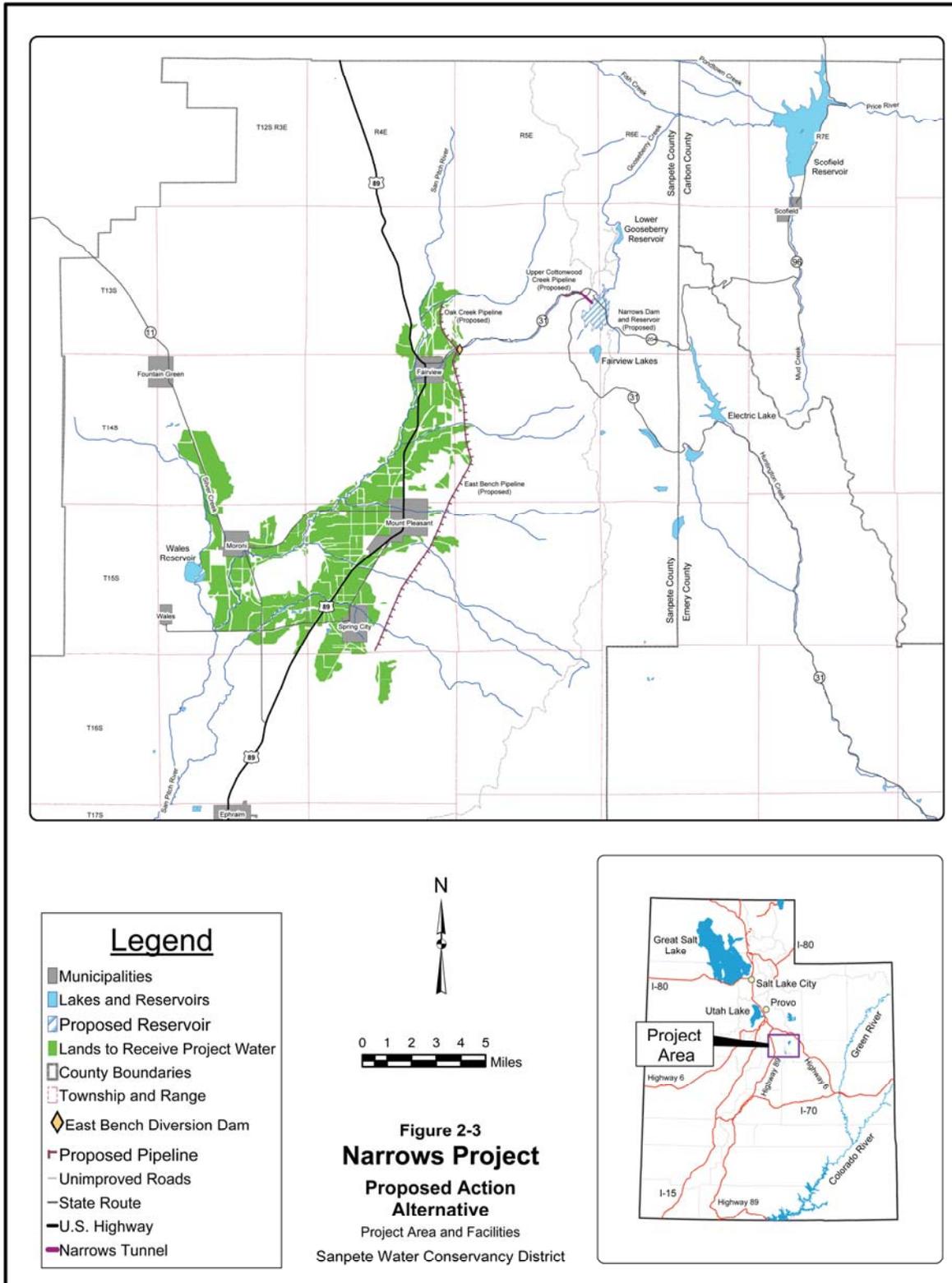


Figure 2-3.—Narrows Project, Proposed Action, Project Area and Facilities.

- ◆ Constructing a pipeline in the upper Cottonwood Creek area to convey project water outside the stream channel (from the tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork).
- ◆ Providing a minimum 2,500-acre-foot conservation pool in Narrows Reservoir for fish.
- ◆ Reducing external phosphorus loading to Scofield Reservoir.
- ◆ Providing mitigation and enhancement of upland habitat (quantified in terms of mule deer and Brewer's sparrow habitat units, each of which represent other wildlife species dependent on similar habitat) in the following ways:
 - Acquiring conservation easements around the Narrows Reservoir
 - Acquiring and fencing land adjacent to the Price River below Scofield Reservoir to protect wildlife habitat
 - Creating new wetlands and enhancing existing wetlands to mitigate for 100 acres of wetlands areas inundated by the reservoir and affected by changes in the stream channels

2.2.2.2.2 Design and Operation

2.2.2.2.2.1 Narrows Dam and Reservoir.—

Narrows Dam and Reservoir would be constructed on Gooseberry Creek, about 9 miles east of Fairview, Utah (see figure 2-3). The dam would be a zoned earthfill embankment structure using locally available earth material. The surface elevation of the proposed reservoir would be at 8,690 feet mean sea level (msl). The embankment would have 3:1 (horizontal to vertical) slopes upstream and downstream. The proposed crest width of 30 feet would allow SR-264 to cross the dam. The

embankment zones would consist of a relatively impervious core, a random zone both upstream of and downstream from the core, and a rockfill zone on the upstream face for slope protection. The embankment would contain an estimated total volume of 363,000 cubic yards of material. The dam would be designed to withstand effects induced by seismicity associated with mining of the coal reserves east of the East Gooseberry Fault (approximately 1 mile away).

Narrows Reservoir would have two main outlets, the Gooseberry Creek outlet and the Narrows Tunnel outlet. The Gooseberry outlet would be constructed through the dam to provide downstream releases for fisheries and emergency evacuation of reservoir water. This outlet would have a 305-cfs capacity. Multiple intakes would be provided to allow temperature control of water released to Gooseberry Creek. The Narrows Tunnel outlet would accommodate releases through the mountain ridge for the transmountain diversion and would have a 60.0-cfs capacity.

Preliminary designs for the dam call for separate low flow intakes at three different levels within the reservoir. These intakes would have their own gates and would be able to deliver up to a 10-cfs release each, even when the main outlet was being inspected or maintained.

The spillway would be a drop inlet (morning glory, so called because of its resemblance to the shape of the flower) structure and would have a 775.0-cfs discharge capacity. The probable maximum thunderstorm flood could be safely stored in the reservoir without overtopping the dam. However, the spillway capacity, combined with that of the two outlet works, would protect the dam against the 100- and 10,000-year snowmelt floods.

The reservoir formed behind the dam would extend about 2 miles up Gooseberry Creek

and would have a total capacity of 17,000 acre-feet and a water surface area of about 604 acres. All of the average annual storable flows (excluding Fairview Lakes) to the reservoir, about 8,185 acre-feet, would come from the Gooseberry Creek drainage.

Narrows Reservoir's active capacity, or that portion of stored water that would be used to satisfy project water needs, would consist of 14,500 acre-feet. Of this amount, 4,500 acre-feet would be dedicated to providing instream flows in Gooseberry Creek below the dam. The dead and inactive capacities of about 2,500 acre-feet would form the reservoir's minimum pool and would not be drawn upon to benefit recreation and fishing use at the reservoir (the 2,500 acre-feet of storage is inactive because it is below the elevation of the tunnel and cannot be diverted to Sanpete Valley).

The proposed reservoir is designed for long-term carryover storage. The dead and inactive storage would be more than adequate to store the 100-year inflow of sediment into the reservoir. Less than 20 acre-feet of sediment would accumulate in a 100-year period, which is less than 1% of the inactive capacity. A summary of the design data for the proposed Narrows Dam and Reservoir, two structural alternatives, and the No Action Alternative is shown in table 2-2.

Narrows Reservoir would fluctuate on a seasonal basis as water is released during the irrigation season. The drawdown would average 9 feet annually. On an average basis, the exposed shoreline area would be 113 acres. This is the difference between the average annual high water surface area and the average annual low water surface area.

Automated flow measurement devices would be installed to collect data in real time using radio or satellite communications. These devices would measure flow at the following locations:

- ◆ Discharges from Fairview Lakes
- ◆ Discharge from Narrows Dam to Gooseberry Creek
- ◆ Flow of Gooseberry Creek at USDA Forest Service campground
- ◆ Discharge from Narrows Tunnel
- ◆ Flow of Cottonwood Creek near the mouth of the canyon

These data would be made available to the public on an Internet Web site.

2.2.2.2.2.2 Oak Creek Pipeline.—The Oak Creek Pipeline would be a 10-inch-diameter polyvinyl chloride (PVC) buried pipeline with a capacity of 2.5 cfs and a length of 2.5 miles. The pipeline would convey water from an existing diversion dam on Cottonwood Creek to the Oak Creek Irrigation Company, north of Fairview. A right-of-way 30 feet wide and 2.5 miles long would be required.

2.2.2.2.2.3 East Bench Pipeline.—The East Bench Pipeline would convey project water from an existing diversion dam on Cottonwood Creek southward to areas of use along the east bench. The pressurized pipeline would have a total length of 13.5 miles (see figure 2-3) and would have a 21.5-cfs capacity at its head. The pipeline would include 1.4 miles of reinforced concrete pipe, 4.2 miles of concrete cylinder pipe, and 7.9 miles of PVC pipe. Pipe diameters would range from 27 to 18 inches.

The pipeline would deliver water to the Spring Creek, Birch Creek, North Creek, Pleasant Creek, Twin Creek, Cedar Creek, and Horseshoe Irrigation Companies. Water delivered to each irrigation company would be discharged from the pipeline into the existing regulating pond for each company's pressurized irrigation system. This pipeline would also have a 30-foot-wide right-of-way.

Table 2-2.—Summary of Design Data for Narrows Project for All Alternatives

Item	Unit	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
Dam					
Height	feet	N/A	120	110	100
Crest length	feet	N/A	550	475	425
Crest width	feet	N/A	30	30	30
Material volume	cubic yards	N/A	363,000	292,000	220,000
Discharge capacity					
Outlet works	cfs	N/A	305	258	210
Spillway	cfs	N/A	775	775	775
Spillway elevation	msl	N/A	8,690	8,680	8,670
Reservoir capacity					
Active storage	acre-feet	N/A	14,500	9,950	5,400
Inactive and dead storage	acre-feet	N/A	2,500	2,500	2,500
Total	acre-feet	N/A	17,000	12,450	7,900
Surface area					
At top of active capacity	acres	N/A	604	489	362
At top of inactive and dead capacity	acres	N/A	144	144	144
Average during recreation season	acres	N/A	454	277	238
Drawdown					
Average annual	feet	N/A	9	11	14
Average during recreation season	feet	N/A	8	10	11
Maximum	feet	N/A	26	30	22
Average annual	acre-feet	N/A	3,974	3,773	3,478
Average during recreation season	acre-feet	N/A	3,512	3,300	3,007
Pipelines					
Oak Creek					
Length	miles	N/A	2.5	2.5	2.5
Capacity	cfs	N/A	2.5	2.5	2.5
Diameter	inches	N/A	10	10	10
East Bench					
Length	miles	N/A	13.5	13.5	13.5
Capacity	cfs	N/A	21.5	21.5	21.5
Diameter	inches	N/A	27–18	27–18	27–18
Upper Cottonwood Creek					
Length	miles	N/A	0.8	0.8	0.8
Capacity	cfs	N/A	50	50	50
Diameter	inches	N/A	30	30	30
Narrows Tunnel rehabilitation					
Length	feet	N/A	3,100	3,100	3,100
Capacity	cfs	N/A	60	60	60
Diameter	inches	N/A	36	36	36
SR-264 relocation					
Length	miles	N/A	2.9	2.9	2.9
Width	feet	N/A	24	24	24

2.2.2.2.2.4 Upper Cottonwood Creek Pipeline.—A 50.0-cfs capacity, reinforced concrete pipeline would be constructed from the existing transmountain Narrows Tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork. The 30-inch-diameter pipeline would carry project water outside the stream to prevent damage to the channel. The pipeline would be constructed in the shoulder of SR-31 and would have a length of about 0.8 mile.

At the Narrows tunnel outlet, a control structure would divide the flow, allowing for releases into Cottonwood Creek to maintain minimum instream flows and improve the fishery, while the remainder of the flow would be conveyed to the pipeline. The pipeline flow would be discharged into Cottonwood Creek 300 feet downstream from the confluence with Left Hand Fork, where an energy dissipation structure would be constructed to reduce flow velocity and control streambed degradation. Energy dissipation would be provided before flows were discharged into Cottonwood Creek. A highway right-of-way 30 feet wide and 0.8 mile long would be required. About half of this right-of-way would be on Reclamation withdrawn lands and the other half on privately owned lands.

The possibility of extending Upper Cottonwood Creek Pipeline the entire length of the canyon was also explored; but, due to the topography and geology of the canyon, such a pipeline would be infeasible and potentially environmentally damaging. A total of 104 landslides, most of which are active, have been mapped in the canyon. The topography of the canyon suggests that the most likely location for the pipeline would be within the existing highway alignment. However, due to the landslides, the highway has continual stability problems; and repairs are needed on an annual basis. This

instability would present unacceptable safety and maintenance problems for the high-pressure pipeline. Construction of the pipeline also would increase significantly project costs and costs to water users.

2.2.2.2.2.5 Narrows Tunnel

Rehabilitation.—The Narrows Tunnel is an existing water conveyance tunnel approximately 3,100 feet long. The 8-foot-diameter tunnel, which was completed in 1968, was constructed to divert irrigation water to the Fairview area and eventually to serve as the outlet for Narrows Reservoir. The tunnel was not concrete lined as planned; and since its construction, the tunnel has experienced severe stability problems. Steel sets with wooden lagging were installed in selected areas of the tunnel to support the unstable areas. The steel sets, however, were widely spaced; and loose rubble significantly loaded the wooden lagging between sets. With time, the lagging began to fail, permitting roof and rib sloughing over significant portions of the tunnel. When it became evident that the tunnel could eventually close, a 36-inch corrugated metal pipe was installed through the least stable tunnel sections to maintain a waterway. This measure is considered to be only a temporary fix because the CMP eventually would collapse due to rust or excessive earth loads.

The tunnel rehabilitation would be accomplished by mucking out the tunnel and installing steel sets and lagging for temporary support. Once the tunnel is fully open and clear, a 36-inch-diameter reinforced concrete pipe would be installed through the tunnel and backfilled to a height of 1 foot above the top of the pipe. The backfill would provide lateral pipe support and protect the pipe from impact loads in the event that the temporary tunnel support deteriorated in the future. Alternatively, the tunnel could be lined completely with shotcrete in lieu of the concrete pipe and backfill. A control gate

would be installed near the tunnel inlet to regulate releases through the tunnel. Following rehabilitation, the tunnel would have a 60-cfs discharge capacity.

Remote control of the Narrows Tunnel operating gate would be provided to regulate automatically the releases through the tunnel. These controls would be coupled to an automated stream gauging station on Cottonwood Creek. The streamflow in Cottonwood Creek would be monitored constantly by these controls. As the streamflow increased during high runoff events such as thunderstorms, the tunnel operation would be discontinued when the flow exceeded 100 cfs near the mouth of the canyon. An automated gauging station would measure flow data and communicate with an automated gate controller at the tunnel. Under this operating regime, the project flows through the tunnel would not increase streamflows above what is considered safe for channel stability. Increased flows under project conditions would be well below the 50-year channel-forming discharge.

2.2.2.2.2.6 State Route 264 Relocation.—Narrows Reservoir would inundate about 0.8 mile of SR-264, which provides access between Fairview and Scofield, Utah. Under the proposed project, this road would be routed around the perimeter of the existing snowmobile parking area. The road would be relocated to include 0.3 mile of FDR No. 50150 and No. 50124 (gravel road) to Lower Gooseberry Reservoir and by constructing 2.6 miles of new road and providing asphalt surfacing for the entire length of the relocation. This new road would cross Narrows Dam. The road relocation would increase the travel distance between Fairview and Scofield by 1.2 miles. The relocated road would have a total pavement width of 24 feet and would be designed to the same standard as the existing road.

2.2.2.2.2.7 Recreation Facilities.—Public recreation facilities for the Narrows Project would be located along the northwest shore of Narrows Reservoir (see figure 2-3). The facilities would include a boat ramp, boat slips, a day use area with 10 picnic sites, restroom facilities, and a 60-unit campground. Access for the handicapped would be provided. All recreation facilities and water systems (nonsurface source) would be constructed to USDA Forest Service standards. The water source for the recreation facilities would be required to meet State of Utah drinking water standards. Although a formal agreement has not been reached, it is anticipated that USDA Forest Service would administer the recreation facilities at the Narrows Reservoir under an operation agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.2.2.3 Fishery Measures

A total of 11 fishery mitigation measures have been included in the project to mitigate for adverse impacts. To the extent possible, an attempt was made to mitigate “in place” and “in kind.”

2.2.2.2.3.1 Restore Streamflow in Gooseberry Creek Tributaries.—

Implementing this aquatic mitigation procedure would consist of altering the release of water from Fairview Lakes, which are owned and operated by CGIC. Presently, during the spring runoff period, water is stored in Fairview Lakes and released for irrigation use in the Fairview area. This release is a transbasin diversion of water to the San Pitch River drainage. With the historic operational pattern, the small unnamed tributaries to Gooseberry Creek located downstream from Fairview Lakes are dry several months each year. This

mitigation measure involves providing year-round releases, averaging about 2.6 cfs, from Fairview Lakes into two of these tributaries to Gooseberry Creek. This amounts to a 1.3-cfs average flow per channel. The total annual amount of water that is released from Fairview Lakes would not be changed. However, the flow would be dispersed during the entire year rather than the present 18- to 20-week discharge period, resulting in a higher water level in the lakes for more of the irrigation season.

Water released from Fairview Lakes during the year would be captured and stored in Narrows Reservoir. Upon notification by the CGIC, the Fairview Lakes water in Narrow Reservoir would be released through the Narrows Tunnel to the San Pitch River drainage.

This mitigation measure would provide not only aquatic mitigation benefits to the Narrows Project but also both aesthetic and recreational benefits to Fairview Lakes. These benefits would be a result of CGIC being able to maintain the lakes at higher water levels during more of the prime summer recreational season.

SWCD would be responsible for entering into operating agreements necessary to implement these year-round releases. SWCD also would ensure that the releases were made according to environmental commitments. Approval of a loan under the SRPA would be contingent upon securing these agreements with CGIC and an endorsement of the environmental commitments by SWCD.

Implementing this mitigation measure would result in creating approximately 2.3 stream miles of spawning and rearing habitat for cutthroat trout.

2.2.2.2.3.2 Provide Minimum Flows Below Narrows Dam.—The project plan calls for a 1.0-cfs minimum year-round release from

Narrows Reservoir to Gooseberry Creek. That flow, combined with flows from springs located immediately below the dam, would be expected to produce a streamflow of at least 1.5 cfs at the Gooseberry Campground. If the flow at the campground is less than the expected 1.5 cfs, then up to an additional 0.25 cfs would be released to help achieve that flow rate.

2.2.2.2.3.3 Provide a Multiple-Level Intake at Narrows Dam.—A multiple-level intake would be provided at Narrows Dam to regulate the temperature of water released to Gooseberry Creek. Each of the three intakes, planned at elevations 8,640; 8,660; and 8,680 feet, would be designed with a 10.0-cfs capacity.

2.2.2.2.3.4 Stabilize Streambanks Along Middle Gooseberry Creek.—This mitigation measure would involve modifying Gooseberry Creek channel between Lower Gooseberry Reservoir and Narrows Dam to provide better habitat with the reduced flows. It is expected that the channel eventually would narrow by itself due to the decreased flow. However, to expedite the process, certain manmade improvements would be made.

Two alternative methods of accomplishing this mitigation measure were considered. The first method, which was eliminated from consideration due to its more invasive approach, would involve using earthmoving equipment to place fill material within the existing high water line of the stream to narrow the channel.

The second and selected alternative method would involve a less intrusive approach, which would consist of installing a variety of fish habitat enhancement structures in the existing stream channel. These structures could include cover logs, depositional structures, organic riprap treatments, rock clusters, rock deflectors, and rock weirs.

Example sketches of several of these enhancement structures are shown in figures 2-4 to 2-7. The objectives of these various structures would be to provide new pool habitat, hiding cover, high flow refuge area, scour holes, and spawning habitat for trout as well as a minimum level of channel erosion control.

Prior to SWCD constructing these improvements, SWCD would coordinate with the USDA Forest Service, Service, USACE, Utah Division of Wildlife (UDWR), and Utah Division of Water Rights. A qualified fluvial geomorphologist would develop a detailed plan based on the second alternative described above. A 200-foot-wide right-of-way corridor also would be acquired where the stream runs through private land. Fencing also would be provided where needed to protect the stream from livestock. Middle Gooseberry Creek would be used as spawning and rearing habitat for cutthroat trout.

2.2.2.2.3.5 Provide Flushing Flows and Other Releases to Gooseberry Creek.—The project would provide releases from Narrows Reservoir to Gooseberry Creek in excess of the minimum 1.0-cfs release described above. These additional releases would be used to provide additional instream flows or to flush accumulated silt and fine sediments from the streambed to enhance spawning habitat. UDWR has expressed interest in using this water to provide additional inflow to Lower Gooseberry Reservoir during the critical winter period when DO levels in the reservoir are low. The project would provide an average of 300 acre-feet per year of additional water for release to Gooseberry Creek. This water, released from carryover storage in Narrows Reservoir, could be used for fish habitat or flushing flows. The annual volume of 300 acre-feet could be released each year in a single event, or the water could be stored in the reservoir for multiple

years to provide a larger magnitude or longer duration flush. In cooperation with UDWR, SWCD would determine the timing and quantity of water to be released each year. Because this water would be released to Gooseberry Creek, it would not count against the 5,400-acre-foot maximum transbasin diversion.

2.2.2.2.3.6 Acquire and/or Improve Stream Segments.—This measure would involve improving fishery habitat and/or fencing 11.5 miles of stream in the Price River drainage. Most of these stream segments are on private land; and, therefore, approximately 206 acres of right-of-way, that is a corridor averaging approximately 200 feet wide, would need to be acquired. Fishery habitat improvements such as riparian plantings and some minor channel work would be performed. As part of the 11.5 miles of habitat improvement, about 2 miles of stream would be improved in conjunction with the wetland restoration; and 1 mile of stream would be improved by providing fencing in conjunction with acquiring 640 acres of wildlife habitat adjacent to the Price River below Scofield Reservoir. The various parcels of land would be contiguous with other public lands and would be managed in conjunction with those public lands. Memoranda of agreement (MOAs) would be required between the SWCD and the managing agencies.

Where appropriate, the corridor would be fenced with a four-strand, barbed wire fence, topped with a rail to protect the streambanks and riparian zone from damage caused by grazing. Where the adjacent land is used for grazing, selected stream access points for livestock watering or other alternative livestock watering means would be provided. Stream crossings also would be provided as needed. Table 2-3 lists stream segments that have been recommended for this measure and

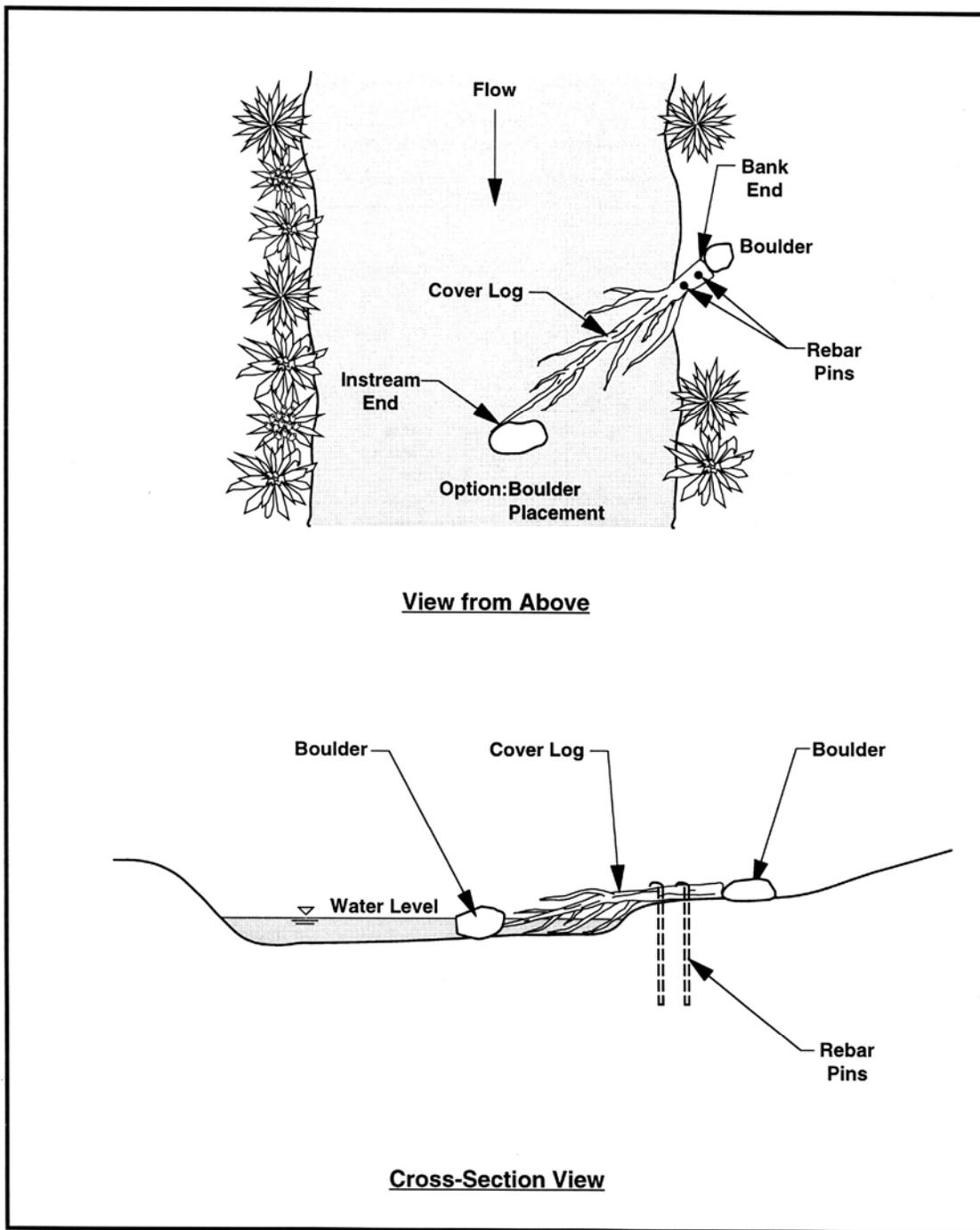


Figure 2-4.—Schematic of Cover Log Structure.

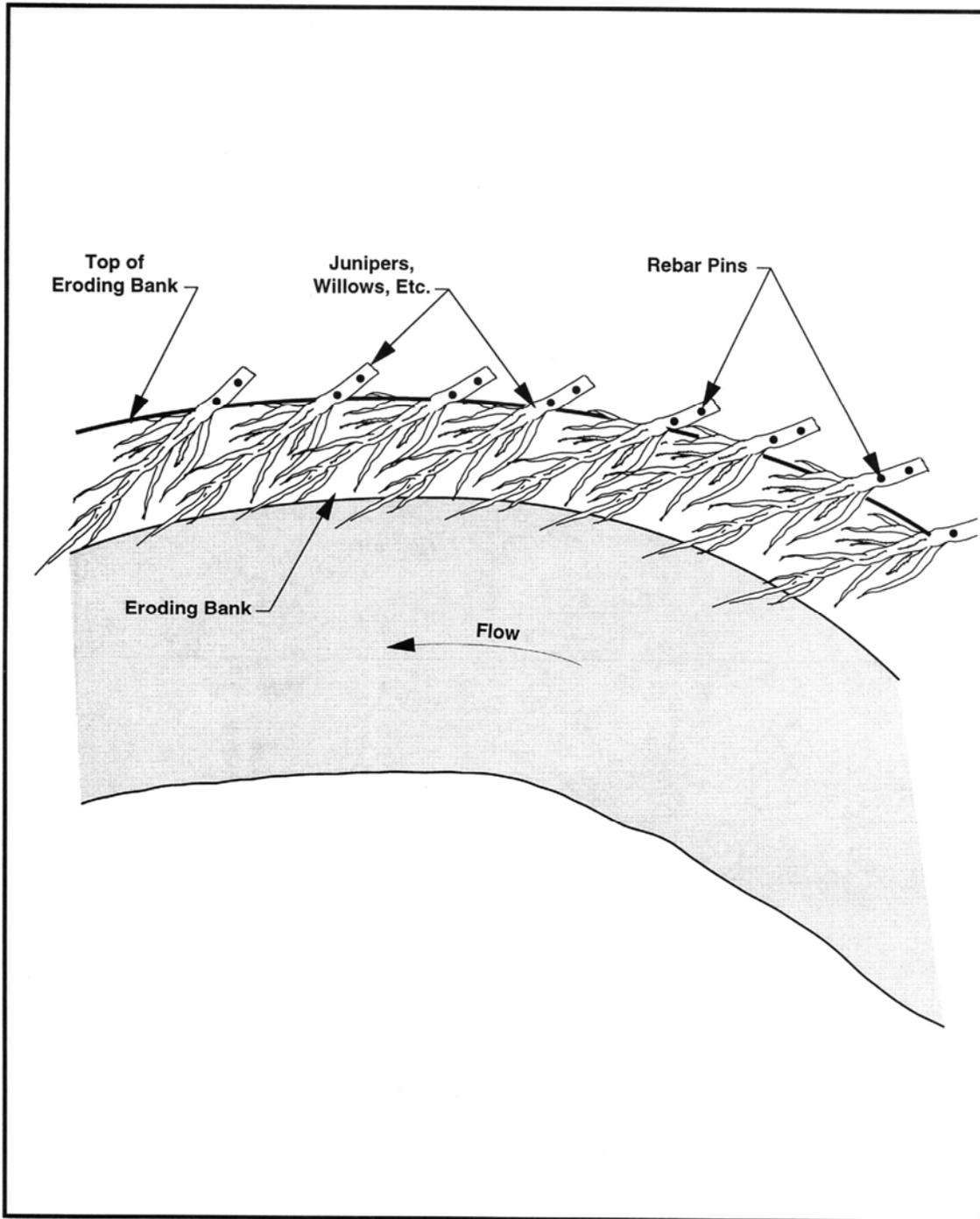


Figure 2-5.—Schematic of Organic Riprap.

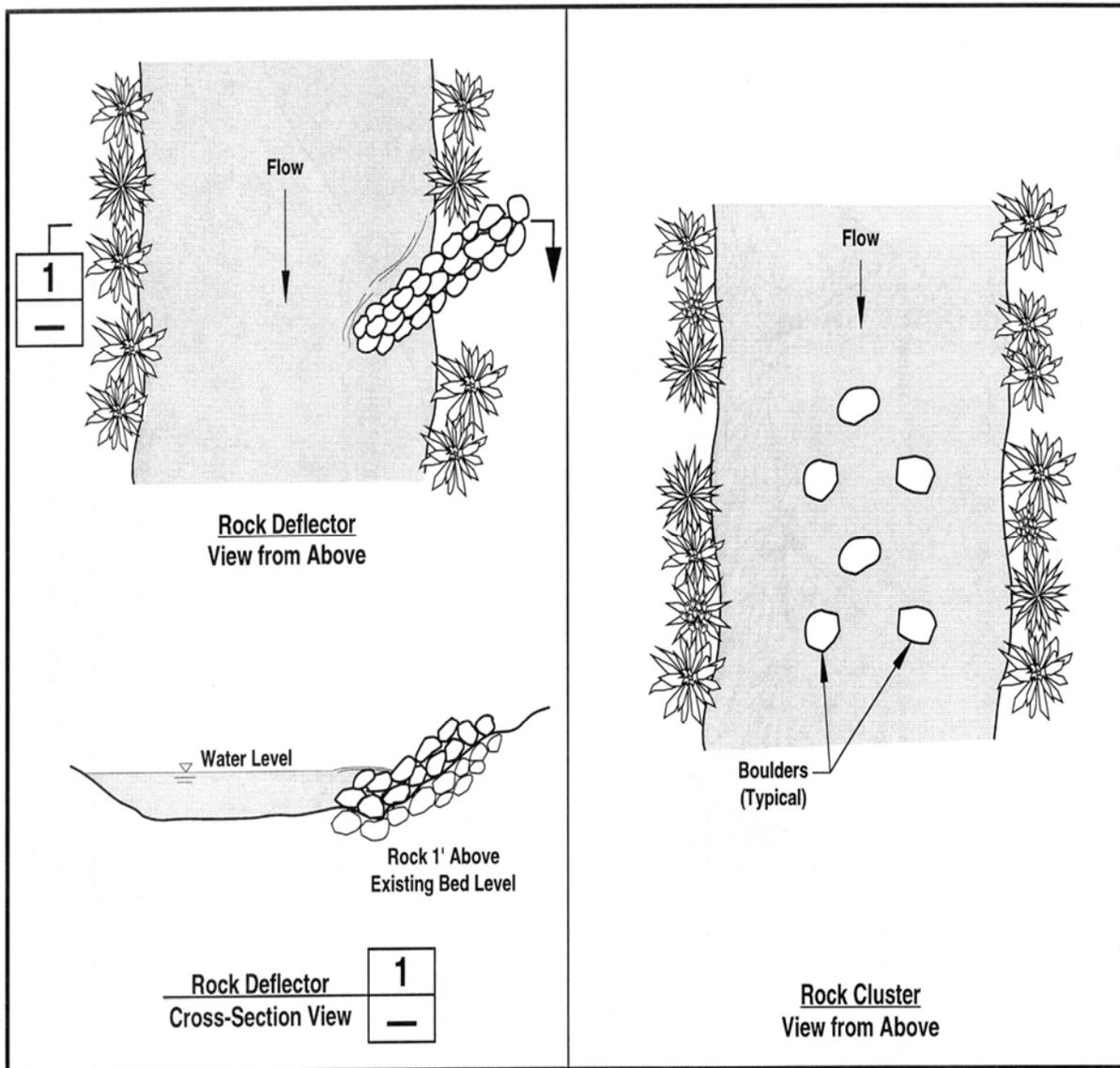


Figure 2-6.—Schematic of Rock Deflector and Rock Cluster.

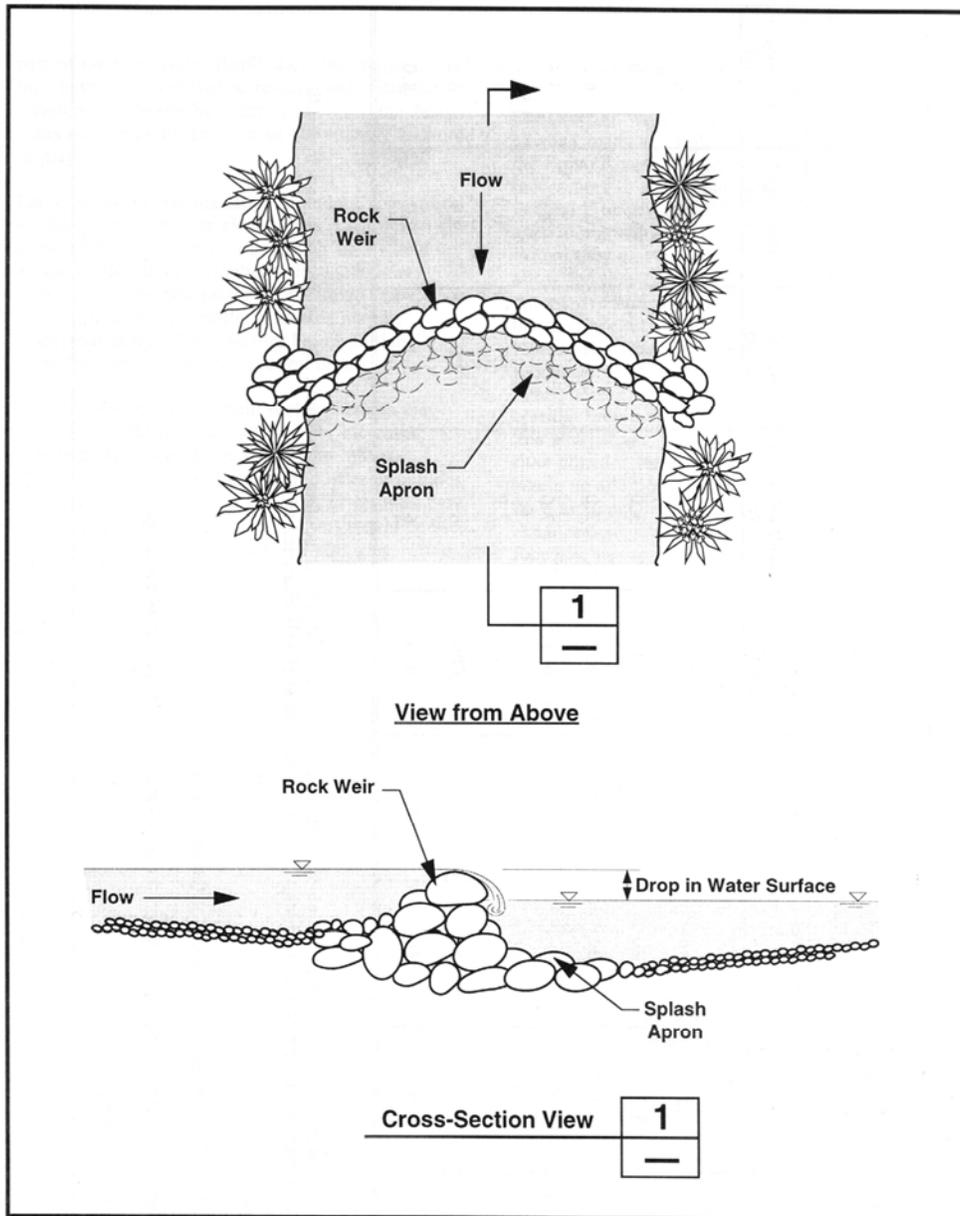


Figure 2-7.—Schematic of Rock Weir.

Table 2-3.—Stream Segments To Be Acquired and/or Improved for Fishery Habitat Proposed Action

Stream Reach	Length of Stream (miles)	Proposed Managing Agency
Price River Basin		
Mud Creek	4.0	UDWR
Winterquarters Creek	2.5	UDWR
Pondtown Creek	2.0	USDA Forest Service
Fish Creek above Scofield Reservoir	1.0	USDA Forest Service
Price River below Scofield Reservoir	2.0	UDWR

the proposed managing agencies. If necessary, additional parcels would be identified and evaluated to achieve the mitigation goal. The streams improved and protected under this measure would provide habitat for all life stages of cutthroat, rainbow, and/or brown trout. The improvements also would enhance wildlife habitat and water quality. A monitoring program would be established to ensure that the stream segments were acquired, improved, fenced, and maintained as planned.

2.2.2.2.3.7 Provide Winter Releases to Cottonwood Creek.—A release sufficient to provide a 2.0-cfs minimum flow at the confluence of Cottonwood Creek and Left Hand Fork would be made from Narrows Reservoir to Cottonwood Creek to increase the available fish habitat. Water released during the winter months would be stored in Wales Reservoir on a space-available basis. Wales Reservoir is a small reservoir that stores winter runoff from the Upper San Pitch River drainage, including Cottonwood Creek drainage.

2.2.2.2.3.8 Provide Summer Flows in Lower Cottonwood Creek.—Water would be released in lower Cottonwood Creek at the Cottonwood Canyon mouth to provide 2.0-cfs minimum instream flows at that location.

This measure would provide year-round flows in the stream that would support fish habitat, create a fishery, and enhance the wetland and riparian corridor. In the past, this segment of stream historically has been dewatered during the irrigation season.

2.2.2.2.3.9 Construct Upper Cottonwood Creek Pipeline.—Upper Cottonwood Creek Pipeline would be constructed as described in the previous section 2.2.2.2.4.

2.2.2.2.3.10 Provide a Minimum 144-acre Conservation Pool in Narrows Reservoir.

—A minimum pool with a surface area of 144 acres containing 2,500 acre-feet of water would be provided in Narrows Reservoir for fish habitat and propagation. This pool would not be drawn upon for project use. At minimum pool, the reservoir would have a maximum depth of 58 feet; and approximately 53 acres of the reservoir would be at least 20 feet deep.

2.2.2.2.3.11 Reduce External Phosphorus Loading to Scofield Reservoir.—This measure would help improve water quality in Scofield Reservoir by reducing phosphorus loading and would be implemented in conjunction with improving stream segments on tributary streams above Scofield Reservoir. About 9.5 miles of stream segments would be improved. The improvements would consist of bank stabilization, primarily through riparian plantings. Where grazing would occur, the stream segments would be fenced to protect them from potential impacts.

This measure would reduce the amount of sediment and animal waste and, hence, the amount of phosphorus flowing into the reservoir. Historically, fish kills have occurred in Scofield Reservoir due to poor water quality. Phosphorus has been identified as the limiting nutrient in the eutrophication of the reservoir. Phosphorus loading occurs from several factors, including inflow of

sediments that are naturally high in phosphorus and animal waste. In a report entitled *Scofield Reservoir Restoration Through Phosphorus Control*, the Utah Division of Water Quality concluded that:

“The most pragmatic and effective means to control the further eutrophication of Scofield Reservoir, or possibly to effect a moderate reversal of the eutrophication process, appears to be a reduction of the phosphorus load to the lake.”

SWCD would have primary responsibility for implementing all fishery measures described above. SWCD would be responsible for funding and acquiring all lands and rights-of-way and would fund and construct all improvements, such as fencing and stream channel improvements. SWCD would provide water from its water rights or enter into operating agreements for all instream flows described above. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of fishery measures would be completed prior to initial filling of the reservoir. SWCD would be responsible to fund all operation and maintenance (O&M) costs of mitigation facilities. SWCD would be responsible to enter into a MOA with UDWR and other appropriate agencies for all fishery measures. The MOA would define clearly the roles and responsibilities of SWCD, UDWR, and other parties for implementing, monitoring, and maintaining the fishery measures.

2.2.2.2.4 Wetlands Measures

Wetlands measures would be included in the project to mitigate unavoidable adverse impacts to wetlands that have been identified with the project. Four alternative wetland

mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas are shown in figures 2-8, 2-9, and 2-10. A brief description of each alternative follows. Alternatives are listed in order of priority.

2.2.2.2.4.1 Enhance, Restore, and Create Wetlands Adjacent to Mud Creek Near Scofield Reservoir.

—This measure includes the purchase of approximately 220 acres of private land adjacent to Mud Creek, south of Scofield Reservoir. The approximate elevation of this site is 7,700 feet. Some of this land consists of former wetlands damaged by cattle, and the remainder is upland habitat. Existing wetland portions would revert to their natural wetland condition by removing the cattle and allowing the vegetation to grow. The remaining wetlands would be created by other methods (e.g., construction).

To implement wetland mitigation at the Mud Creek site, a preliminary study of the site would use the following steps:

1. Perform wetland delineation mapping of the site to determine the location and quantity of existing wetlands.
2. Install piezometers to determine ground water levels.
3. Install a temporary check dam with a series of piezometers to determine the effectiveness of using check dams to raise ground water levels.
4. Excavate test pits to determine soil types and stratification of soils.
5. Design mitigation measures based on data collection.
6. Perform HEP analysis to quantify premitigation habitat.

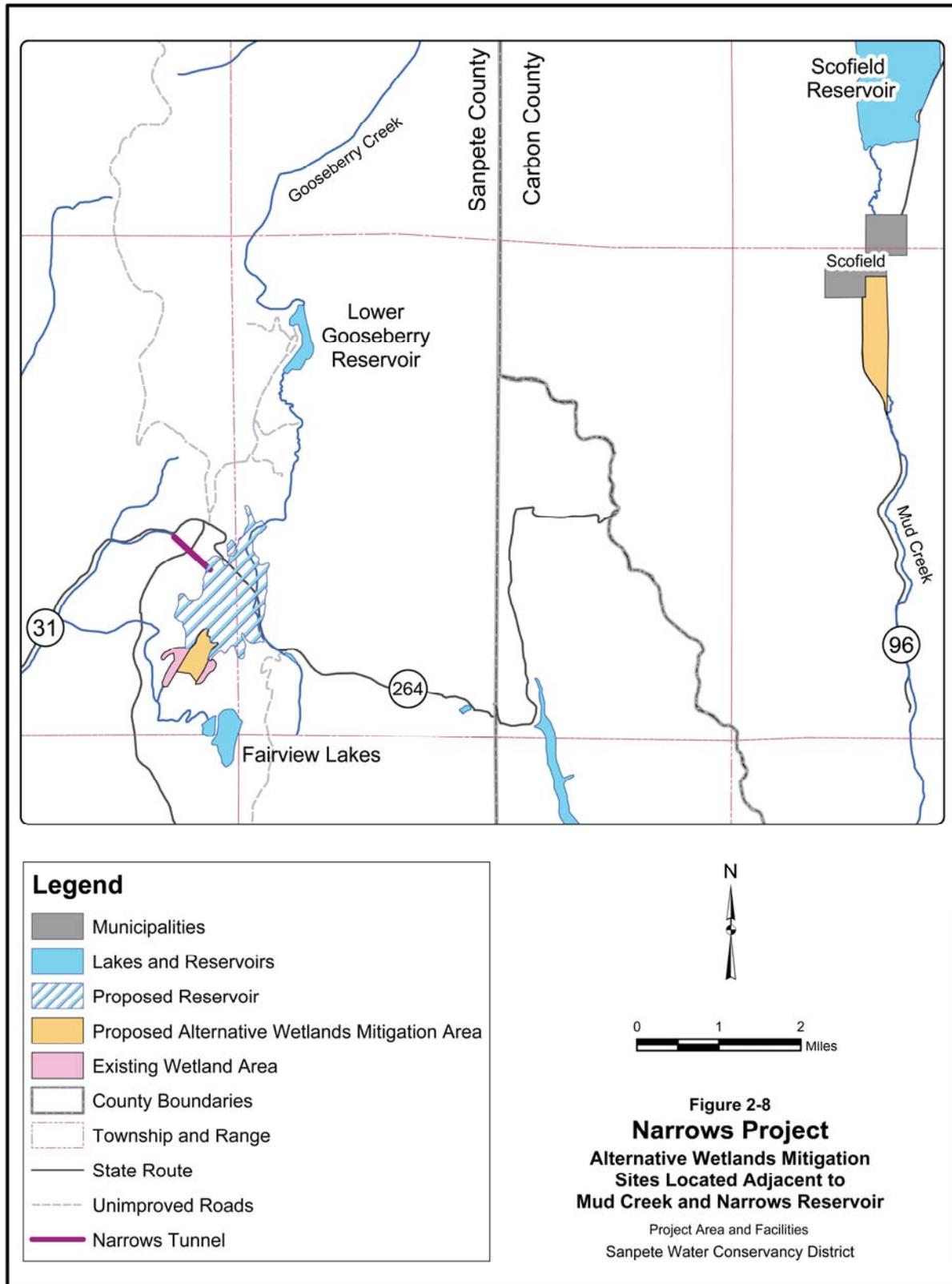


Figure 2-8.—Alternative Wetlands Mitigation Sites Located Adjacent to Mud Creek and Narrows Reservoir.

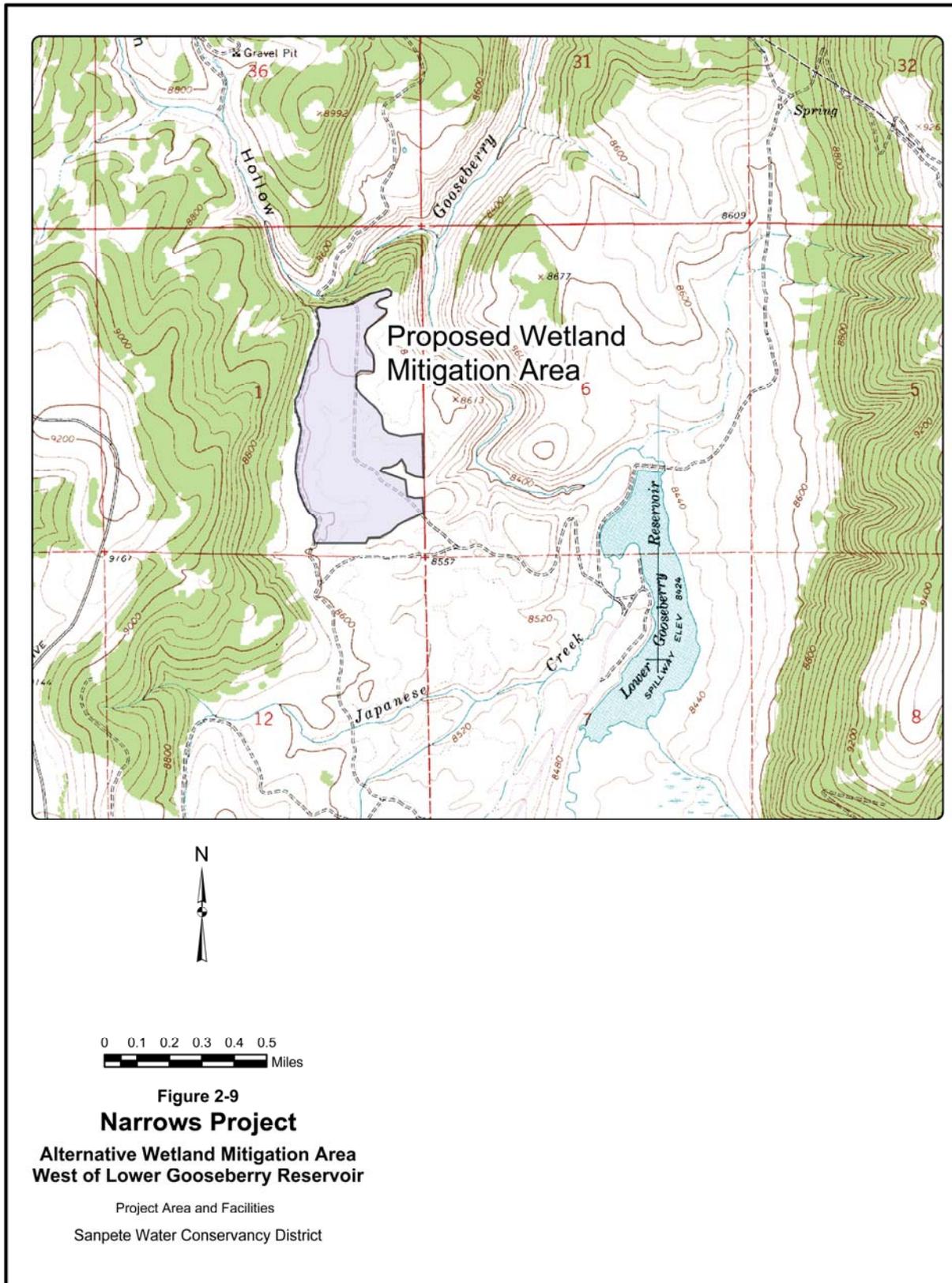


Figure 2-9.—Alternative Wetland Mitigation Area West of Lower Gooseberry Reservoir.

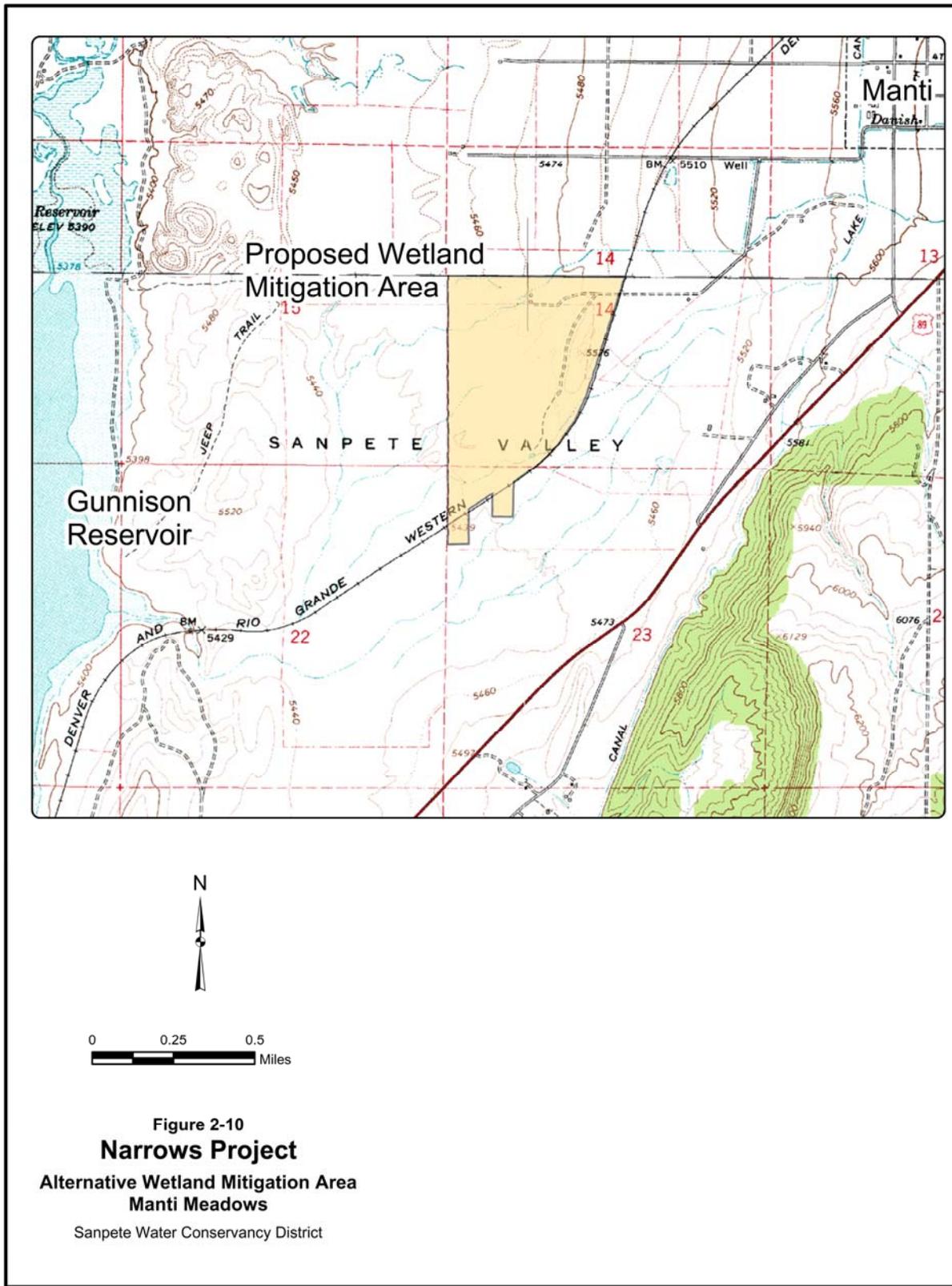


Figure 2-10.—Alternative Wetland Mitigation Area Manti Meadows.

The proposed design concept is to raise ground water levels by installing a series of check dams as explained in step 3. If the preliminary study shows that this is not a feasible option, reverse underdrains (buried perforated pipes) may be needed. This would expand the extent of saturated soils. Some minor recontouring may be required at this site. Also, wetland vegetation growth would be encouraged by transplanting suitable wetland species. All or a portion of the required mitigation could be performed at this site. The wetland area would be maintained by the SWCD under a MOA with UDWR (see figure 2-8).

2.2.2.2.4.2 Area West of Lower Gooseberry Reservoir.—This alternative would be developed near Lower Gooseberry Reservoir with an approximate elevation of 8,600 feet above msl. Approximately 120 acres of private land would be acquired west of the reservoir. The land currently is used for grazing sheep, and there are few existing wetlands. Water would be diverted from an existing diversion structure on Cabin Hollow, transported to the site through an existing open ditch, and would cause no additional adverse impacts to Cabin Hollow Creek.

The water planned for mitigation purposes is an existing diversion now used for pasture irrigation at the same site. The water would be diverted from the ditch at several locations and allowed to flow across the uplands and the surrounding wetlands. The existing wetlands on this site appear to have been created and maintained by the existing irrigation system.

Some earth work would need to be done to create small berms and swales that would create cells of wetlands. The area around the perimeter would be excavated somewhat deeper and to a 20-foot-minimum width and a wider width in some areas so that the edge of the swale is not abrupt but serpentine.

This deeper area would allow willows and other shrubs to be planted to create a vegetation barrier to the interior wetlands. The area still would be available for grazing and wildlife use. However, sheep would be deterred from entering the wetland by perimeter swale, which would eliminate the need for fencing the area and would allow access for wildlife.

This wetland would be maintained by SWCD under a MOA with UDWR, USACE, and USDA Forest Service.

2.2.2.2.4.3 Enlarge and Create New Wetlands Adjacent to Narrows Reservoir.—

This alternative would include enlarging existing wetland areas and creating new wetlands adjacent to Narrows Reservoir. Elevation of this site is approximately 8,800 feet above msl. At least 100 acres of new wetlands would be created adjacent to Narrows Reservoir by releasing water from Fairview Lakes to irrigate lands adjacent to existing wetlands. A new outlet from Fairview Lakes would be provided. The outlet would be designed to begin releasing water automatically once Fairview Lakes reached a certain level. The releases would stop as the water level receded in the fall. SWCD and CGIC jointly would develop a policy establishing how seasonal releases from Fairview Lakes would be coordinated to optimize system benefits. The water would be conveyed to and distributed within the wetland area by a system of open ditches. Some recontouring would be performed to ensure that the soils became saturated. All or a portion of the required wetland mitigation could be performed at this site alone. This wetland area would be maintained by SWCD under a MOA with UDWR and CGIC.

2.2.2.2.4.4 Manti Meadows.—Under this alternative, return flows from the Narrows Project in the San Pitch River drainage would be made available to UDWR to use at the Manti Meadows Waterfowl Management Area

located southwest of Manti. The elevation of this site is approximately 5,460 feet above msl. The water would be delivered by diverting Sixmile Creek water, which belongs to the Gunnison Irrigation Company and flows into Gunnison Reservoir, and delivering it to the Manti Meadows area through existing facilities belonging to the Manti Irrigation and Reservoir Company. Narrows Project return flows arising in the San Pitch River would be delivered to Gunnison Reservoir in exchange for the water delivered to Manti Meadows. The water would be used to create at least 100 acres of new wetlands and to improve wetland habitat values of existing wetlands in the area. Some excavation and ground re-contouring of existing uplands would be required to control drainage and encourage wetland development.

Wetland mitigation sites would provide similar functional value to that provided by the 100 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites was similar in function and equal in value to the wetlands lost. The method to determine this would be using HEP analyses or equivalent for the sites and comparing habitat values. The wetland monitoring plan would need to be designed to be re-evaluated after 4 years and continued for as long as necessary to ensure that, at a minimum, a replacement of lost habitat values had occurred.

SWCD would have primary responsibility for implementing wetlands measures described above. SWCD would be responsible for funding and acquiring all lands and rights-of-way. SWCD would provide and transplant any plantings needed. SWCD would be responsible to ensure that all fences are in good repair and are maintained properly. SWCD also would be

responsible to install and maintain any diversion and/or irrigation facilities. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of wetlands measures would be completed prior to initial filling of the reservoir. SWCD also would be responsible to fund the monitoring of the wetland mitigation. SWCD would be responsible to enter MOAs with UDWR, USACE, and other appropriate agencies for all wetlands measures. The MOAs would define clearly the roles and responsibilities of the SWCD, UDWR, USACE, and other parties for implementing and maintaining the wetland measures, including timeframes for future commitments such as fence maintenance. The MOAs would be required to be in place before the SRPA construction funds were dispersed.

2.2.2.2.5 Wildlife Measures

The wetlands measures previously described would offset any losses to wetland habitat caused by inundation. Impacts to upland habitat (mule deer and Brewer's sparrow habitat) would be mitigated by SWCD in the following ways:

- ◆ Acquisition of 150 acres of conservation easements adjacent to the Narrows Reservoir. These easements would impose restrictions on land use that would benefit impacted species. In addition, the conservation easements would provide a setback of about 500 feet on the west side of the reservoir for any new development or construction on private land adjacent to the reservoir.
- ◆ Acquisition of 640 acres of private land adjacent to the Price River below Scofield Reservoir. Wildlife values would be enhanced by providing 4 miles of fencing to protect the land from livestock grazing.

As with fishery mitigation, the goal of the wildlife mitigation would be to provide at least full mitigation for each impacted species.

As part of the conservation easements for the 150 acres adjacent to Narrows Reservoir, certain restrictions on the landowners' use of their lands would be needed. These restrictions would include prohibiting actions such as further construction of residential structures; commercial uses such as motels, cafes, hunting or fishing clubs, subdivisions, including the construction of sewers and septic tanks; livestock grazing; and storage or use of pesticides, herbicides, or chemical agents, either directly or indirectly lethal to wildlife. In addition, many of these lands would be made available to the general public for hunting, fishing, or other recreational uses without permit or fees charged by the landowners. Specific measures or restrictions would be developed individually as part of the easement negotiation process with each involved landowner.

As part of the wildlife mitigation plan, a monitoring program would be developed. Existing wildlife values on mitigation lands would be identified using the same models that were used to identify project impacts. These same models also would be used to measure the success of any wildlife mitigation programs. If the proposed mitigation programs are not as successful as anticipated, additional mitigation could be required. This procedure would apply to both wetland and upland wildlife habitat.

SWCD would have primary responsibility for implementing all wildlife measures described above. SWCD would be responsible for funding and acquiring all lands and easements. SWCD would provide native seed to supplement the USDA Forest Service-recommended seed mixture for the watershed and range improvement projects.

SWCD would fund, construct, and maintain all improvements such as fencing. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of wildlife measures would be completed prior to initial filling of the reservoir. SWCD would also be responsible for funding the mitigation monitoring. SWCD would be responsible for entering into MOAs with UDWR, USDA Forest Service, and other appropriate agencies for all wildlife measures. The MOAs would clearly define the roles and responsibilities of SWCD, UDWR, USDA Forest Service, and other parties for implementing and maintaining the wildlife measures. All parties would be required to sign the MOAs before SRPA construction funds were dispersed.

2.2.2.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-3. Most of the embankment material for the Narrows Dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry on Reclamation withdrawn land near SR-264. An alternative rockfill material quarry site is located on private land. Granular material for drains within the dam would be hauled from commercial pits in Sanpete Valley near Wales, Utah. Concrete for the outlet works, spillway, and other structures would be batched in Sanpete Valley and hauled to the damsite in transit mixers. Other materials such as pipe, steel gates and structures, electric motors, and operating and control equipment would be manufactured or processed outside the project area. The materials would be hauled to the construction sites by truck.

2.2.2.2.7 Lands for Project Features and Relocation

About 1,931 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. About 0.8 mile of SR-264 would be inundated by Narrows Reservoir, as described in section 2.2.2.2.2.6. The amounts of land by present ownership or administration and proposed project use are shown in table 2-4. There would be no relocation of persons, families, businesses, farms, or nonprofit organizations resulting from construction of the Narrows Project.

Approximately 225 acres of Reclamation withdrawn land would be used for project purposes. SWCD has acquired 366 acres of private lands for project uses from owners by perpetual easement or in fee. SWCD would purchase 1,340 additional acres of private and State School Trust lands for project needs.

The conservation area adjacent to the reservoir would be created through conservation easements. These lands would be administered by SWCD under a cooperative agreement with UDWR. To ensure proper management of easement lands needed to mitigate fish and wildlife losses attributed to the project, certain restrictions on the landowners' use of their

Table 2-4.—Proposed Action Right-of-Way Requirements for Project Features

Project Feature Type of Acquisition	Ownership or Administration		
	Private (acres)	Reclamation Withdrawal (acres)	Total (acres)
Narrows Dam and Reservoir	428	176	604
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	12	12
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	640	0	640
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	220	0	220
Materials source area ¹	0	2	2
Total	1,705.5	225.5	1,931

¹ Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

lands would be needed. Specific measures or restrictions, including those to protect fish and wildlife values, would be developed by UDWR as part of the easement negotiation process with each involved landowner. If adequate easements cannot be secured, a fee-title acquisition of the lands would be made.

2.2.2.2.8 Access to Features

Construction access is fairly good for all project features. The proposed damsite is near an existing paved highway. This highway would be adequate for hauling materials and equipment to the site. Temporary haul roads would need to be constructed within the reservoir basin to move material from the borrow area to the damsite.

2.2.2.2.9 Construction Program

Construction of the Narrows Project would be under the supervision of SWCD with overall supervision furnished by Reclamation. All recreational facilities would be built by SWCD. Temporary construction offices would be located within the proposed reservoir basin.

2.2.2.2.10 Water Quality Protection Program

Several water quality permits must be obtained prior to construction of the project. The Clean Water Act of 1972 (Public Law 95-217), as amended in 1977, requires that Section 402 permits be obtained from the State or EPA for the discharge of any waste water or process water into a waterway. A Section 402 permit would be required for stormwater runoff during construction of the dam. In accordance with Section 404 of Public Law 95-217, permits must be obtained from USACE to discharge dredge and fill material below the normal high water level of streams, associated wetlands, and other water bodies as well as dam construction. A

Section 404 permit would be required for construction of the project. SWCD has applied for that permit.

Approval by the Utah Division of Water Quality is required before installing any sanitary or industrial pollution control facilities, including turbidity control equipment. This approval also would be obtained before dewatering, diversion, and other such facilities could be constructed. In addition, a temporary waiver of the turbidity standard would be requested from the Utah Division of Water Quality during those periods of construction when it is physically impossible to provide turbidity control. A State Engineer's permit to alter a natural stream channel also would be requested for the proposed dam. Driving, fueling, and parking of heavy equipment would be controlled so as to avoid wetland and stream areas, precluding downstream sedimentation and other water quality impacts.

2.2.2.2.11 Public Safety

The final design of Narrows Dam would be based on additional and extensive geologic investigation and would include full consideration of such factors as seismic history, geology, induced seismicity from coal mining, and the dam's material composition. In addition, final design data and specifications for the dam would be reviewed by Reclamation and the State Engineer to ensure that it would be a safe and well-designed structure, fitting geological conditions of the site.

During construction, excavations would be mapped and studied to determine whether geologic conditions were the same as had been indicated from preliminary subsurface investigations. If actual geologic conditions were found to differ from what previously had been predicted, designs would be changed to accommodate the existing conditions. Also, geologists and inspectors

would report such hazardous conditions as potential slide or slump areas that might pose a danger to workers and equipment. All hazardous areas would be roped off and appropriate signs displayed to prevent accidents.

SWCD would develop a safety of dams program that would satisfy the State of Utah requirements. SWCD, with supervision by the State Engineer, would be responsible for monitoring structural performance and conducting safety inspections during construction and initial filling of the reservoir. Criteria would be developed and strictly followed for filling the reservoir and monitoring the safety of the dam. Marker buoys and float lines would be installed around spillway intake structures and other areas that might be hazardous to boaters. In accordance with State Engineer requirements,

a standard operating procedure would be prepared to ensure that the dam was operated in a safe manner. In addition, an emergency action plan would be prepared and distributed to public safety officials. This plan would describe procedures to be followed if an emergency involved the dam.

2.2.2.3 Costs and Financing

The Proposed Action would cost approximately \$40.3 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government. Of the \$40.3-million cost, about \$7.6 million would be allocated to fish and wildlife enhancement and recreation (table 2-5). These costs are nonreimbursable to the project sponsor. Total financing would be through provisions of the SPRA.

Table 2-5.—Narrows Project Cost Comparison of Storage Alternatives Evaluated in Detail¹

	Proposed Action	Mid-Sized Reservoir Alternative	Small Reservoir Alternative
Narrows Dam and Reservoir	\$ 12,292,000	\$ 10,752,000	\$ 9,212,000
Narrows Tunnel rehabilitation	4,021,000	4,021,000	4,021,000
Upper Cottonwood Creek Pipeline	677,000	677,000	677,000
Oak Creek Pipeline	341,000	341,000	341,000
East Bench Pipeline	7,997,000	7,997,000	7,997,000
Recreation area	1,065,000	937,000	801,000
Highway SR-264 relocation	3,292,000	3,292,000	3,292,000
Wetlands, wildlife, and fishery mitigation	4,274,000	4,274,000	4,147,000
Reclamation participation (EIS and planning)	950,000	950,000	950,000
SWCD's costs to date	2,818,000	2,818,000	2,818,000
Total construction cost	\$37,727,000	\$36,059,000	\$34,256,000
Estimated interest during construction (IDC)	2,528,000	2,447,000	2,386,000
Total project costs	\$40,255,000	\$38,506,000	\$36,642,000
Average annual water yield of project (acre-feet)	5,308	5,171	4,935
Capital cost per acre-foot of yield	\$7,584	\$7,447	\$7,425

¹ Cost estimates have been indexed from July 2006 to 2008.

2.2.2.4 Project Administration

On completion of construction, the Narrows Project would be administered by SWCD. SWCD would have overall responsibility for administration and would contract with the water users for repayment of reimbursable project costs.

Although a formal agreement has not been reached, it is anticipated that the USDA Forest Service would administer the recreation facilities at the Narrows Reservoir under an operation agreement with SWCD and Reclamation.

A fishery management plan also would be developed, and a MOA would be agreed to between SWCD, USDA Forest Service, Reclamation, and UDWR. This plan would outline goals for fish species and angling opportunities that would be provided by the proposed reservoir and determine funding sources or contributions needed for reservoir fishery management. Any fish species released into the reservoir eventually could escape downstream. These species must not interfere with downstream fisheries. Species native to the Gooseberry drainage or that have already been introduced to this drainage would be acceptable for introduction into the proposed reservoir.

2.2.3 Mid-Sized Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 12,450 acre-feet. Of that amount, 9,950 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 110 feet high dam, with a crest length of 475 feet and crest width of 30 feet, would be in the same location as that for the Proposed Action (figure 2-11). Other features of the project would be the same as

those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel, relocation of SR-264, and provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are described below.

2.2.3.1 Water Supply and Use

The average annual water supply under the Mid-Sized Reservoir Alternative would be reduced to 4,964 acre-feet because there would be less carryover storage. In years with average or above average precipitation, the full 5,400-acre-foot water right would be available. In 10 of 46 years studied, this alternative could not provide the full 5,400 acre-feet of water supply. However, in years with below average precipitation, the available water supply could be reduced by as much as 79% because of the reduced long-term carryover storage. This means less than 1,138 acre-feet of water could be available for transmountain diversion during those years when the water is needed most.

Of the average annual yield of 4,964 acre-feet, 855 acre-feet would be used for M&I purposes, and the remaining 4,109 acre-feet would be used for agriculture. As noted in section 1.4.2, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early season water needs. On the average, the Mid-Sized Reservoir Alternative would reduce the average annual shortage to about 11,141 acre-feet per year or 21.6% of the diversion demand. With below average precipitation, the remaining shortage would be about 30,017 acre-feet per year or 58.1%. In either case, shortages still would be considerably greater than the 5% optimum shortage for irrigation projects.

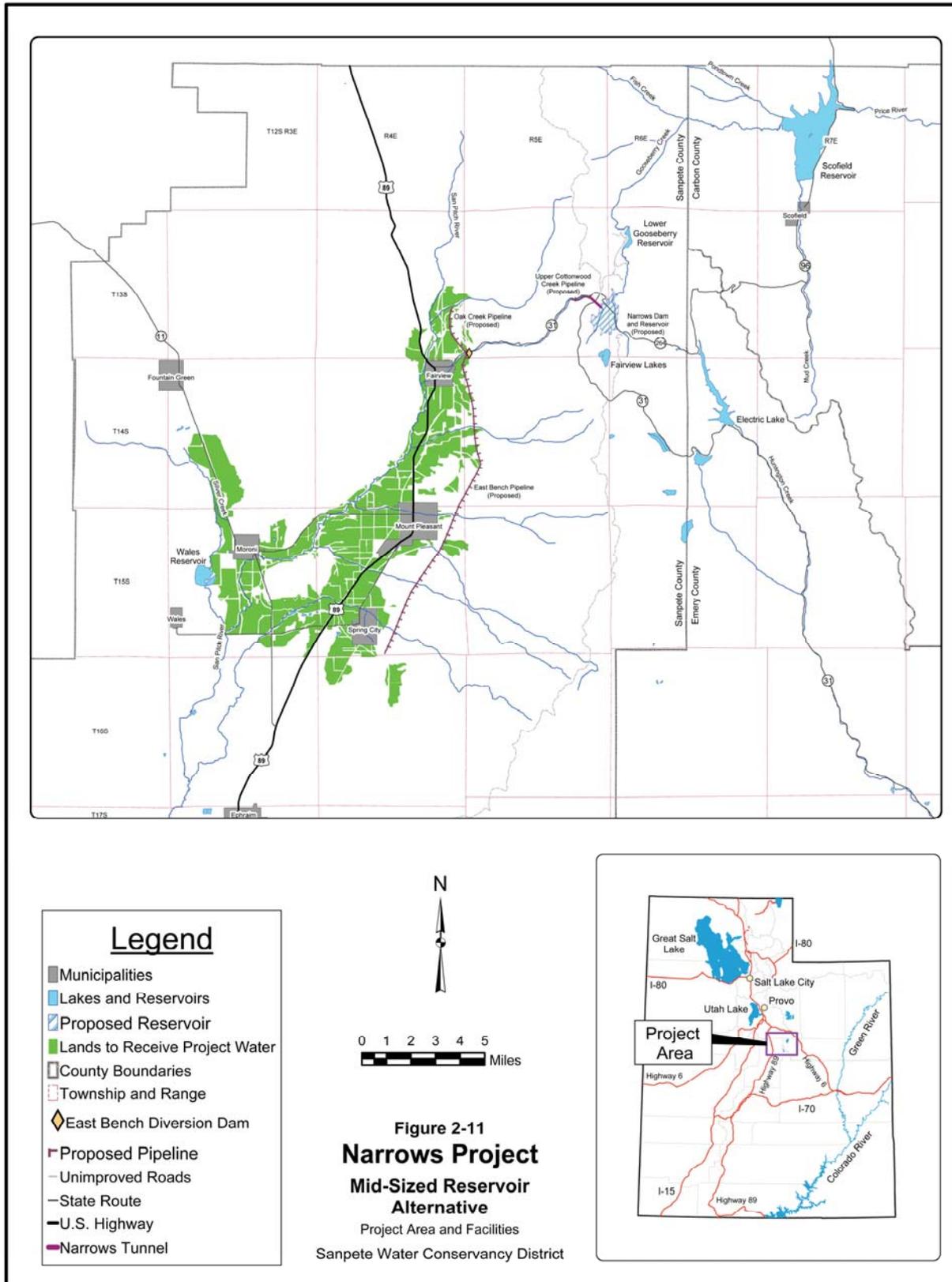


Figure 2-11.—Narrows Project, Mid-Sized Reservoir Alternative, Project Area and Facilities.

As with the Proposed Action, local water users would be expected to employ efficient water use practices or agree to implement them as a condition for receiving project water.

2.2.3.2 Construction Features and Project Operations

2.2.3.2.1 General

As in the Proposed Action, construction features of the Mid-Sized Reservoir Alternative would include one reservoir, three pipelines, rehabilitation of the existing Narrows Tunnel, the relocation of SR-264, and the relocation of some FDRs. Recreation facilities also would be provided at Narrows Reservoir. Design data for the construction features were presented earlier in table 2-2 for this alternative. The changes that would occur are depicted in table 2-2, and are described in more detail in section 2.2.3.2.2.

Specific fish and wildlife measures under the Mid-Sized Reservoir Alternative would remain the same as those stated under the Proposed Action.

Additionally, mitigation and enhancement of upland habitat would be the same as that described for the Proposed Action. New wetlands totaling about 81 acres would be created to mitigate for wetlands areas inundated by the reservoir rather than the 100 acres under the Proposed Action.

2.2.3.2.2 Design and Operation

2.2.3.2.2.1 Narrows Dam and Reservoir.—The design of Narrows Dam under the Mid-Sized Reservoir Alternative would be similar to that of the Proposed Action, but the height of the dam would be 10 feet lower. The embankment would contain an estimated total volume of 292,000 cubic yards of material.

Narrows Reservoir would still have two main outlets. A stream-level outlet would be

constructed through the dam to provide downstream releases for fisheries and emergency evacuation of the reservoir. This outlet would have a 258-cfs capacity. The existing transmountain Narrows Tunnel, with a 60.0-cfs capacity, would serve as the other reservoir outlet and would accommodate releases through the mountain ridge for the transmountain diversion. The outlets would be designed and operated the same as in the Proposed Action.

The reservoir formed behind the dam would have a total capacity of 12,450 acre-feet and a water surface area of about 489 acres.

The reservoir's active capacity, or that portion of stored water that would be used to satisfy project water needs, would be 9,950 acre-feet. In all other respects, the Mid-Sized Reservoir would be designed and operated in the same manner as the Proposed Action.

2.2.3.2.2.2 Oak Creek Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.3 East Bench Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.4 Upper Cottonwood Creek Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.5 Narrows Tunnel Rehabilitation.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.6 State Route-264 Relocation.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.7 Recreation Facilities.—For this alternative, public recreation facilities would be similar to those provided for in the Proposed Action. The facilities would include a boat ramp, boat slips, and a day-use area. The day-use area would include 8 picnic sites, restroom facilities, and a 50-unit campground. USDA Forest Service would participate in the recreation facility design, and the facilities would be constructed to their standards. USDA Forest Service would operate and maintain the facilities under agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.3.2.3 Fishery Measures

A total of 11 fishery measures have been included in the project to mitigate for adverse impacts that have been identified with the project. To the extent possible, an attempt was made to mitigate “in place” and “in kind.” Under this alternative, these measures are identical to the same measures as those described in the Proposed Action.

2.2.3.2.4 Wetlands Measures

Wetlands measures would be included in the project to mitigate for unavoidable adverse impacts to wetlands that have been identified with the project. Four alternative wetland mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas have been shown previously in figures 2-8, 2-9, and 2-10. A complete description of each alternative was provided in the discussion of the Proposed Action. Modifications unique to the Mid-Sized Reservoir Alternative are discussed below.

2.2.3.2.4.1 Wetlands Adjacent to Mud Creek Near Scofield.—This measure would entail purchasing about 190 acres of private

land adjacent to Mud Creek, south of the town of Scofield, rather than the 220 acres described in the Proposed Action.

2.2.3.2.4.2 Area West of Lower Gooseberry Reservoir.—Under this alternative, about 105 acres of private land west of Lower Gooseberry Reservoir would be acquired, rather than the 120 acres under the Proposed Action. This land would be treated in the same manner as in the Proposed Action.

2.2.3.2.4.3 New Wetlands Adjacent to Narrows Reservoir.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 81 acres.

2.2.3.2.4.4 Manti Meadows.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 81 acres.

Wetlands measures would be needed to provide similar wildlife values as those in the 81 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites was at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analyses of the sites and comparing habitat values.

SWCD would have primary responsibility for implementing the wetlands measures described above and would assume all other responsibilities associated therewith, as described in connection with the Proposed Action.

2.2.3.2.5 Wildlife Measures

The wetlands measures described above would offset any losses to wetland habitat caused by inundation. Impacts to upland

habitat (mule deer and Brewer’s sparrow habitat) were described earlier in connection with the Proposed Action, and the mitigation measures discussed there also would be implemented under the Mid-Sized Reservoir Alternative.

2.2.3.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-11. In all other respects, the description of the construction materials is the same for this alternative as that described in connection with the Proposed Action.

2.2.3.2.7 Lands for Project Features and Relocation

About 1,516 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. The amounts of land by present ownership or administration and proposed project use for this alternative are shown in table 2-6.

2.2.3.2.8 Access to Features

Construction access would be the same as that described for the Proposed Action.

Table 2-6.—Mid-Sized Reservoir Alternative Right-of-Way Requirements for Project Features (Acres)

Project Feature Type of Acquisition	Ownership or Administration		
	Private	Reclamation Withdrawal	Total
Narrows Dam and Reservoir	338	151	489
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	7	7
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	385	0	385
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	180	0	180
Materials source area ¹	0	2	2
Total	1,320.5	195.5	1,516

¹ Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

2.2.3.2.9 Construction Program

The construction program would be similar to that incorporated into the Proposed Action.

2.2.3.2.10 Water Quality Protection Program

The water quality protection program would be the same as that incorporated into the Proposed Action.

2.2.3.2.11 Public Safety

The public safety measures for this alternative would be the same as those incorporated into the Proposed Action.

2.2.3.3 Costs and Financing

The Mid-Sized Reservoir Alternative would cost about \$38.5 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government (table 2-5). Of the \$38.5-million cost, about \$4.9 million would be for fish and wildlife enhancement and recreation. These costs are nonreimbursable to the project sponsors. Total financing would be through provisions of the SPRA. Because of a smaller storage capacity, the cost of project water would be approximately 31% higher than the Proposed Action.

2.2.3.4 Project Administration

Under the Mid-Sized Reservoir Alternative, project administration would be the same as that described for the Proposed Action.

2.2.4 Small Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 7,900 acre-feet. Of that amount, 5,400 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 100-foot-high dam, with a crest length of 425 feet and crest width

of 30 feet, would be in the same location as that for the Proposed Action (figure 2-12). Other features of the project would be the same as those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel, relocation of SR-264, and provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are discussed below.

2.2.4.1 Water Supply and Use

The average annual water supply under the Small Reservoir Alternative would be reduced to 4,710 acre-feet because there would be less carryover storage. In years with average or above average precipitation, the full 5,400-acre-foot water right would be available. In 17 of 46 years studied, this alternative could not provide the full 5,400-acre-foot water supply. However, in years with below average precipitation, the available water supply could be reduced by as much as 74% because of the lack of long-term carryover storage. This means that less than 1,427 acre-feet of water could be available for transmountain diversion during those years when the water is most needed.

Of the average annual 4,710-acre-foot yield, 855 acre-feet would be used for M&I purposes; and the remaining 3,105 acre-feet would be used for agriculture. As noted in section 1.4.2, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand, assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early-season water needs. On the average, the Small Reservoir Alternative would reduce the average annual shortage to about 11,395 acre-feet per year or 22.1% of the diversion demand. With below average precipitation, the remaining shortage would amount to 29,728 acre-feet per year or 57.5%.

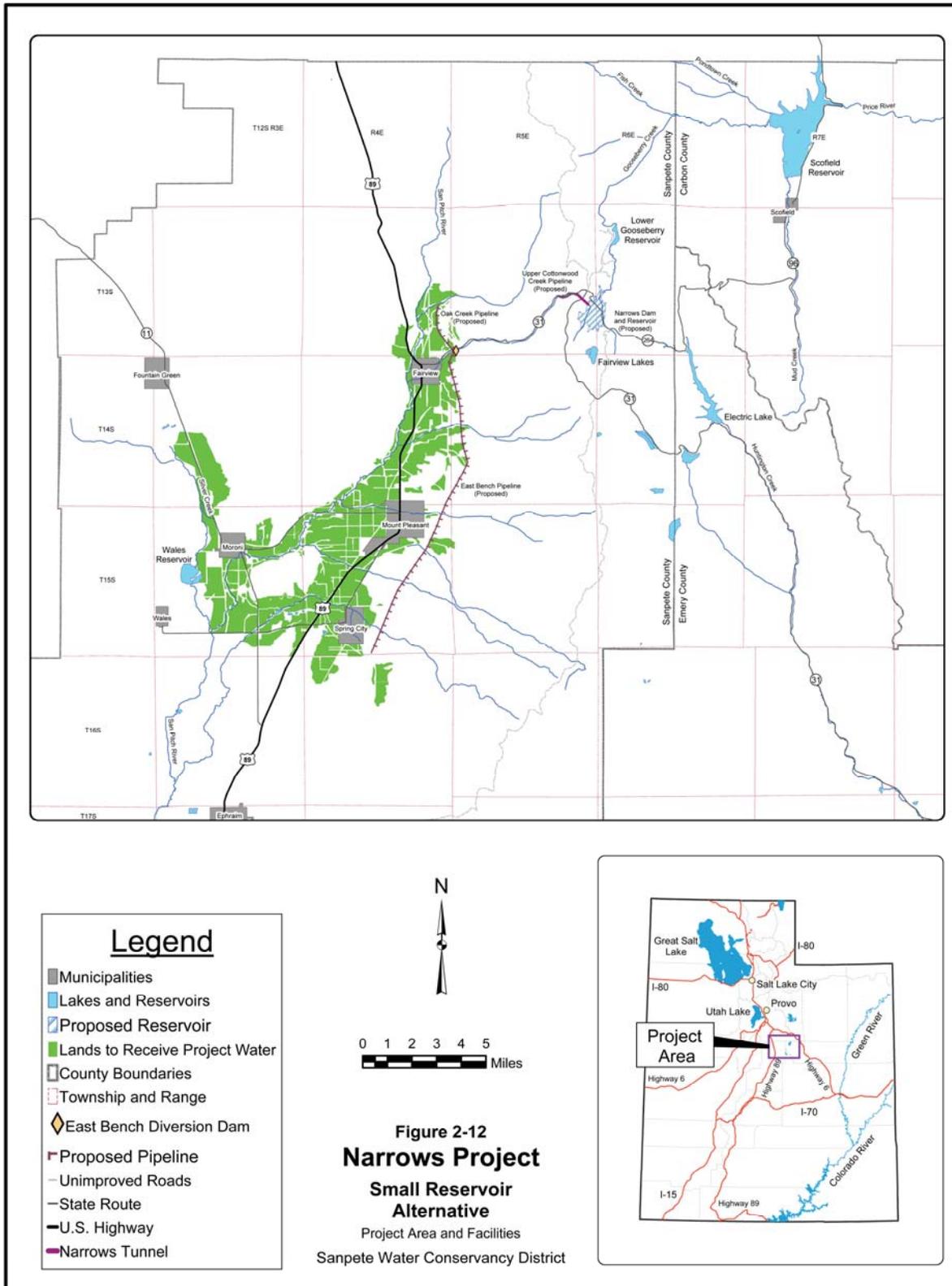


Figure 2-12.—Narrows Project, Small Reservoir Alternative, Project Area and Facilities.

In either case, shortages are still considerably greater than the 5% optimum shortage for irrigation projects.

As with the Proposed Action, local water users would be expected to employ efficient water use practices or agree to implement them as a condition for receiving project water.

2.2.4.2 Construction Features and Project Operations

2.2.4.2.1 General

As in the Proposed Action, construction features of the Small Reservoir Alternative would include one reservoir, three pipelines, rehabilitation of the existing Narrows Tunnel, the relocation of SR-264, and the relocation of some FDRs. Recreation facilities also would be provided at Narrows Reservoir. Design data for this alternative was presented earlier in table 2-2.

Of the 11 specific fish and wildlife measures included in the Proposed Action, 9 would be employed under the Small Reservoir Alternative. Those measures, some with modifications, include:

- ◆ Provide minimum flows of 1.0 cfs in Gooseberry Creek below Narrows Dam
- ◆ Provide a multiple-level outlet at Narrows Dam to regulate the temperature of releases to Gooseberry Creek from Narrows Reservoir
- ◆ Modify and/or stabilize streambanks and associated riparian zones along Middle Gooseberry Creek
- ◆ Acquire and/or improve stream segments to provide additional fish habitat
- ◆ Provide winter releases to Cottonwood Creek

- ◆ Provide summer flows in lower Cottonwood Creek
- ◆ Construct a pipeline in the upper Cottonwood Creek area to convey project water outside the stream channel
- ◆ Provide a minimum pool in Narrows Reservoir for fish
- ◆ Reduce external phosphorus loading to Scofield Reservoir

Because of the reduced reservoir capacity, there would not be enough storage to include the following measures that would be part of the Proposed Action:

- ◆ Provide year-round flows in two tributaries of Gooseberry Creek that are presently dewatered
- ◆ Provide an additional 300 acre-feet per year of releases from the Narrows Reservoir for channel maintenance and fish habitat

In lieu of providing year-round flows in the Gooseberry Creek tributaries, 1.8 miles of spawning and rearing habitat would be replaced. (This mitigation would require additional coordination with UDWR and the USDA Forest Service. If improvement of existing stream segments is used as the method of replacing the habitat, as much as 5.4 miles of stream may need to be improved.)

Mitigation and enhancement of upland habitat would be the same as that described for the Proposed Action. New wetlands totaling about 72 acres would be created to mitigate for wetlands areas inundated by the reservoir.

2.2.4.2.2 Design and Operation

2.2.4.2.2.1 Narrows Dam and Reservoir.— Under the Small Reservoir Alternative, the design of Narrows Dam would be similar to that of the Proposed Action; but the dam

would be 20 feet lower in height. The embankment would contain an estimated total volume of 220,000 cubic yards of material.

Narrows Reservoir would have two main outlets. A stream-level outlet would be constructed through the dam to provide downstream releases for fisheries and emergency evacuation of the reservoir. This outlet would have a 210-cfs capacity. The existing transmountain Narrows Tunnel, with a 60.0-cfs capacity, would serve as the other reservoir outlet and would accommodate releases through the mountain ridge for the transmountain diversion. The outlets would be designed and operated the same as in the Proposed Action.

The reservoir formed behind the dam would have a total capacity of 7,900 acre-feet and a water surface area of about 362 acres.

The reservoir's active capacity, or that portion of stored water that would be used to satisfy project water needs, would be 5,400 acre-feet. In all other respects, the Small Reservoir Alternative would be designed and operated in the same manner as under the Proposed Action.

2.2.4.2.2.2 Oak Creek Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.3 East Bench Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.4 Upper Cottonwood Creek Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.5 Narrows Tunnel Rehabilitation.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.6 SR-264 Relocation.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.7 Recreation Facilities.—For this alternative, public recreation facilities would be similar to those provided for in the Proposed Action. The facilities would include a boat ramp, boat slips, and a day-use area. The day-use area would include 6 picnic sites, restroom facilities, and a 40-unit campground. USDA Forest Service would participate in the recreation facility design, and the facilities would be constructed to their standards. USDA Forest Service would operate and maintain the facilities under agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.4.2.3 Fishery Measures

A total of nine fishery measures have been included in the project to mitigate for adverse impacts identified with this alternative for the project. These nine measures are the same as nine of the measures included as part of the Proposed Action. Two of the Proposed Action measures, however, would not be possible under the Small Reservoir Alternative. To the extent possible, an attempt was made to mitigate “in place” and “in kind.” The two mitigation measures not included under this alternative are the restoration of streamflow in the Gooseberry Creek tributaries below Fairview Lakes and the provision for flushing flow releases to Gooseberry Creek below Narrows Reservoir. These two fishery mitigation measures could not be included due to the absence of capacity for carryover storage in the reservoir.

2.2.4.2.4 Wetlands Measures

Wetlands measures would be included in the project to mitigate for unavoidable adverse

impacts to wetlands that have been identified with the project. Four alternative wetland mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas have been shown previously in figures 2-8, 2-9, and 2-10. A complete description of each alternative was provided in the discussion of the Proposed Action. Modifications unique to the Small Reservoir Alternative are discussed below. Alternatives listed are in order of priority.

2.2.4.2.4.1 Wetlands Adjacent to Mud Creek Near Scofield.—This measure would entail purchasing about 160 acres of private land adjacent to Mud Creek, south of the town of Scofield, rather than the 220 acres described in the Proposed Action.

2.2.4.2.4.2 Area West of Lower Gooseberry Reservoir.—Under this alternative, about 86 acres of private land west of Lower Gooseberry Reservoir would be acquired rather than the 120 acres under the Proposed Action. This land would be treated in the same manner as in the Proposed Action.

2.2.4.2.4.3 New Wetlands Adjacent to Narrows Reservoir.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 72 acres.

2.2.4.2.4.4 Manti Meadows.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 72 acres.

The wetlands measures would need to include similar wildlife values as the 72 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure

that the value of the mitigation sites is at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analyses of the sites and comparing habitat values.

SWCD would have primary responsibility for implementing the wetlands measures described above and would assume all other responsibilities associated therewith and described in connection with the Proposed Action.

2.2.4.2.5 Wildlife Measures

The wetlands measures described above would offset any losses to wetland habitat caused by inundation. Impacts to upland habitat (mule deer and Brewer's sparrow habitat) were described earlier in connection with the Proposed Action, and the mitigation measures discussed there also would be implemented under the Small Reservoir Alternative.

2.2.4.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-12. In all other respects, the description of the construction materials is the same for this action as that described in connection with the Proposed Action.

2.2.4.2.7 Lands for Project Features and Relocation

About 1,345 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. The amounts of land by present ownership or administration and proposed project use for this alternative are shown in table 2-7.

2.2.4.2.8 Access to Features

Construction access would be the same as that described for the Proposed Action.

Table 2-7.—Small Reservoir Alternative Right-of-Way Requirements for Project Features (Acres)

Project Feature Type of Acquisition	Ownership or Administration		
	Private	Reclamation Withdrawal	Total
Narrows Dam and Reservoir	244	119	363
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	7	7
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	385	0	385
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	135	0	135
Materials source area ¹	0	2	2
Total	1,181.5	163.5	1,345

¹ Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

2.2.4.2.9 Construction Program

The construction program would be similar to that incorporated into the Proposed Action.

2.2.4.2.10 Water Quality Protection Program

The water quality protection program would be the same as that incorporated into the Proposed Action.

2.2.4.2.11 Public Safety

The public safety measures for this alternative would be the same as those incorporated into the Proposed Action.

2.2.4.3 Costs and Financing

The Small Reservoir Alternative would cost about \$36.6 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government (table 2-5). Of the \$36.6-million cost, about \$4.0 million is for fish and wildlife enhancement and recreation. These costs are nonreimbursable to the project sponsor. Total financing would be through provisions of the SPRA. Because of a smaller storage capacity, the cost of project water would be approximately 96% higher than the Proposed Action.

2.2.4.4 Project Administration

Under the Small Reservoir Alternative, project administration would be the same as that described for the Proposed Action.

2.3 ALTERNATIVES CONSIDERED AND ELIMINATED FROM THE STUDY

Several alternatives considered were determined to be nonviable. Those alternatives are summarized below.

2.3.1 Direct Diversion Without Reservoir

The Direct Diversion Without Reservoir Alternative was formulated to avoid impacts to wetlands in the Narrows Reservoir basin and does not require constructing a dam and reservoir. Water would be diverted from Gooseberry Creek according to water demands within the project service area to the extent it is available in the natural runoff pattern (figure 2-13). Key features and elements of this alternative include:

- ◆ A diversion structure and pumping plant on Gooseberry Creek located about 1,000 feet downstream from the SR-264 highway crossing of Gooseberry Creek
- ◆ An electrical transmission line
- ◆ A 1,000-foot-long discharge pipeline
- ◆ An open canal about 0.8 mile long
- ◆ Narrows Tunnel rehabilitation
- ◆ Upper Cottonwood Creek Pipeline
- ◆ Oak Creek Pipeline
- ◆ East Bench Pipeline

A hydrologic operation study indicates that an average of 1,373 acre-feet per year could be diverted from Gooseberry Creek

to Cottonwood Creek. This analysis is based on 1960–92 flow records and takes into consideration the maximum annual transbasin diversion of 5,400 acre-feet, the 1.0-cfs minimum streamflow requirement at the Narrows damsite, and the demand for supplemental irrigation water. The majority of flow on Gooseberry Creek occurs in May and June. However, the demand for supplemental irrigation water generally occurs in July, August, and September. Therefore, the high flows of May and June would not be diverted because there would be no place to store the water to use later in the irrigation season. During low flow periods, natural flows in Gooseberry Creek would not be great enough to meet the 1.0-cfs minimum streamflow in Cottonwood Creek. Similarly, the project could not provide water as needed in the late irrigation season.

The total cost of the Direct Diversion Without Storage Alternative would be about \$12.1 million. Since this alternative would provide neither recreation nor fish and wildlife benefits, there would be no grants available for those purposes; and the total project cost would be borne by the water users. In addition to capital costs, an annual pumping cost of about \$7,200 would be incurred.

2.3.1.1 Reasons Eliminated from Further Consideration

Direct diversion does not supply irrigation water when it is needed during the mid- and late-summer months.

During low flow periods, this alternative cannot provide the 1.0-cfs minimum streamflow in Gooseberry Creek at the Narrows damsite as required by the project water rights.

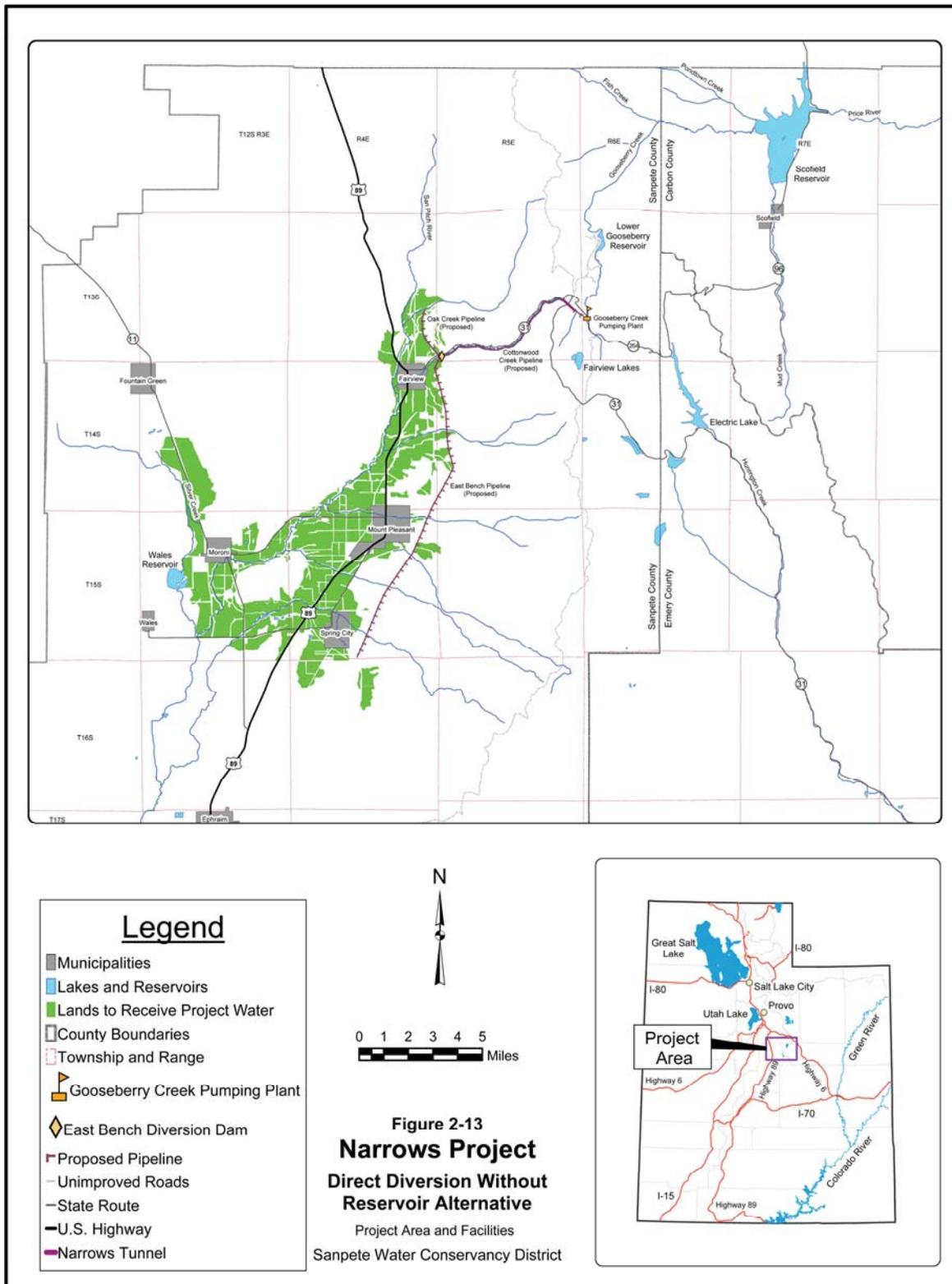


Figure 2-13.—Narrows Project, Direct Diversion Without Reservoir Alternative.

Because this alternative would provide neither recreation nor fish and wildlife benefits, there would be no grants available for those purposes that would offset some of the project costs. The total cost would be borne by the water users. The capital cost per acre-foot of water yield to the water users would be about 2.5 times that of the Proposed Action.

2.3.2 Direct Diversion with Reservoir in Sanpete Valley

This alternative would include the same facilities in Gooseberry Creek as the Direct Diversion Without Reservoir Alternative, but a storage reservoir would be provided at a lower elevation in Sanpete Valley. The storage would allow the water to be delivered at times during the irrigation season when it is needed (figure 2-14).

A hydrologic operation study indicates that an average of 4,671 acre-feet per year could be diverted from Gooseberry Creek to Cottonwood Creek. This analysis is based on 1960–92 flow records and takes into consideration the maximum annual transbasin diversion of 5,400 acre-feet and the 1.0-cfs minimum streamflow requirement at the Narrows damsite. The majority of the divertible flow occurs in May and June. This flow would be added to the usual spring peak flows in Cottonwood Creek and could result in considerable degradation of the stream channel. During low flow periods, natural flows in Gooseberry Creek would not be great enough to meet the 1.0-cfs minimum streamflow in Gooseberry Creek or to provide the 2.0-cfs minimum year-round flow in Cottonwood Creek, as required by the 1984 Compromise Agreement.

To avoid severe degradation of the stream channel, the flow would need to be conveyed through a pipeline (the Cottonwood Creek Pipeline) for the entire length of the canyon.

Proper placement of the pipeline is critical because a total of 104 landslides, most of which are active, have been mapped in the canyon. The topography of the canyon suggests that the most likely location for the pipeline would be within the existing highway alignment. However, due to the landslides, the highway has continual stability problems; and repairs are needed on an annual basis. The instability would present continual safety and maintenance problems for the high-pressure pipeline. The terminus of the Cottonwood Creek Pipeline would require a control/energy dissipation structure.

To identify the best damsite available, a reconnaissance-level study was performed in which all potentially practicable reservoir sites within the project area were identified (see appendix B). Preliminary estimates of storage capacity, dam height, and dam length were made. A total of 10 damsites were included in this evaluation. Of these damsites, a site located near Milburn appeared to be the most feasible. This determination was made based on the amount of embankment material required to construct the dam versus the volume of water that could be stored. The other damsites were eliminated because they were either technically or economically infeasible. The reservoir basin at the Milburn site contains about 60 acres of high quality wetlands, including willow thickets, cattails, and sedges that would be impacted.

In addition to the dam, the Oak Creek Pipeline would need to be enlarged to deliver water from the reservoir to the project area. A pumping plant also would be needed to lift the water into the pipeline. Key features and elements of this alternative include the following:

- ◆ A diversion structure and pumping plant on Gooseberry Creek located about 1,000 feet downstream from the SR-264 highway crossing of Gooseberry Creek.

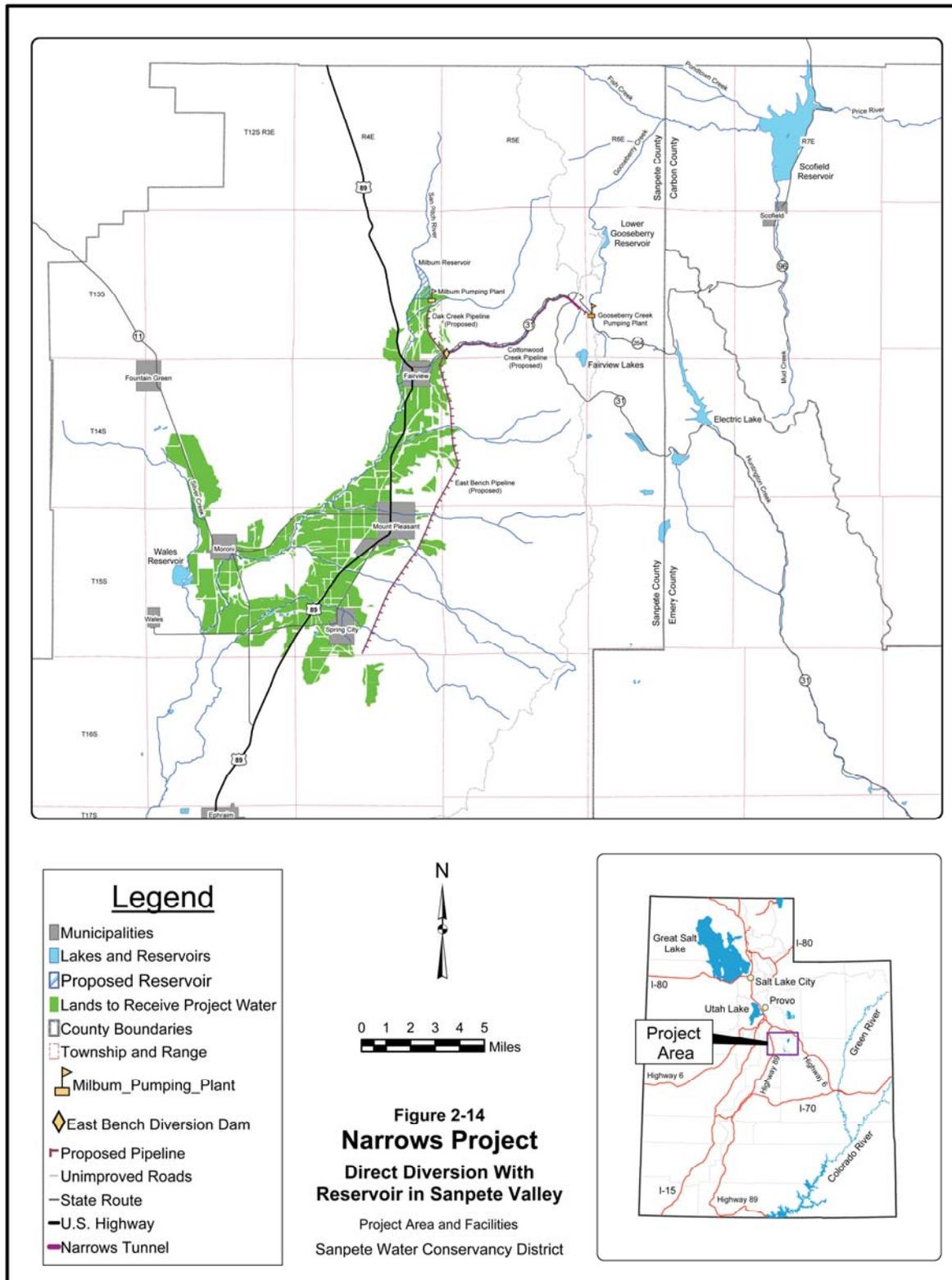


Figure 2-14.—Narrows Project, Direct Diversion with Reservoir in Sanpete Valley.

- ◆ An electrical transmission line.
- ◆ A 1,000-foot-long discharge pipeline.
- ◆ An open canal about 0.8 mile long.
- ◆ Narrows Tunnel rehabilitation.
- ◆ Cottonwood Creek Pipeline.
- ◆ Milburn dam and reservoir (5,400-acre-foot capacity). The dam would have a maximum height of 64 feet and a crest length of 2,185 feet.
- ◆ A pumping plant near Milburn dam.
- ◆ An enlarged Oak Creek Pipeline.
- ◆ East Bench Pipeline.

Total project cost would be about \$50 million or about \$18.4 million higher than the Proposed Action. However, this alternative does not have any carryover storage and would not provide recreation or fish and wildlife benefits. As a result, it would not be eligible for State or Federal grants for these purposes. All costs would be allocated to and repaid by the local water users. Costs allocated to the water users would be about 2.8 times those under the Proposed Action while the yield would be about 13% less than the Proposed Action. In addition, annual O&M costs would be increased by about \$155,000 per year to provide for pumping power at two locations.

2.3.2.1 Reasons Eliminated from Further Consideration

The proposal is financially infeasible. With the substantially higher initial cost and higher annual costs, the sponsor lacks resources to meet SRPA cost-sharing requirements. In addition, annual costs exceed the sponsor's repayment capacity.

The feasibility of constructing the Cottonwood Creek Pipeline is highly doubtful

due to the geologic instability of the canyon. The safety concerns and maintenance problems posed by this instability would be unacceptable.

Total cost of this plan is about 1.9 times the cost of the Proposed Action and produces about 13% less water than the Proposed Action.

The water right for this plan is questionable. During low flow periods, natural flow in Gooseberry Creek is insufficient to maintain the 1.0-cfs minimum streamflow required to establish and maintain the water right, as provided in the 1984 Compromise Agreement.

This proposal would still inundate about 60 acres of high quality wetlands.

2.3.3 Conservation Without Development of Other Water Supplies

Instead of developing new water supplies, implementing conservation measures has been suggested to extend existing water supplies. Under this alternative, the Narrows Dam and Reservoir would not be constructed. Without the dam construction, there would be no need to relocate SR-264; and there would be no recreational facilities constructed at the reservoir site. The East Bench, Oak Creek, and Upper Cottonwood Creek Pipelines would not be built. The existing Narrows Tunnel would have to be rehabilitated at some future date. If the tunnel were to collapse, Cottonwood Creek Irrigation Company would have to acquire some type of emergency funding to repair it.

Irrigators in the project area have already implemented extensive efficiency improvements (conservation measures) to extend their scarce water supplies. Approximately 60% of the irrigated land within the project area is irrigated with

sprinklers. About 75% of the land is served by improved conveyance facilities such as pipelines and lined canals and ditches. Based upon these conditions, the diversion requirement was computed to be an average of about 62,900 acre-feet per year for the 15,420 acres of project-eligible lands (see section 1.4.2). With average annual water supplies of 34,200 acre-feet per year, this would leave a shortage of about 28,700 acre-feet per year.

Because of this shortage, certain individuals and canal companies were planning to install, or were currently installing, a variety of efficiency improvements on much of the unimproved portions of project lands. These improvements would be expected to be in place by the projected date of completion for the proposed Narrows Project. These improvements would consist mainly of additional pipe delivery and sprinkler irrigation systems. Land leveling is often used as a technique to improve onfarm efficiency; however, due to the topography and shallow depth of soil, land leveling is generally not practical or economically feasible in the project area. Drip irrigation systems, which are highly efficient, are not considered practical for the alfalfa/grain rotation crops that are grown in the project area. With completion of these improvements, most of the cost-effective measures would have been implemented. There still could be limited opportunities for some localized improvements.

As a result of these efficiency improvements, diversion demands would be expected to be reduced from an average of 62,900 to about 51,700 acre-feet per year. This would be an average reduction in diversion demand of about 11,200 acre-feet per year. (In previous documents, this reduction has been reported to be 8,000 acre-feet per year but now has been revised based upon updated crop consumptive use data.) Even with these

improvements in place, remaining shortages would be estimated at about 15,250 acre-feet per year. With this amount of shortage, significant soil moisture deficits would continue to seriously impact crop growth and production.

It should be noted that the 11,200-acre-foot reduction in diversion demand is not new water. New water would become available only if demands could be reduced below available supplies. In this case, efficiency improvements would make more use of the existing water supply available to the plants by reducing the amount of water lost to the plants because of evaporation, seepage, and spills from the carriage system; deep percolation through the root zone; and runoff from the ends of the fields. There would be two consequences of implementing efficiency improvements:

1. More of the existing water supplies would become available to support plant growth and development. Here, an additional 3,500 acre-feet per year of existing water supplies would be available to the plants.
2. Conversely, 3,500 acre-feet per year, less the amount previously lost by evaporation, no longer would be available as return flows to support wetlands, aquatic habitat, and downstream users.

As mentioned previously, most of the remaining cost-effective efficiency improvements would be implemented within a relatively short timeframe independent of the Narrows Project or any other organized program. In essence, their implementation would be a component of the No Action Alternative and would not satisfy the need for additional supplemental water.

2.3.3.1 Reasons Eliminated from Further Consideration

This is an ongoing activity that is a component of the No Action Alternative, the Proposed Action, and any other alternative that might be considered.

Implementing efficiency improvements does not adequately satisfy the need for additional supplemental irrigation water.

Efficiency improvements do not provide significant relief for water shortages during the late irrigation season when supplemental water is needed the most.

With implementing the planned efficiency improvements, the opportunity for additional large-scale conservation programs is nonexistent.

2.3.4 Mammoth Damsite Alternative

Several alternative damsite locations were evaluated and studied during the early stages of project planning. Because of the topography of many of these alternative damsites and technical difficulties relating to dam length and height and storage capacity, only two of the sites were further evaluated. The first of these is the damsite contemplated in the original Gooseberry Project.

The original Gooseberry Project transmountain diversion plan contemplated a reservoir site generally located in the south half of section 6 and part of sections 7 and 18, T. 13 S., R. 6 E., Salt Lake Base and Meridian, commonly referred to as the Mammoth reservoir site (figure 2-15). Through direct diversions and storage in the Mammoth reservoir, the original project plan contemplated a transmountain diversion of up to 30,000 acre-feet of water per year.

Through public reviews, the Service, among others, requested moving the Gooseberry damsite from the proposed Mammoth site to the proposed Narrows site to protect fishery values. In 1984, UDWR made a similar request and specifically requested the exclusion of Cabin Hollow Creek from the Gooseberry Project. Next, using Brooks Canyon Creek water became impractical because the existing wetlands are dependent upon its water supply. The amount of water available from this source did not justify the impact on the wetlands.

In 1984, Reclamation, SWCD, the Price River Water Users Association, and the Carbon Water Conservancy District entered into a Compromise Agreement that set forth conditions upon which water rights for both the Scofield Project and the Narrows Project would be established. The 1984 Compromise Agreement established priorities, quantities of flow, storage capacities, location of storage facilities, and points of diversion for these projects. The agreement recognized the above environmental concerns and expressly excluded the Mammoth damsite as a location for project storage facilities. The 1984 Compromise Agreement was a resolution of many years of disagreement between Carbon and Sanpete water interests over the Gooseberry Project. In 1985, the Utah State Engineer approved both the Narrows portion and the Scofield portion of the Gooseberry Project Plan water rights. Both approvals were expressly made subject to terms of the 1984 Compromise Agreement. Thus, no water right is now or likely would be approved in the future for a project constructed at the Mammoth damsite without amendment to the compromise agreement and approval of associated water right changes.

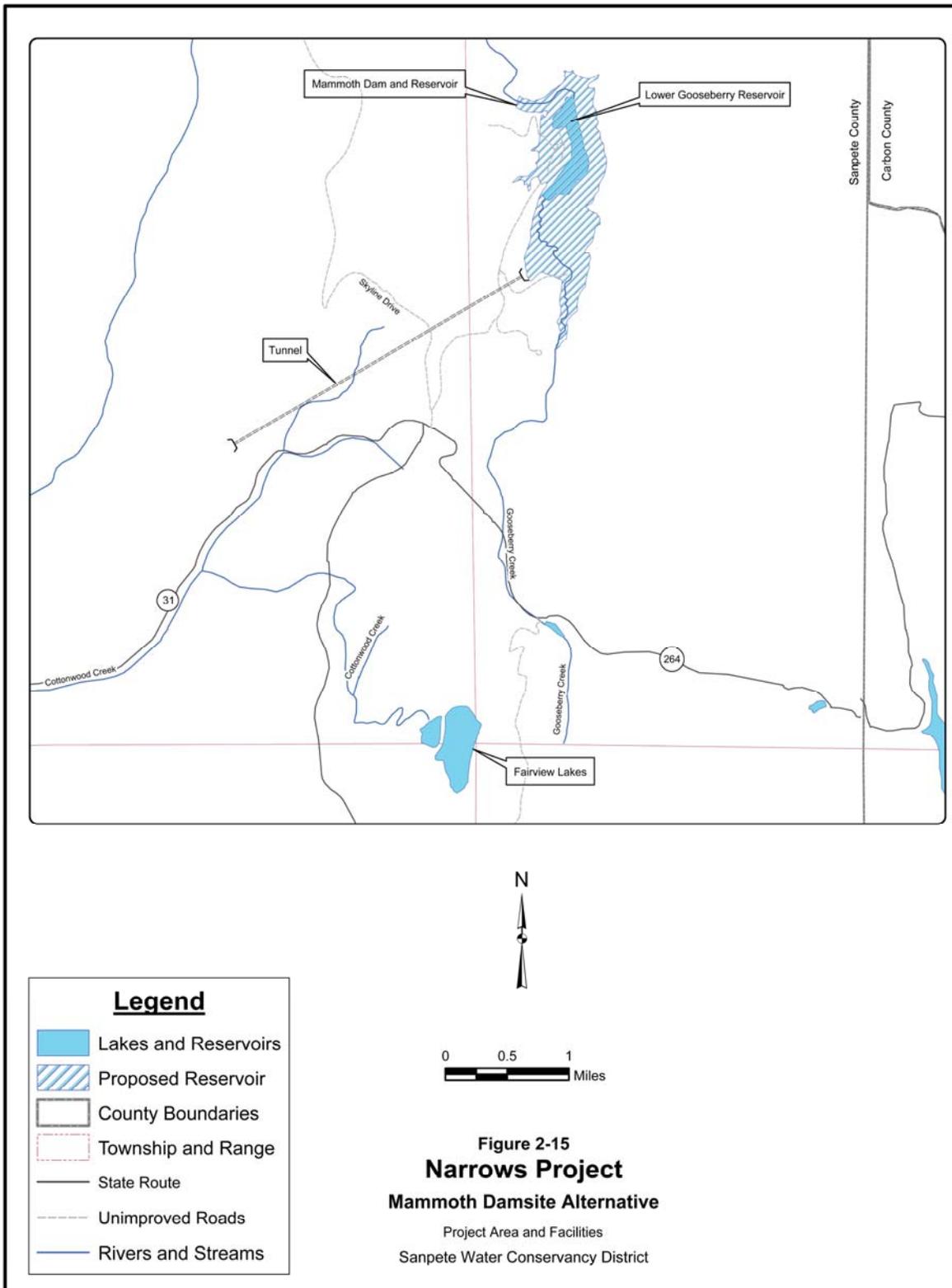


Figure 2-15.—Narrows Project Mammoth Damsite Alternative.

2.3.4.1 Reasons Eliminated from Further Consideration

The Mammoth damsite was specifically eliminated from consideration during negotiations leading to the 1984 Compromise Agreement because the environmental impacts of a project constructed at that location were unacceptable to the Service and UDWR.

The alternative is technically infeasible. The sponsor cannot secure the water rights necessary to establish project water supplies as required by SRPA.

2.3.5 Valley Damsite Alternative

Several alternative damsite locations were evaluated and studied. Because of the topography of many of these alternative damsites and technical difficulties relating to dam length and height as well as storage capacity, only two of the sites were further evaluated. The Valley damsite is the second of the two sites evaluated.

An alternative damsite for the Narrows Dam was evaluated and presented at the public scoping meetings. That dam would be located in the valley upstream of the Narrows damsite (figure 2-16). The dam, having a crest length of about 5,000 feet, would be located upstream of SR-264. The reservoir, with a 4,500-acre-foot capacity, would produce an annual average yield of about 4,376 acre-feet. This alternative would produce only about 82% of the yield of the Proposed Action. The dam and reservoir would be located off stream, so a diversion structure and feeder canal would be required to convey flows from Gooseberry Creek into the reservoir. The rehabilitated Narrows Tunnel would be required to convey project water transmountain into Cottonwood Creek. The East Bench and Oak Creek Pipelines would deliver water

to the users. Total estimated cost of this alternative is about \$31.1 million.

The reservoir would not have sufficient capacity for any carryover storage. Without the carryover storage, this alternative would not produce any recreation or fish and wildlife benefits; and the alternative would, therefore, be ineligible for grants for these purposes. The applicant would be responsible for the entire cost of the alternative. The lack of eligibility for grants increases the capital cost per acre-foot of yield attributed to the applicant to about 2.1 times the capital cost per acre-foot of yield of the Proposed Action. Based upon SRPA's financial feasibility requirements, the applicant would be eligible for a loan of about \$16,900,000 and would be required to provide \$7,200,000 in local funds toward project construction. The loan would be repaid in 30 years with annual payments of about \$563,000.

In 1984, Reclamation, SWCD, the Price River Water Users Association, and the Carbon Water Conservancy District entered into a Compromise Agreement that set forth conditions upon which water rights for both the Scofield Project and the Narrows Project would be established. The 1984 Compromise Agreement established priorities, quantities of flow, storage capacities, location of storage facilities, and points of diversion for these projects. In 1985, the Utah State Engineer approved both the Narrows portion and the Scofield portion of the Gooseberry Project Plan water rights. Both approvals were expressly made subject to terms of the 1984 Compromise Agreement. This alternative does not conform to the terms of the 1984 Compromise Agreement as to location, storage capacity, or point of diversion. This alternative would not be eligible for an approved water right unless terms of the 1984 Compromise Agreement and the approved water rights were modified.

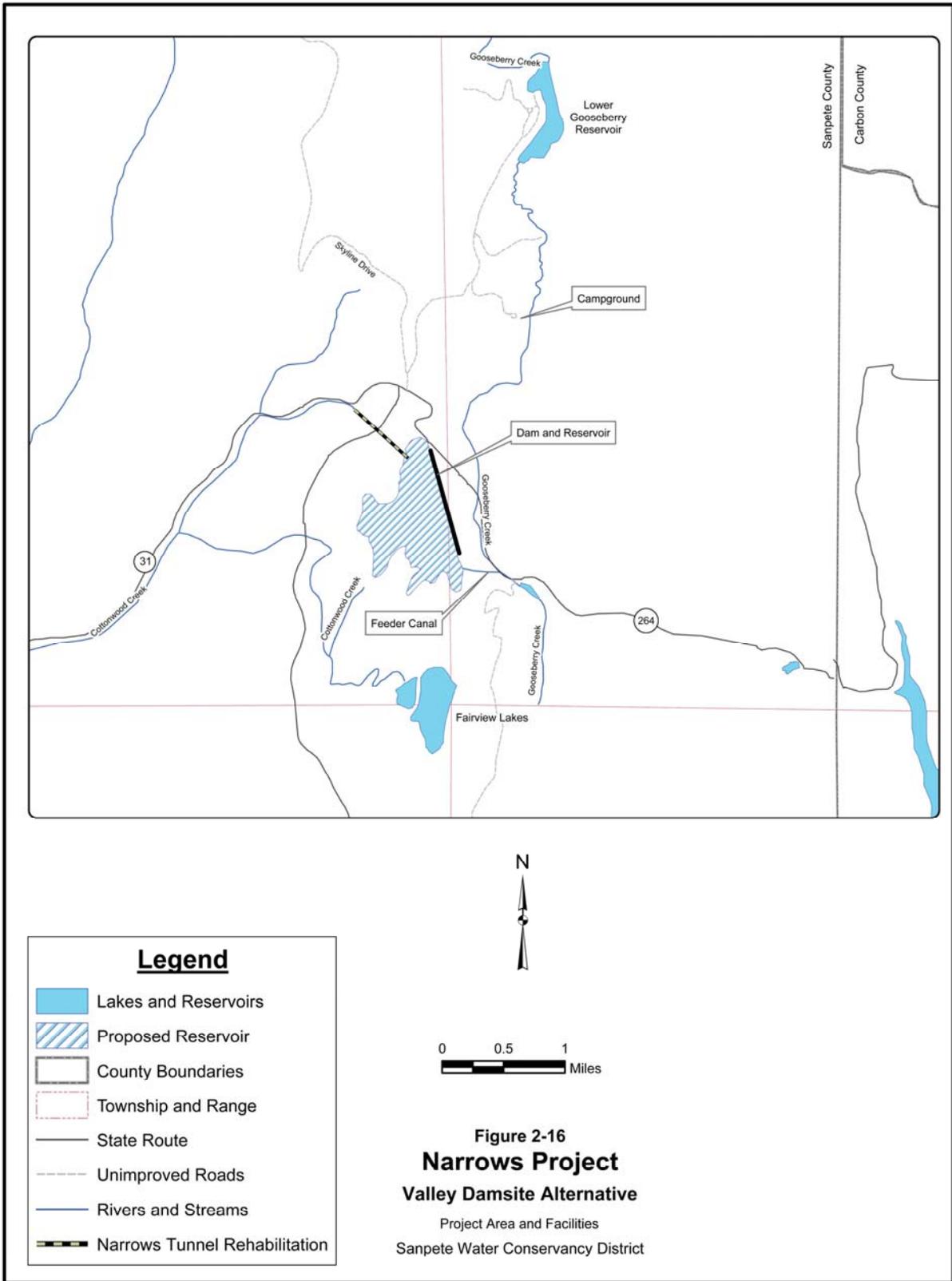


Figure 2-16.—Narrows Project Valley Damsite Alternative.

2.3.5.1 Reasons Eliminated from Further Consideration

The annual cost per acre-foot of yield exceeds the Proposed Action by about 2.1 times, whereas this alternative produces about 18% less yield than the Proposed Action. In addition, the required local cost share exceeds the locally available funds, and the annual repayment exceeds the local repayment capacity.

The average annual yield would be about 18% less than the Proposed Action; whereas, the absence of any carryover storage would mean that this shortage would be felt most severely in an extended drought and would, in that sense, provide virtually no water when it is most needed.

Water rights for this alternative are questionable. Lacking modification to the 1984 Compromise Agreement, the applicant would not be able to secure the water rights necessary to establish project water supplies as required by SRPA. Without an approved water right, the alternative would be technically infeasible and ineligible for SRPA funding. Under Utah law, a change of water right cannot be filed on an approved application to appropriate; a change application can be filed only on a certificated water right, which only can be acquired after the applied-for application has taken place and the water thereunder placed to beneficial use. Moving to another site, such as the Valley damsite, would require abandonment of the existing approved application and establishment of a new one, with a much junior priority date and associated complications relating to the downstream rights on Gooseberry Creek and Scofield Reservoir.

The overall financial feasibility is questionable. Without SRPA funding, the applicant lacks financial resources necessary to construct the project. Other lending

institutions likely also would refuse to provide funding if a valid water right could not be established.

The average annual cost of water for this alternative is about 2.1 times greater than the Proposed Action, and this alternative does not eliminate most of the impacts to wetlands and Gooseberry Creek that are objectionable aspects of the Proposed Action

2.3.6 Skyline Mine Alternative

Under this alternative, ground water would be developed in the Flat Canyon area, located east of the proposed Narrows Reservoir basin, by drilling deep wells and pumping the ground water from bedrock. This plan originally was developed and proposed by Canyon Fuel Company, the owner of the Skyline Coal Mine.

On August 16, 2001, coal miners in central Utah's Skyline Mine inadvertently tapped into a saturated sandstone formation. As a result, 4,700 gallons per minute of water began flowing into the mine. The coal company, in turn, spent \$6 million on pipe and pumping equipment to remove the water from the mine and drain it into Scofield Reservoir. Additional wells were drilled near Electric Lake and were pumped into the Huntington Creek drainage.

Early investigations performed by the mine identified the water as potentially being a new, potentially unappropriated source from a prehistoric aquifer. The mine developed a theory that if the water was a new source, development of this source would not interfere with any existing water rights—therefore, this ground water could be developed as a new source of water supply. The idea was that the mine would help pay the capital cost of the project if the surrounding counties (Carbon, Emery, and Sanpete) would pay the cost of pumping the water and then use it for a temporary water

supply. The mine would, in turn, benefit by having the ground water levels adjacent to the mine lowered, which would make it economical for Canyon Fuel to mine the remainder of the coal deposit. Some individuals suggested that the water supply developed by this project could be an alternative to the Narrows Project.

However, before the logistics of this alternative could be coordinated among Carbon, Emery, and Sanpete Counties, Utah Power claimed ownership of the water. Utah Power asserted that since the miners had tapped into the aquifer, Electric Lake, owned by Utah Power, began losing 700 acre-feet of water per month.

In discussions with mine officials, Utah Power, water users, and county officials, the State Engineer gave his opinion that it would be difficult, if not impossible, to prove that the water pumped from the mine is unappropriated.

Recently, Canyon Fuel has abandoned the Flat Canyon portion of the mine where the ground water was encountered and has expanded its operations to the north. It has sealed off that portion of the mine and does not have plans to resume mining operations in the Flat Canyon area.

2.3.6.1 Reasons Eliminated from Further Consideration

Preliminary studies performed by Canyon Fuel showed that water developed by the project would be very expensive, even with Canyon Fuel's assistance with capital costs. The project would be cost prohibitive without Canyon Fuel's participation.

The source of the water and the impact on existing water rights has not been established. The State Engineer maintains the position that

all water in the area is fully appropriated; without a water right, this alternative is not feasible.

Since it would have provided only a temporary water supply, Sanpete County never considered this project to be a viable alternative.

2.3.7 Year-round Release with Ground Water Exchange and Pumping Alternative

The purpose and intent of this alternative is to avoid impacts to Cottonwood Creek by making releases from the Narrows Reservoir on a year-round basis. Year-round releases would eliminate the need for much higher releases during the latter part of the irrigation season. Water would be released through the Narrows Tunnel and would flow down Cottonwood Creek to the San Pitch River and be stored in Gunnison Reservoir. This water would be exchanged with ground water pumped from wells during the irrigation season.

Under the Ground Water Exchange Alternative, a total of about 50.0 cfs would be required to satisfy project demands. Based on typical hydraulic transmissivity of the alluvial material in the northern Sanpete Valley aquifers, it is estimated that properly engineered wells could produce only about 2.0 to 3.0 cfs each. At this capacity, about 20 wells would be required to deliver the water to the various irrigation companies within the project area. These wells would be located strategically near the existing distribution systems. Under this alternative, the Narrows Reservoir and Tunnel would still be needed. The Upper Cottonwood, East Bench, and Oak Creek Pipelines would be eliminated.

Ground water occurs in northern Sanpete Valley in the unconsolidated alluvial fill

under water table (unconfined) and artesian (confined) conditions. Depth to water ranges from 10 feet in the center of the valley to about 88 feet near the alluvial slopes at the base of the Wasatch Plateau. The hydraulic transmissivity ranges from less than 1,000 square feet per day (ft²/day) to about 20,000 ft²/day. Formations with the lowest transmissivity generally are located in the center of the valley. Typical well depths range from about 50 to 500 feet. There are about 55 pumped wells and about 185 flowing wells in the entire Sanpete Valley. Most of the ground water currently is being used for irrigation.

As noted, in addition to the Narrows Reservoir and Tunnel, approximately 20 wells would be required to produce a total capacity of 50.0 cfs. These would be 20-inch-diameter rotary-drilled wells. Because they would be drilled in unconsolidated alluvial fill, the wells would need to be fully cased and screened with gravel packing. The wells would cost about \$6.5 million at a cost of approximately \$325,000 per well. O&M costs for pumping would be about \$52 per acre-foot or \$281,000 per year to deliver 5,400 acre-feet. The total estimated cost of this alternative is about \$26,632,000 or about 0.85 times the cost of the Proposed Action. However, with the added cost of pumping, the average annual cost for water is about 1.07 times the cost for the Proposed Action.

As noted above, the productivity of the aquifer as reflected by the range in transmissivity varies considerably from location to location throughout the valley. This suggests some risk associated with the site selection and the associated uncertainty as to whether the required flow could be developed with the 20 wells for the estimated cost. In addition, the 20 new, high-capacity wells coupled with the relatively large number of existing wells and low

transmissivity in parts of the valley suggest that the potential for interference with other wells would be significant.

Change applications would need to be approved by the State Engineer to exchange the imported water from the Narrows Project to the new wells. Historically, the State Engineer has been reluctant to approve change applications or new applications where there is a possibility of significant interference with existing wells. With the high potential for interference, it is unlikely that extensive changes as proposed by this alternative would be approved by the State Engineer.

An additional alternative configuration would be to implement this alternative without constructing the Narrows Dam and Reservoir, diverting approximately 4,671 acre-feet of water. This configuration is simply a variation of the Year-Round Release Alternative and would suffer from the same deficiencies. Therefore, this configuration has been eliminated from further study for the same reasons as the Year-Round Release with the Ground Water Exchange and Pumping Alternative.

2.3.7.1 Reasons Eliminated from Further Consideration

Technical feasibility of the alternative is uncertain. The range of transmissivity of the aquifer formation introduces significant risk and suggests that more than 20 wells might be required to produce the 50.0-cfs capacity. The potential for obtaining an approved change application is equally uncertain because of the potential for significant interference with existing wells.

The alternative is financially infeasible. Annual costs far exceed the sponsor's repayment capacity and other available resources as needed to maintain eligibility for SRPA funding. Similarly, water right

uncertainties also cloud eligibility for SRPA funding. As with other alternatives, SRPA funding is essential to maintain financial feasibility.

Even though the average annual cost of water for this alternative is about 1.75 times greater than the Proposed Action, this alternative does not eliminate most of the impacts to wetlands and Gooseberry Creek that are aspects of the Proposed Action.

2.3.8 New Ground Water Development

Some suggestions received in scoping meetings proposed developing local ground water sources in lieu of constructing the Narrows Dam and Reservoir. Under this alternative, there would be no need for the Narrows Dam and Reservoir or the pipelines included in the Proposed Action. However, the Narrows Tunnel eventually would need rehabilitation. A total well capacity of about 50.0 cfs would be required to supply project needs. As discussed in the previous alternative, about 20 wells with a capacity of 2.0 to 3.0 cfs would be required. Total cost of the wells would be about \$6,500,000; and annual pumping costs would be about \$281,000.

This alternative would require approval by the State Engineer. However, the State Engineer considers the ground water aquifer in north Sanpete County to be fully appropriated. Further development of ground water in the area without import would impact existing water rights in downstream locations. In a November 5, 1997, policy memorandum entitled Water Rights Policy, Sevier River Basin Areas 61, 63, 65, 66, 67, 68, and 69, the State Engineer published the following:

“As of March 19, 1997, the Sevier River Basin was closed to all new appropriations of ground water. . . . All new ground-water development will be based on the acquisition and changing of existing valid water rights from surface (including direct flow and reservoir storage) and underground sources.”

No new water is available for development of the magnitude required here. The only water that might be made available would be through purchasing existing water rights. Purchasing existing water rights is essentially the same as the proposal to retire irrigated lands, which is discussed subsequently.

2.3.8.1 Reason Eliminated from Further Consideration

This alternative is technically infeasible. No water supply exists for the proposal. Consequently, this alternative does not satisfy the project purpose and need.

2.3.9 New Surface Water Development in Sanpete County Alternative

Several suggestions have been made to expand the use of local streams to satisfy project needs. These suggestions include storing excess spring flows either in a new reservoir built in Sanpete County or using these flows to recharge the ground water basin for later use. Another version of this alternative would be for SWCD to purchase existing water rights to meet its needs. Under this alternative, there would be no need to construct the Narrows Dam and Reservoir or the pipelines included in the Proposed Action. However, the Narrows Tunnel eventually would need rehabilitation.

While it is true that there are excess flows in the local streams during the spring runoff, this water is not available for use in northern Sanpete County. On November 30, 1936, a final decree was entered by Judge LeRoy Cox adjudicating the water and water rights of the Sevier River system. Under the terms of the Cox Decree, all of the waters within the project area, located in the Sevier River drainage, are fully appropriated; and no additional local supplies are available for appropriation or development. Any water, either underground or surface water, in the project area is either fully appropriated by local water right owners or is necessary to satisfy the water rights of downstream appropriators. Thus, no new surface water is available for local development.

Even though the local surface water supplies are fully appropriated, the State Engineer would consider applications to transfer water rights and change points of diversion. To be approved, the change in points of diversion must not adversely impact third party water rights holders. With the complexity of water rights in the Sevier River Basin involving direct and return flows, the possibility of adverse impacts is substantial with almost any conceivable change in points of diversion.

The suggested purchase of water rights and transfer of points of diversion implies that certain irrigated lands would be removed from production with the transfer of the water right. This proposal is essentially the retirement of irrigated lands, which is discussed subsequently.

2.3.9.1 Reason Eliminated from Further Consideration

The alternative is technically infeasible. There is no adequate surface water supply for the project. Consequently, this alternative does not satisfy the project purpose and need.

2.3.10 Central Utah Project Water Alternative

Use of CUP water has been suggested to meet project needs. The CUP originally intended to deliver CUP water to southern Sanpete County, south of the city of Gunnison. It is suggested that this water be made available to northern Sanpete County by exchange or through a new pipeline constructed from the outlet of Syar Tunnel to northern Sanpete County. An exchange is not technically possible. No water could be retained in northern Sanpete County to be exchanged for CUP water. As a result, CUP water would need to be delivered directly from Syar Tunnel.

Under this proposal, 50 cfs of CUP water would be delivered from the outfall of Syar Tunnel through a series of pipes and tunnels using the available pressure head from Strawberry Reservoir. This 38.8-mile-long pipeline would start at Syar Tunnel and end at the mouth of Cottonwood Creek Canyon in Sanpete County. It would require three tunnels and pressure pipe with ratings as high as 750 pounds per square inch.

The hydraulics require a minimum of 48-inch-diameter pipe through the reach between the Syar Tunnel and the outfall of the third tunnel, a length of 116,600 feet. From this point on, the pipeline is reduced to a 36-inch-diameter pipe for an additional 88,300 feet. A total of 13,300 feet of tunnel would be required. Costs were developed using 1987 estimates for steel pipe and tunnels for the CUP and indexing them to April 1994. The total cost for the Syar-Cottonwood Pipeline is estimated to be \$146,600,000. This includes the cost of the East Bench Pipeline that still would be required to deliver project water.

To be eligible for funding under terms of the SRPA, total project costs must be under \$15 million indexed from 1956 to the present or about \$50 million in today's dollars. The total cost of the Syar-Cottonwood Pipeline proposal exceeds the maximum limit by over 2.5 times and is more than 8 times that of the Proposed Action. Thus, the proposal would not be eligible for SRPA funding.

The Central Utah Project Completion Act, which authorized completion of the remaining features of the CUP, placed certain restrictions on delivery of project water. It restricted development of the CUP to the Wasatch Front area of central Utah if certain Utah counties withdrew from the CUP. Since passage of the CUPCA, Millard and Sevier Counties formally have withdrawn from the CUP. As a result, delivery of water to Sanpete County has been dropped from the CUP plan in compliance with the CUPCA.

2.3.10.1 Reasons Eliminated from Further Consideration

The plan is financially infeasible because the proposal does not qualify for SRPA funding, and no other major funding sources are available.

Costs exceed the estimated cost of the Proposed Action by more than eight times.

CUP water cannot be legally delivered to Sanpete County under present law.

2.3.11 Conservation Through Retirement of Irrigation

Retirement of irrigated lands is one method of reducing water shortages where local supplies are inadequate to meet all demands for irrigation water. In practice, certain irrigated lands are retired; and the water is transferred to other irrigated lands. The shortage on the

active lands thereby is reduced by some corresponding increment. If storage is available, water originally allocated to the retired lands would be held until needed on the active lands. In the absence of storage, only the existing streamflow allocated to the retired lands would be available for diversion to the active lands. Where snowmelt is the major component of local supplies, flows diminish during the irrigation season. Thus, absent storage, water would be available only for transfer to the remaining active lands when it would normally be applied to the retired land. Since any land that might be considered for retirement is already water short during the mid- to late-summer, little additional water would be available when it is needed most.

It has been suggested that sufficient irrigated lands be retired to reduce the demand by 4,900 acre-feet per year, the amount of irrigation water that would be produced by the Proposed Action. Local water supplies amounting to about 1.78 acre-feet per acre are available in the late irrigation season to lands proposed for retirement. In order to make 4,900 acre-feet of water available to the active lands, about 2,760 acres of land would need to be retired. This represents about 18% of the 15,420 acres of project-eligible lands. Project-ineligible lands normally do not receive water during most of the water-short portion of the growing season, so there would be no advantage in retiring project-ineligible lands.

To achieve this benefit for the lands remaining in production, the lands (18%) removed from production would be taken out of production in their entirety. An 18% reduction of project-eligible farmland is contrary to one of the stated needs for the project. Agriculture is one of the major components of the economy of north Sanpete

County and is seriously impacted by persistent water shortages. Land retirement would not materially improve the overall water supply situation in the project area. It would improve only the water supply for selected farmland, and then only marginally.

It should be noted that the suggested land retirement still would not provide a full water supply to the remaining active lands. To put land retirement in perspective, consider how many acres of land must be retired to provide a full water supply to the remaining active lands. In a typical June when local supplies are still relatively abundant, available local water supplies could supply only the June demands on about 11,900 acres of project-eligible farmland—a reduction of about 3,500 acres from what is now farmed. The typical September demands are considerably lower, but local supplies have also dwindled to the point that they could provide a full water supply only to about 6,000 acres of land—a reduction of about 9,400 acres.

Reduced water shortages on active irrigated lands definitely would provide an incremental improvement in production and yield on those lands. The economic impact of land retirement is detrimental to the local economy and is politically unacceptable to local residents.

Major sources of funding for the proposed project would be from the SRPA and a State loan and grant. However, land retirement is a local land use issue that does not qualify as a water development feature under requirements of the SRPA loan program. Similarly, land retirement does not provide benefits that would be eligible for State funding. Without State and SRPA funding, local funds would be inadequate to retire 2,760 acres of irrigated farmland.

The concept of land retirement also presupposes that there are willing sellers and willing buyers of land, forbearance, or water

rights. There seems to be little indication that local farmers are willing to forgo farming on 20% of their irrigated farmland. To the contrary, local farmers appear to be more willing to support the Proposed Action to improve the water supply for their irrigated lands.

The purchase of land or rights for retirement would have to be accomplished either by the project sponsor or by individual farmers. In either case, prospective purchasers most likely would not have the resources to make such extensive land purchases. Land and rights purchases are not eligible for funding under terms of the SRPA, and most banks would not accept idle, nonproductive land as collateral for a bank loan. Further, no buyers have announced any interest in making such purchases. Lacking willing sellers, there may be no equitable or acceptable means for determining which lands would be retired.

2.3.11.1 Reasons Eliminated from Further Consideration

This plan does not meet a stated need for supplemental water supplies to support existing farmland; rather, it proposes taking farmland out of production to reduce the need for supplemental water.

The plan does not qualify for SRPA and State funding. Without these sources of funds, the plan is financially infeasible.

Any water made available for late season irrigation under this proposal would be only that fraction of the water formerly used on retired lands during the late irrigation season; most of the water formerly used on these lands would flow past without being used locally.

2.3.12 Purchase of Sanpete County's Water Rights by Carbon County Water Interests

Scoping comments suggested that Carbon County water interests could purchase Sanpete's rights to Gooseberry Creek water. This would eliminate impacts to Carbon County that would occur as a result of constructing the Narrows Project and diverting Gooseberry Creek water. Since the inception of the Gooseberry Project, this alternative has been available to Carbon County water interests.

2.3.12.1 Reasons Eliminated from Further Consideration

The proposal does not provide any relief from the persistent water shortages that prompted northern Sanpete County water users to pursue developing additional water supplies.

The proposal is infeasible without the presence of both willing sellers and willing buyers.

This plan does not satisfy the stated project purpose and need.

2.3.13 Carbon County Proposed Recharge Alternative

In September 2006, Carbon County proposed an alternative for review consisting of diverting transbasin water through a rehabilitated Narrows Tunnel and down Cottonwood Creek to a proposed ground water recharge aquifer at the mouth of the canyon. The alternative also would include construction of production wells and a delivery system. Following coordination with the Utah State Engineer to verify feasibility

of the alternative from a water rights perspective, Sanpete County agreed to an analysis of the alternative overseen by the Central Utah Water Conservancy District. CH2MHill, under contract to the CUWCD, analyzed this alternative and included it in the June 2008 draft update to the *Sanpete County Master Plan*, which was distributed for public review and comment, including a public meeting on June 26, 2008, hosted by CUWCD in Orem, Utah. Following consideration of comments received on the draft plan, the final *Update to the Sanpete County Master Plan* was published in August 2008.

2.3.13.1 Reasons Eliminated from Further Consideration

As indicated on page 20 of the August 2008 *Update to the Master Plan*, this alternative would meet the purpose of and the need for the project, but it is not a feasible option for several reasons:

- ◆ It is unlikely that an aquifer with a capacity to hold over 4,000 acre-feet of water could be found in northern Sanpete County.
- ◆ Direct diversion of flows would require extensive construction of diversion dams and canals within the reservoir basin, potentially negating the avoidance of impacts by not building the proposed reservoir.
- ◆ Water would have to be treated to drinking water standards before injection; or alternately, a large infiltration pond and settling basin, equivalent to a small reservoir, would be required to hold water diverted during spring runoff.

- ◆ The nature and location of available aquifers and apparent separation of bedrock and shallow aquifers poses technical problems due to the requirement to inject and remove water from the same aquifer.
- ◆ High drawdown from the proposed high capacity wells could affect adjacent wells and water rights

2.4 COMPARISON OF ALTERNATIVES

Table 2-8 compares the closely examined alternatives against the issues associated with the Proposed Action that are outlined in chapter 1. The scientific and analytical basis for these comparisons can be found in chapter 3.

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues

Issues	No Action		Proposed Action		Mid-Sized Reservoir		Small Reservoir	
THREATENED AND ENDANGERED								
Acre-feet depletion from Colorado River system	0		5,491 acre-feet		5,124 acre-feet		4,703 acre-feet	
WILDLIFE	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)
Change in habitat units for the following species: mule deer, Brewer's sparrow, beaver, Richardson vole, yellow warbler	Mule deer	0 (0)	Mule deer	-135 (0)	Mule deer	-109 (0)	Mule deer	-78 (0)
	Brewer's sparrow	0 (0)	Brewer's sparrow	-477 (0)	Brewer's sparrow	-386 (0)	Brewer's sparrow	-263 (0)
	Beaver	0 (0)	Beaver	-13 (0)	Beaver	-11 (0)	Beaver	-9 (0)
	Richardson vole	0 (0)	Richardson vole	-63 (0)	Richardson vole	-57 (0)	Richardson vole	-45 (0)
	Yellow warbler	0 (0)	Yellow warbler	-26 (0)	Yellow warbler	-24 (0)	Yellow warbler	-19 (0)
WATER RESOURCES								
Acre-feet of depletion to the Price River drainage	0		5,491 acre-feet		5,124 acre-feet		4,703 acre-feet	
Acre-feet of water available to San Pitch River drainage	0		5,136 acre-feet		4,964 acre-feet		4,710 acre-feet	
FISHERIES								
<i>Instream</i>								
Change in weighted usable area in fish habitat as measured by instream flow incremental methodology for the following life stages:	Preproject		Postproject (Percent Change)		Postproject (Percent Change)		Pos-project (Percent Change)	
▪ Adult	11,932.32		10,958.04 (-8.17)		10,958.04 (-8.17)		10,958.04 (-8.17)	
▪ Juvenile	2,623.93		2,312.67 (-11.86)		2,312.87 (-11.86)		2,312.87 (-11.86)	
▪ Spawning	69.14		69.91 (+1.11)		69.91 (+1.11)		69.91 (+1.11)	
▪ Fry	427.44		373.25 (-12.68)		373.25 (-12.68)		373.25 (-12.68)	
<i>Reservoir</i>								
Change in surface area in Scofield Reservoir (average)	0		-290		-284		-258	

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues (Continued)

Issues	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
WATER QUALITY				
Change in Scofield Reservoir Trophic State Index	0	+3.5	+3.5	+3.5
Change in average phosphorus level in Scofield Reservoir based on external phosphorus loading (milligrams per liter)[]	0	0.0026	≈0	≈0
WETLANDS				
Acres of wetlands lost	0 acres (without mitigation) 0 acres (with mitigation)	100 acres (without mitigation) 0 acres (with mitigation)	81 acres (without mitigation) 0 acres (with mitigation)	72 acres (without mitigation) 0 acres (with mitigation)
RIPARIAN AND AQUATIC HABITATS				
Miles of stream lost due to inundation of the reservoir	0	5.3 miles	4.8 miles	4.8 miles
Number of miles of stream affected by flow:				
▪ Increase in flow	0	4.9 miles	4.9 miles	4.9 miles
▪ Decrease in flow	0	16.1 miles	16.1 miles	16.1 miles
RECREATION AND VISUAL				
Change in projected fisherman days in Scofield	0	-6,800	-6,400	-5,800
Increase in developed recreation visitor days at Narrows (including fishing)	0	+46,400	+37,600	+27,800
Increase in dispersed recreation visitor days at Narrows (including fishing)	0	+910	+740	+560
Change in visual quality objective	Partial retention	Partial retention	Partial retention	Partial retention
CULTURAL RESOURCES				
Sites inundated or otherwise impacted	0	3	3	3
SOCIAL AND ECONOMIC				
Number of jobs (Carbon, Sanpete) created during construction	0	50-100	50-100	50-100
Change in farm income	0	11% increase	10% increase	10% increase
Change in available water supply				
▪ Sanpete County	0	+5,318 acre-feet	+5,157 acre-feet	+4,935 acre-feet
▪ Carbon County	0	-439 acre-feet	-457 acre-feet	-457 acre-feet

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues (Continued)

Issues	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
LAND MANAGEMENT/ROW/MINERAL LEASING				
Change in number of AUMs of forage	0	-240 AUMs	-203 AUMs	-166 AUMs
Acres of mineable coal reserves not available for mining	0	0	0	0
PUBLIC SAFETY				
Percent change in the volume of traffic in the project area	0	19% increase	15% increase	11% increase
AIR QUALITY¹				
Number of days project will exceed National Ambient Air Quality Standards for PM ₁₀	0	0	0	0
SLOPES AND CHANNEL STABILITY				
Exceed 50-year channel-forming discharge	0	0	0	0
Lateral and vertical degradation	0	0	0	0
GEOLOGIC HAZARDS				
Known geologic hazards within vicinity of dam and reservoir	3	3	3	3
SOILS				
Acres of new soil disturbance	0	668 acres	547 acres	426 acres
Change in sediment loads in Gooseberry Creek	0	-400 tons	-400 tons	-400 tons
TRACE ELEMENTS				
Increase in levels of select trace elements in ground water	0	0	0	0
INDIAN TRUST ASSETS				
Number of Indian trust assets affected	None	None	None	None
ENVIRONMENTAL JUSTICE				
Number of minority communities disproportionately affected by the Narrows Project	None	None	None	None

¹ Particulate matter of 10 microns in diameter or smaller.