RECLAMATION
Managing Water in the West

Value Engineering
Final Report

Hogback Diversion Dam – Fish Screen Project

A30-1745-6313-001-94-0-0

Conducted in Cooperation with Fish and Wildlife Service for Bureau of Reclamation, Upper Colorado Region.

U.S. Department of the Interior
Bureau of Reclamation
Upper Colorado Region

Friday, July 20 2007

Table of Contents

Executive Summary

The Value Study Team met on June 11, 2007, for a 5-day study of the Hogback Diversion Dam – Fish Screen. The estimated cost of the baseline concept is $ 2,200,000. The Team developed nine proposals which are summarized below. If all the savings proposals are accepted, their maximum savings potential is $1,185,000. Note that in calculating the maximum potential savings, the cost of the study ($15,000) was deducted only once.

Independent Proposals: The following proposals are independent of all other proposals and could be accepted or rejected individually without affecting other proposals. Proposal Nos. 1a, 1b, 1e, 1f, and 1h are recommended improvements to the baseline and should be accepted regardless of whether any of the other proposals are accepted. With Proposal Nos. 1a, 1b, 1e, 1f, and 1h added to the baseline project, the total additional cost of the project would be $288,000. The baseline project could be further enhanced by including Proposal Nos. 1c and 1d for minimal cost. Proposal 1g may be required depending upon the acceptance one or more of the other proposals and the spacing to which the existing trashracks are modified in Proposal 1f. If all of the independent Proposals are accepted, the total additional cost to the baseline project would be $900,000

Proposal No. 1a. Modify Sluice Return Channel. The estimated additional cost of this proposal is $21,000 before deducting any study costs.

Proposal No. 1b. Different Site Configuration. The estimated additional cost of this proposal is $100,000 before deducting any study costs.

Proposal No. 1c. Additional Mechanical Equipment. The estimated additional cost of this proposal is $69,000 before deducting any study costs.

Proposal No. 1d. Traveling Water Screens. The estimated savings of this proposal is $0 before deducting any study costs.

Proposal No. 1e. Site Security. The estimated additional cost of this proposal is $122,000) before deducting any study costs.

Proposal No. 1f. Modify Existing Trashrack. The estimated additional cost of this proposal is $35,000 before deducting any study costs.

Proposal No. 1g. Build Second Trash Removal Structure and Vehicular Access. The estimated additional cost of this proposal is $851,000 before deducting any study costs.

Proposal No. 1h. Minimize Automation. The estimated savings of this proposal are $100,000 before deducting any study costs.

Dependent Proposals: Proposal Nos. 1a, 1e, 1f, and 1h are recommended improvements that should be included in the design of the project even if proposal 2 is accepted in lieu of the baseline proposal. If the additional proposals are accepted, the total additional cost to Proposal 2 would be $230,000

Proposal No. 2. Use a Weir Wall in Lieu of Fish Screens. The estimated savings of this proposal are $1,200,000 before deducting any study costs.

Other Ideas: The Team identified 134 ideas for consideration that are listed in the "Disposition of Ideas" table near the end of this report.

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Acknowledgement of Consultation Assistance

The Value Study Team wishes also to express thanks and appreciation to those listed on the Consultation Record of this report. Their cooperation and help contributed significantly to the technical foundation and scope of the team's investigation and final proposals.

The goal of the value method is to achieve the most appropriate and highest value solution for the project. It is only through the efforts of a diverse, high-performing team, including all those involved, that this goal can be achieved. This study is the product of such an effort.

Value Method Process

The Value Method is a decision making process, originally developed in 1943 by Larry Miles, to creatively develop alternatives that satisfy essential functions at the highest value. It has many applications but is most often used as a management or problem-solving tool.

The study process follows a job plan that provides a reliable, structured approach to the conclusion. Initially, the team examined the component features of the program, project or activity to define the critical functions (performed or desired), governing criteria and associated costs. Using creativity (brainstorming) techniques, the team suggested alternative ideas and solutions to perform those functions, consistent with the identified criteria, at a lower cost or with an increase in long-term value. The ideas were evaluated, analyzed and prioritized, and the best ideas were developed to a level suitable for comparison decision making and adoption.

This report is the result of a "formal" Value Study, by a team comprised of people with the diversity, expertise, and independence needed to creatively attack the issues. The team members bring a depth of experience and understanding to the disciplines they represent and an open and independent enquiry of the issues under study, to creatively solve the problems at hand. Ideally, the team members have not been notably involved in the issues prior to the study. The team applied the Value Method to the issues and supporting information, and took a "fresh" look at the problems to create alternatives that fulfill the client's needs at the greatest value.

Current Description

To reestablish a self-sustaining fish population and allow current and future water development, federal, state and tribal (including: Jicarilla, Southern Ute, Ute Mountain Ute, and Navajo Tribes) agencies, water user groups and environmental organizations in Colorado and New Mexico formed the San Juan River Recovery Implementation Program (SRRIP). One goal of the SRRIP is to prevent the loss of endangered fish at diversion facilities.

Located approximately 15 miles East of Shiprock and 21 miles West of Farmington, New Mexico, the Hogback Diversion is a sheet pile cutoff core dam that includes a grouted riprap crest, dumped riprap ramp downstream and a grouted boulder step-pool fish passage along the right bank (see figure 1).

The baseline concept is a straight line stationary screen structure. The screen would start on the right bank in the upper canal and extend to the headwall dividing the canal gates from the sluice gate. A concrete, broken back transition structure makes the change in side slope from the existing right canal bank at 1 ½:1 to vertical at the fish screen. Ten feet of vertical concrete wall is on each of the upstream and downstream abutments and in-plane with the fish screen. Each 10 feet of area provides run-out and parking room for the screen cleaning brushes. Design length of the fish screen is 200 feet. An additional 10 feet is added to account for areas not screened due to supporting guides, columns, and beams (see figures 2 and 3).

A concrete sill with a top elevation 4992.4, constitutes the bottom of the fish screens, and will deflect bed load sediment and fish to the sluice channel.

The existing trashracks on the diversion headworks will be modified by adding additional equipment that will automate the trash raking and conveying measures to keep the racks clean.

In emergency situations, screen panels can be raised to allow flow to reach the Hogback Canal. Flow to the upper canal could be shut off for short periods of time by closing the gate at the headworks to allow for more extensive maintenance of the fish screens. Yearly maintenance of the fish screens will be done during the months when the canal is normally out of service.

No vehicular access is being provided to access the north side (right side facing down stream) of the canal and right abutment of the fish screen. A grated walk way provides for foot traffic.

Figure 1. Location Map

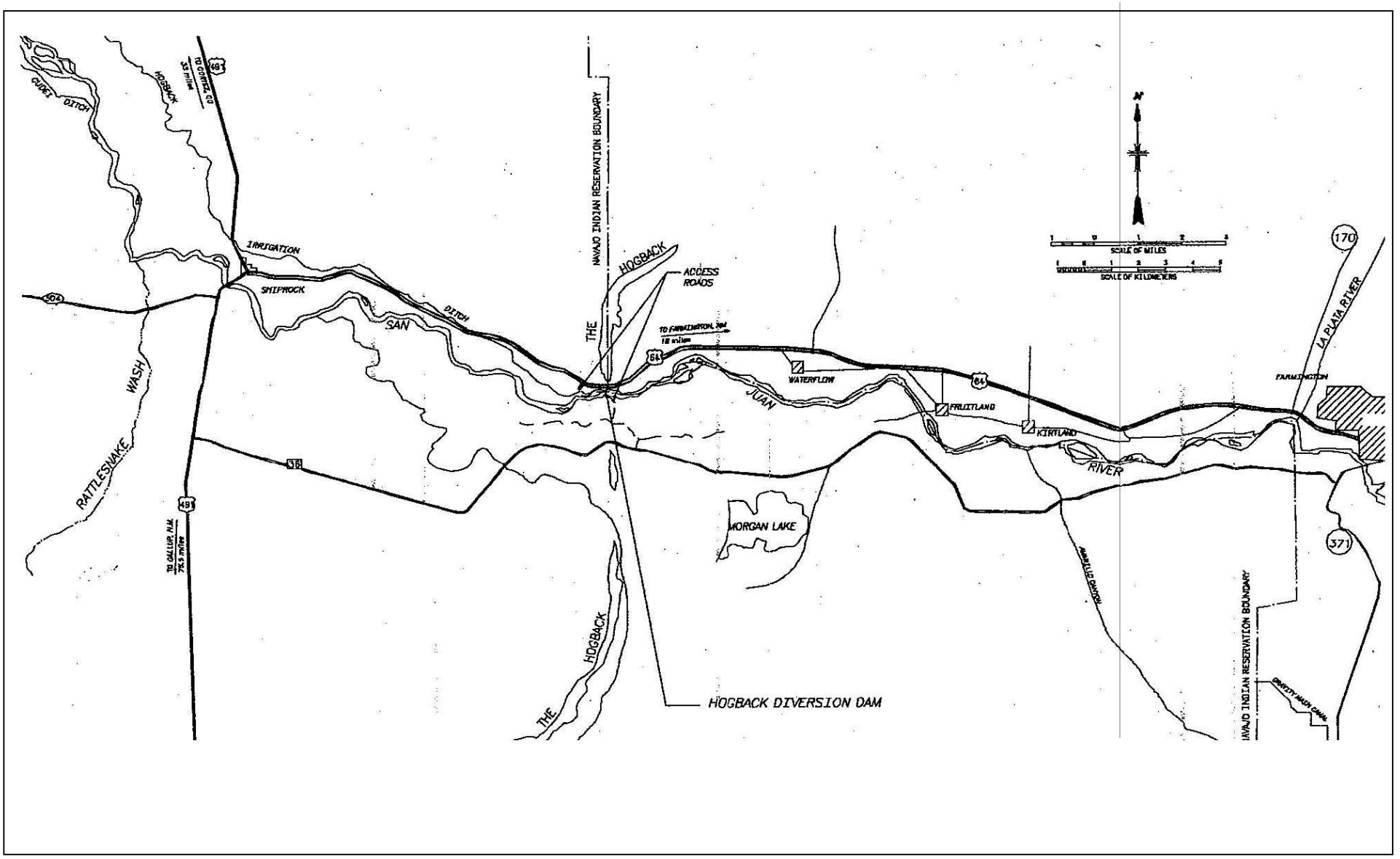


Figure 2. Site Layout

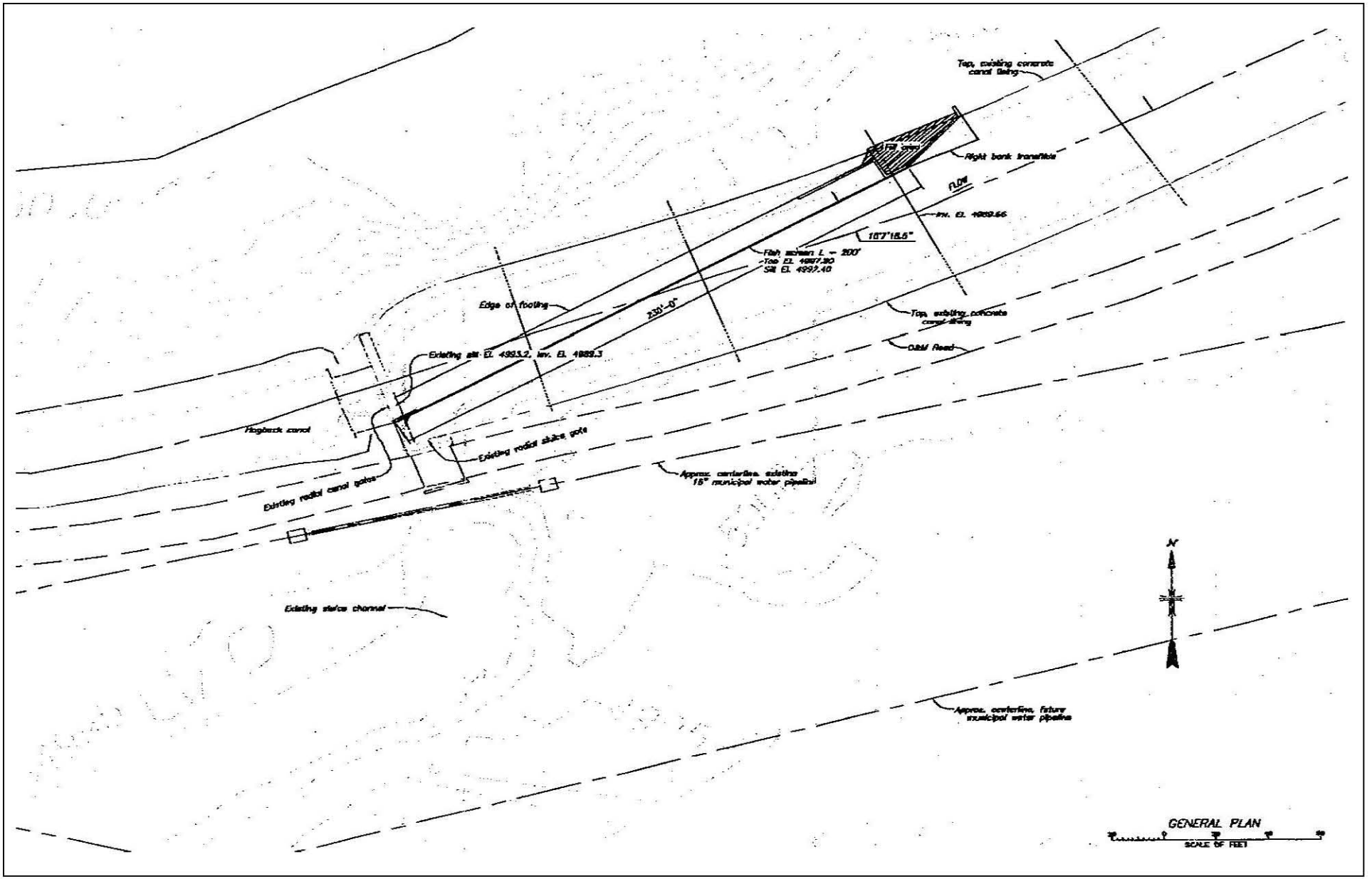
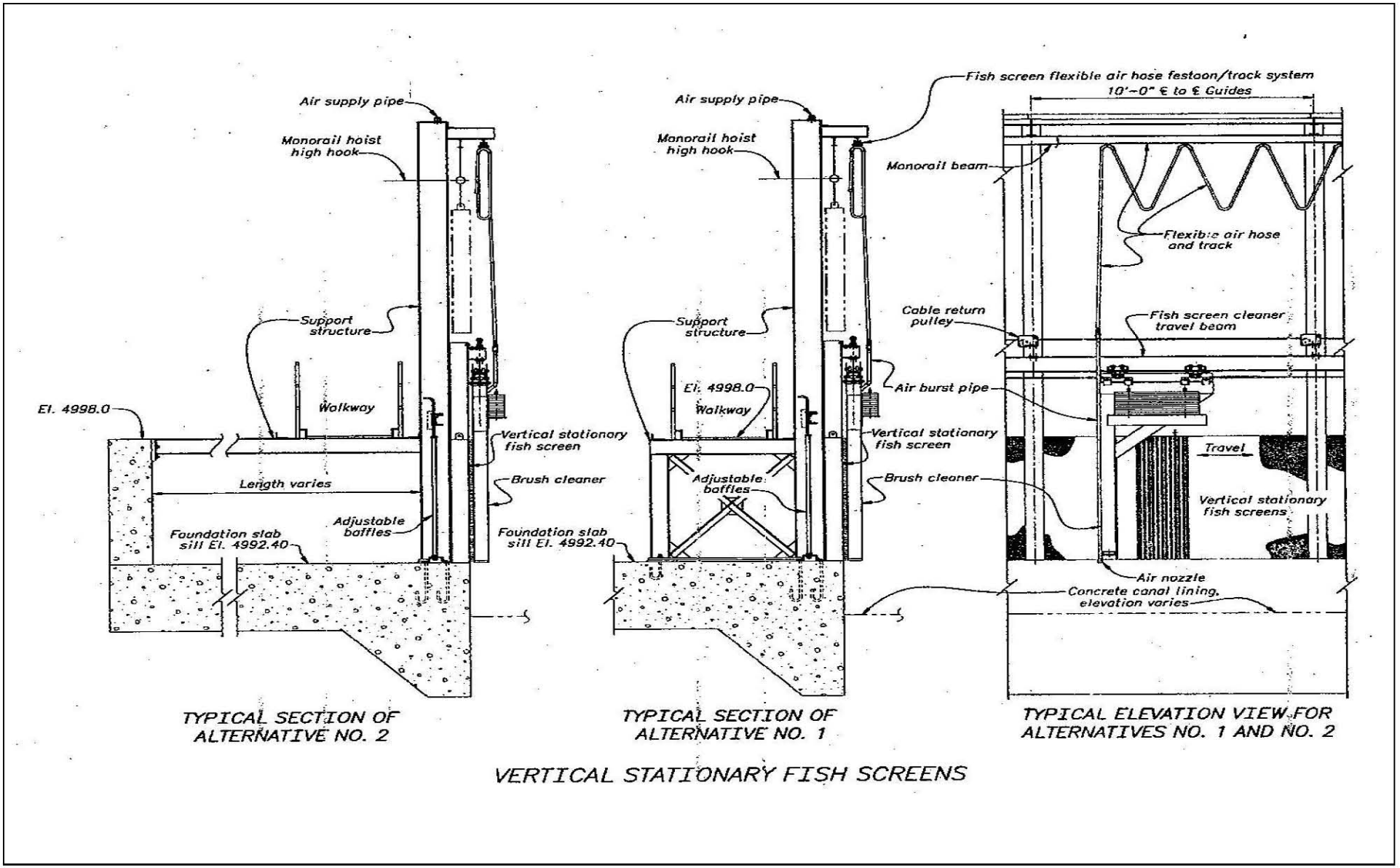


Figure 3 Stationary Screen Details



Owner, Users, and Stakeholders List
Identification and Issues Determination

Owner	Owner Issues (all inclusive)	Desire/ Criteria
Navajo Nation	Water Delivery	C
	Low O&M Requirements	D
	Sediment Transport	C
	Trash Removal	C
User	**User Issues (all inclusive)**	**Desire/ Criteria**
San Juan River Diné Water Users Association	Water Delivery	C
	Low O&M Requirements	D
	Sediment Transport	C
	Trash Removal	C
Stakeholder	**Stakeholder Issues (all inclusive)**	**Desire/ Criteria**
New Mexico, Colorado State Agencies Jicarilla, Southern Ute, Ute Mountain Ute, Navajo Tribal Agencies Water Development Agencies Conservation Groups Federal Agencies	Protect Endangered Fish	C
	Protect Diversion	C
	Protect existing and future water uses	C

Function Analysis

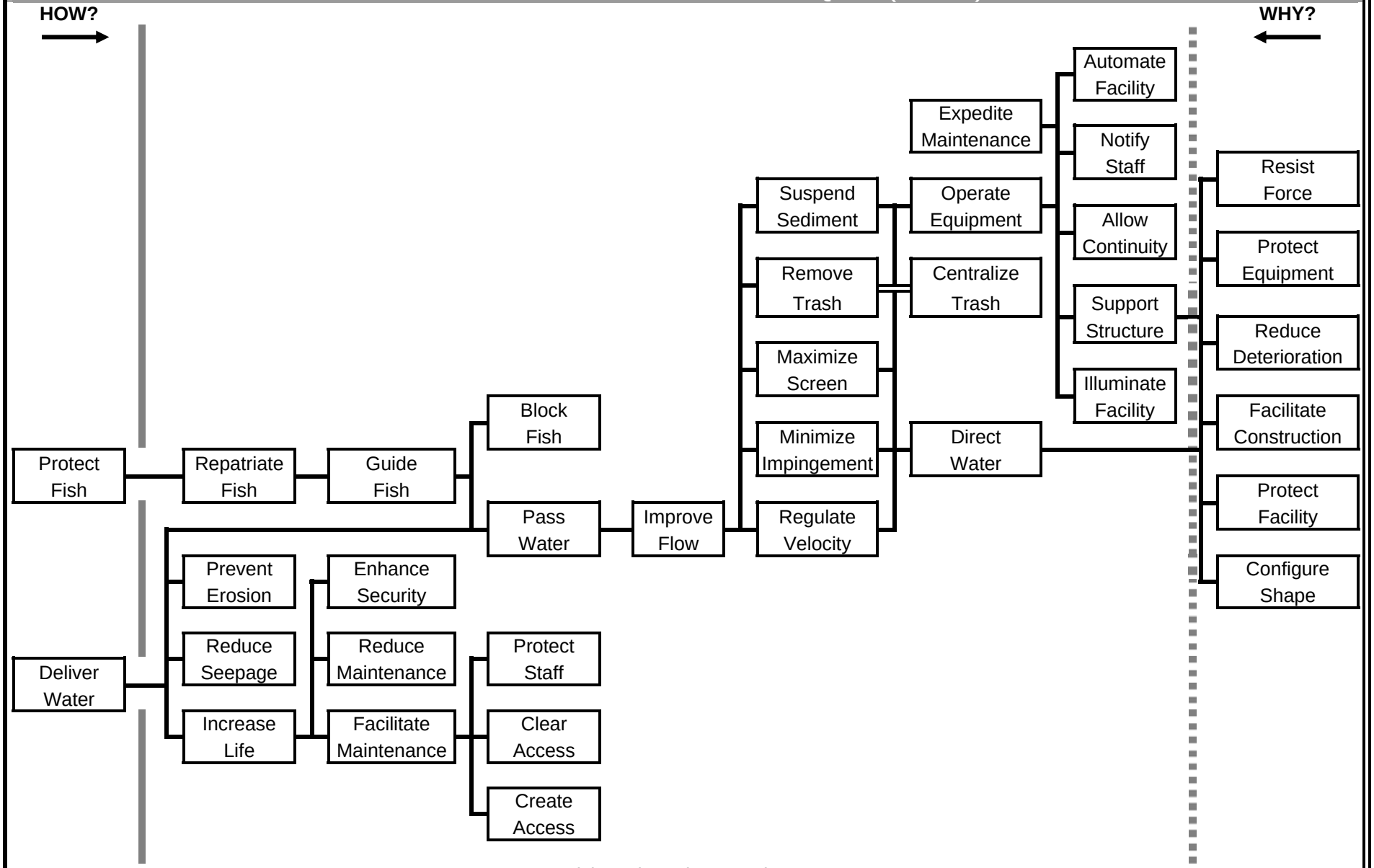
Component	Active Verb	Measurable Noun
Stationary Fish Screens	Protect	Fish
Structural Concrete	Deliver	Water
Stationary Fish Screens	Repatriate	Fish
Stationary Fish Screens	Guide	Fish
Structural Concrete	Prevent	Erosion
Structural Concrete	Reduce	Seepage
Fish Screen Cleaners	Increase	Life
Stationary Fish Screens	Block	Fish
Stationary Fish Screens	Pass	Water
Electrical Installation	Enhance	Security
Screen Guides and supports	Facilitate	Maintenance
Hydraulic Trash Rake	Reduce	Maintenance
Structural Concrete	Improve	Flow
Steel Pipe Guardrails	Protect	Staff
Conveyor	Clear	Access
Grated Walkway	Create	Access
Air Compressor	Suspend	Sediment
Hydraulic Trash Rake	Remove	Trash
Adjustable Baffles	Maximize	Screen
Adjustable Baffles	Minimize	Impingement
Adjustable Baffles	Regulate	Velocity
Monorail Travel Beam	Expedite	Maintenance
Electrical Installation	Operate	Equipment
Conveyor	Centralize	Trash
Structural Concrete	Direct	Water
Water Level Measuring System	Automate	Facility
Electrical Installation	Notify	Staff
Diesel Engine Generator	Allow	Continuity
Structural Concrete	Support	Structure
Electrical Installation	Illuminate	Facility
Structural Concrete	Resist	Force
Structural Concrete	Protect	Equipment
Screen Guides and Supports	Reduce	Deterioration
Remove Existing Lining	Facilitate	Construction
Structural Concrete	Protect	Facility
Structural Concrete	Configure	Shape

Function Analysis System Technique (FAST)

The Value Study Team used the function-analysis process to generate a Function Analysis System Technique (FAST) diagram, designed to describe the present solution from a functional point of view. The FAST diagram helped the Team identify those design features that support critical functions and those that satisfy non-critical objectives. The FAST diagram also helped the Team focus on potential value mismatches, and generate a common understanding of how project objectives are met by the present solution.

Hogback Diversion Fish Screen – Conceptual Design

FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM



Activity-Oriented FAST Diagram

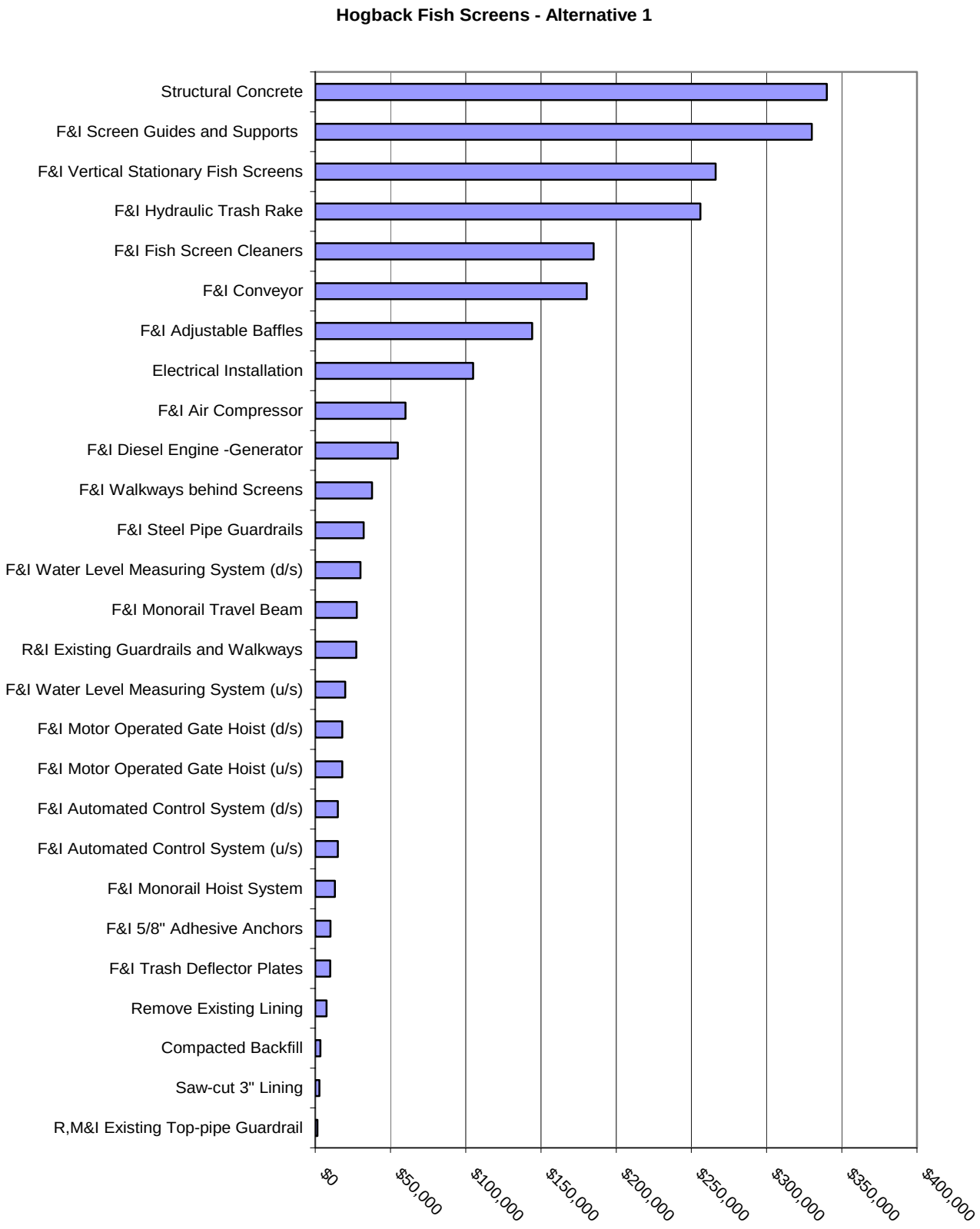
Cost Model and Estimate Information

The Value Study Team cost model is based on the conceptual design estimates provided by the design team for the preferred project design. The cost model was developed by the Value Study Team and was used to focus on features with the greatest potential for savings and to highlight areas of value mismatch. Unit prices were reviewed by the Cost Estimator and Value Study Team members to ensure reliability and applicability.

Cost avoidances/savings and the original design concept estimates are of the same general level of development, although these costs may vary as final designs are pursued.

Note: The cost estimates prepared for this study have been developed for the sole purpose of comparing costs of proposals to the functional equivalent in the baseline concept. The value study schedule dictates the time and resources allowed for preparation of cost estimates for each proposal alternative. Therefore, these cost estimates are not recommended to be used for budgeting or construction purposes. At final spec the design team will more accurately quantify any savings/avoidances resulting from acceptance of proposals. This information will be reported in the accountability report. If as a result of the Value Study a cost estimate is required for appropriations, we recommend that a new total baseline cost estimate be completed.

Cost Model


Hogback Fish Screens - Alternative 1
Structural Concrete
F&I Screen Guides and Supports
F&I Vertical Stationary Fish Screens
F&I Hydraulic Trash Rake
F&I Fish Screen Cleaners
F&I Conveyor
F&I Adjustable Baffles
Electrical Installation
F&I Air Compressor
F&I Diesel Engine -Generator
F&I Walkways behind Screens
F&I Steel Pipe Guardrails
F&I Water Level Measuring System (d/s)
F&I Monorail Travel Beam
R&I Existing Guardrails and Walkways
F&I Water Level Measuring System (u/s)
F&I Motor Operated Gate Hoist (d/s)
F&I Motor Operated Gate Hoist (u/s)
F&I Automated Control System (d/s)
F&I Automated Control System (u/s)
F&I Monorail Hoist System
F&I 5/8" Adhesive Anchors
F&I Trash Deflector Plates
Remove Existing Lining
Compacted Backfill
Saw-cut 3" Lining
R,M&I Existing Top-pipe Guardrail
$0
$50,000
$100,000
$150,000
$200,000
$250,000
$300,000
$350,000
$400,000

Proposal No. 1a

Description

Proposal No. 1a. Modify Sluice Return Channel

Proposal Description: This proposal consists of placing geotextile and riprap in the upper portion of the sluice channel and placing two rows of boulder weirs in the channel to produce a stilling pool for protecting the fish that leave the sluice gate.

Critical Items to Consider: The current configuration for the sluice return channel results in a high velocity, turbulent exit of water from the canal. Given the maximum diversion of up to approximately 650 cfs from the San Juan River by the Hogback Canal headworks and the intended canal diversion downstream of 230 cfs, the sluice return channel consistently receives high flow. The sluice return channel exits the canal at a right angle and then makes a subsequent right angle turn en route to confluence with the San Juan River. The sluice gate allows for both bottom and top release of diverted water. While the top (overflow of gate) release is of low velocity, the predominately bottom release controlled by the sluice gate results in high velocities that enter the sluice return bed in a turbulent fashion that is injurious to fish.

Given the goal of the fish screening project is to return Colorado pikeminnow and razorback sucker unharmed to the river channel, modifications to the sluice return channel and/or sluice gate are necessary to avoid such harm. To not modify the sluice return to reduce harm to fish can result in mortality, as a worst case response, or injury and/or disorientation of fish entering the sluice return channel from the canal. Injury and/or disorientation of fish increase susceptibility to predation pressures in the sluice return bed channel and at the downstream confluence with the San Juan River.

Two sources (wild, hatchery) and four size classes of Colorado pikeminnow are of concern to this screening project: 1) larvae (<20 mm total length [TL]) that may be produced as a result of natural spawning, 2) young-of-year (ca. 70 mm TL) from hatchery stockings, 3) juvenile (ca. 170 mm TL) from hatchery stockings, and 4) sub-adult and adult fish surviving from previous hatchery stockings or of wild origin and migrating upstream from downstream reaches. Razorback sucker sub-adult and adult fish are the primary concern. All razorback suckers currently occupying the San Juan River upstream of Hogback Diversion are derived from hatchery stockings and size of fish stocked exceeds 200 mm TL. Regardless of origin (wild, hatchery), response of both species to the turbulent, high velocity entrance to the sluice return bed will be similar. However larger sized individuals will be more resistant to mortality or injury, but will remain susceptible to disorientation.

A hydraulic analysis is recommended to adequately size the channel restrictions to adequately provide the necessary tailwater and hydraulic conditions for the fish while maintaining an effective sluice capability of the existing canal.

Ways to Implement: Modifications to the sluice return channel and/or sluice gate should include reduction of water velocity and turbulence. This can be accomplished by a combination of actions, including velocity reduction through modification of the sluice gate and its operation. Creation of a 'stilling' basin or pool immediately downstream of the gate and other instream modifications will reduce velocity and turbulence.

Changes from the Baseline Concept: This requires modification to sluice gate and/or sluice return channel to reduce water velocity and turbulence.

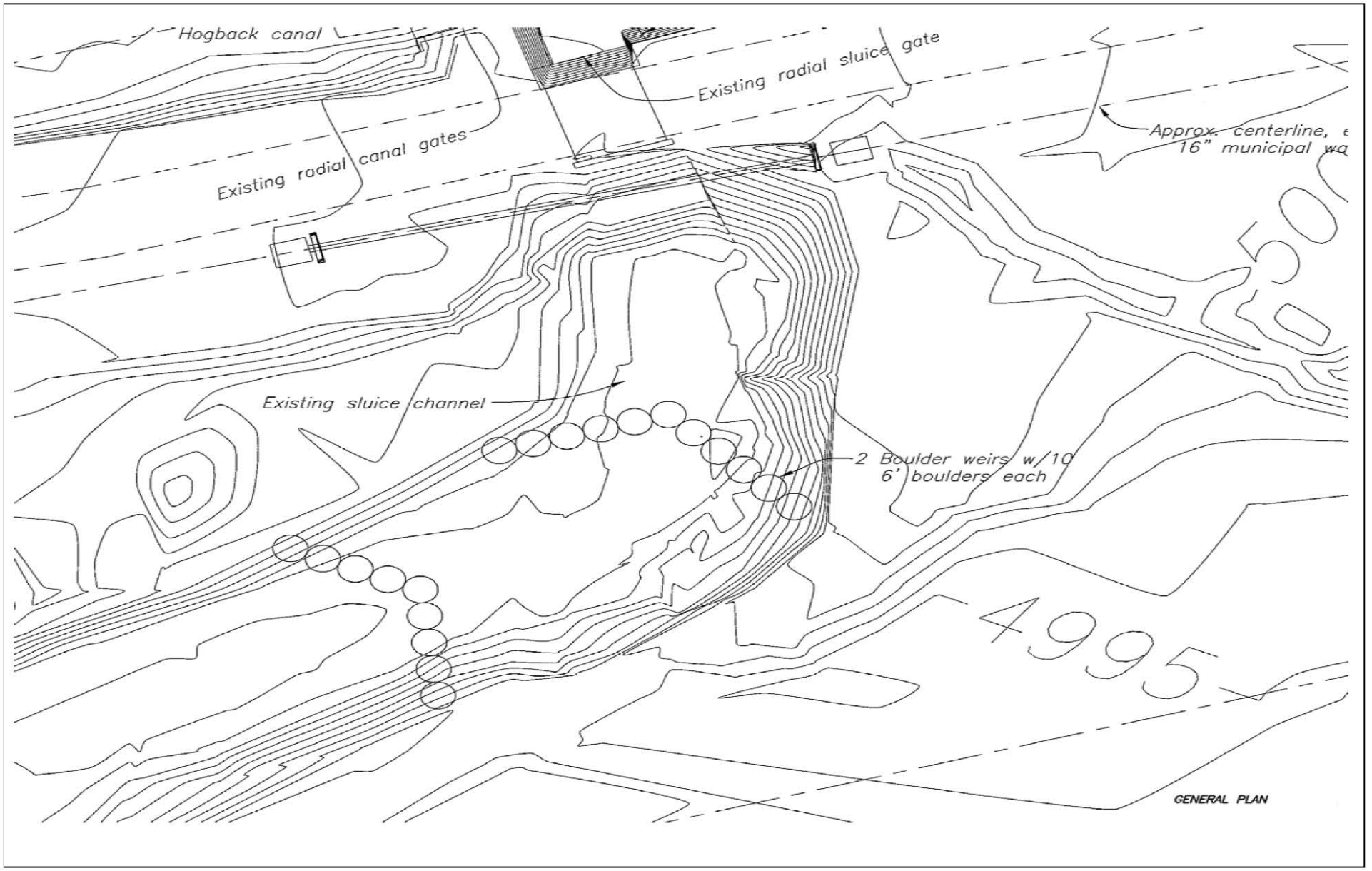
Advantages	Disadvantages
• Improved fish release. • Reduced erosion on bank.	• Potential silt build-up.

Potential Risks
None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,221,000
Estimated additional cost	$ 21,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Figure 4. Site Layout for Proposal No. 1a



Proposal No. 1b

Description

Proposal No. 1b. Different Site Conditions

Proposal Description: This proposal consists of providing an equipment access ramp on the back side of the fish screen and adding a concrete wall and slide gate at the end of the screen. The access ramp would be approximately 8 feet wide and would slope from the top of the canal lining down to invert on a slope of approximately 10:1.

The additional concrete wall would be constructed at the end of the fish screen and extend to the existing headwall at the existing canal radial gate structure. The wall is proposed to prevent water flow from behind the screens towards the open sluice gates. The wall is assumed to be 12 inches thick and approximately 20 feet long. A 72-inch by 72-inch gate would be installed in the wall to assist in removing silt from behind the screens. The 72-inch gate would have an electrical gate operator. This gate would also assist returning accumulated fish from behind the screen to the sluice channel and river.

Critical Items to Consider: None identified.

Ways to Implement: See above.

Changes from the Baseline Concept: See above.

Advantages	Disadvantages
• Capability to remove sediment. • Prevent reverse flow through screens. • Provide equipment access for O&M.	• None.

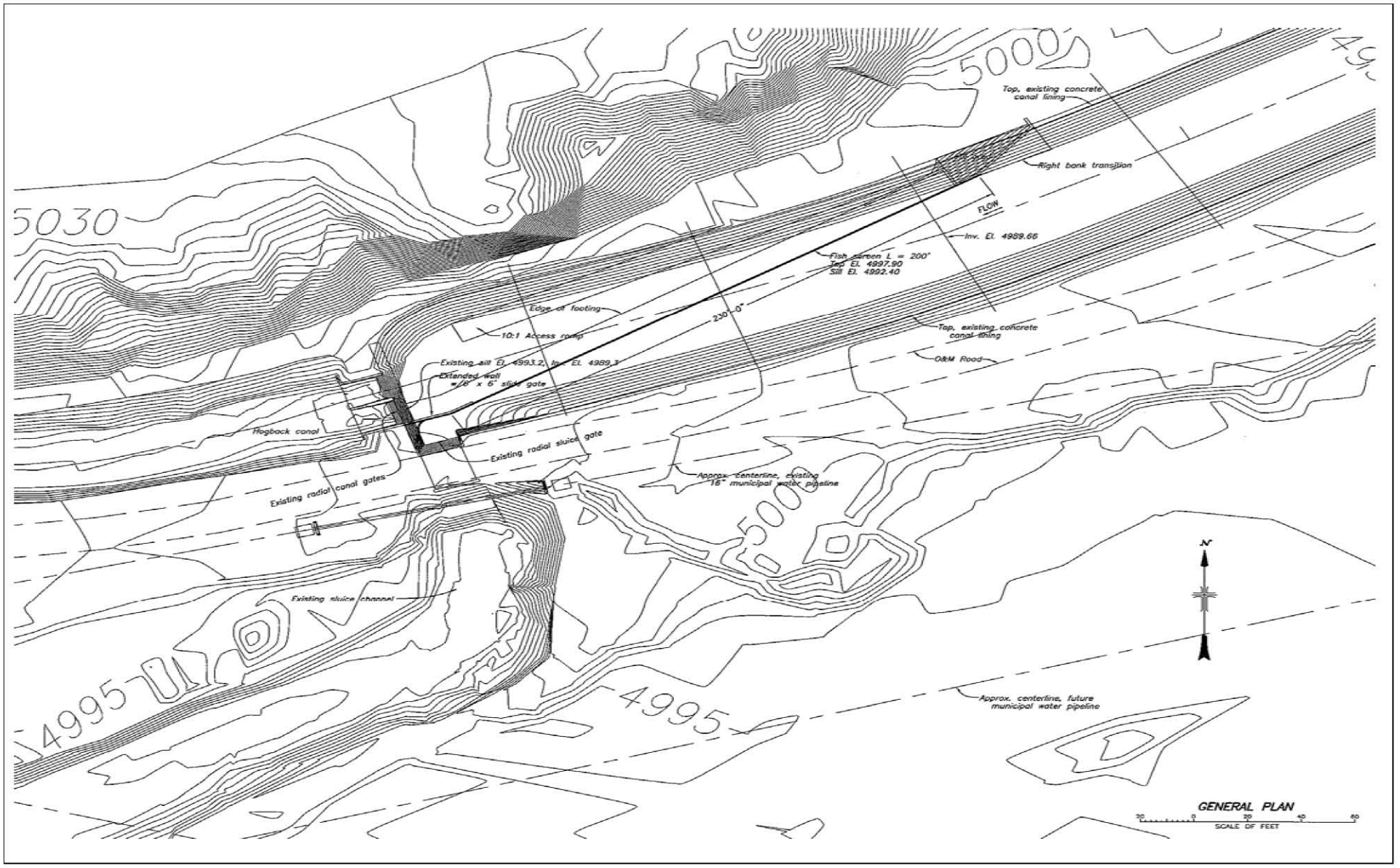
Potential Risks

None identified.

Cost Item	Nonrecurring Costs	
Original Baseline Concept	$	2,200,000
Value Concept	$	2,300,000
Savings	$	-100,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Figure 5. Site Layout for Proposal No. 1b



Proposal No. 1c

Description

Proposal No. 1c. Additional Mechanical Equipment

Proposal Description: This proposal includes providing additional mechanical equipment for operation and maintenance of the fish screen facility consisting of portable gate actuator, mobile light plant and a skid steer loader.

A portable gate actuator, powered by a portable electric generator, instead of a permanent power and gate actuator to remove the need for permanent power at the existing radial gates and gate actuators. The gate actuator proposed is a Milwaukee drill motor Model No. 2404-1 with a clutch attachment. An 8,000 watt generator was assumed to be sufficient for this operation but should be checked for rating based on the in-rush amps of the drill motor.

A mobile light plant is proposed for the facility for operation and maintenance at night. Permanent facility lighting is not recommended due to vandalism at the site. The mobile light plant will consist of an electrical generator and lights mounted on a two wheel trailer. The light plant proposed has a 6 kilowatt generator, four 1,000 watt lights on a 30-foot stem.

A skid steer loader is proposed to assist in moving trash removed by the hydraulic trash rake and to assist in removing sediment that may accumulate behind the screens. The skid steer loader also would have a grappling hook attachment to the bucket for moving the trash. The skid steer proposed Bob Cat model S220.

Critical Items to Consider: This eliminates the need for permanent power to diversion structure.

Ways to Implement: See above.

Changes from the Baseline Concept: this eliminated the need for the permanent power to diversion structure.

Advantages	Disadvantages
• Efficient trash handling. • Provide ability for maintenance 24hr/day. • Eliminate conveyor belt & maintenance. • Reduce vandalism protection.	• Inconvenience. • Equipment security.

Potential Risks
None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,269,000
Estimated Additional Cost	$ 69,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Proposal No. 1d

Description

Proposal No. 1d. Traveling Water Screens

Proposal Description: This proposal uses traveling water screens in lieu of stationary screens to provide a constant cleaning surface. This is listed as an option to alternative 1 in the Predesign Memorandum – Hogback Diversion Dam Fish Screen Project.

Critical Items to Consider: Use of the traveling water screens will provide a constantly cleaned surface and will therefore be able to handle a larger trash load. The traveling water screens are also considered better suited for the higher sediment and bed load expected at the facilities.

Ways to Implement: See above.

Changes from the Baseline Concept: See above

Advantages	Disadvantages
• Consistent cleaning larger surface area. • Eliminate compressor. • Smaller backup generator. • Eliminate brush cleaning system. • Greater redundancy. • Reduce construction tolerance requirements. • Potentially lower overall O&M.	• Unknown fish screen track record. • Potentially higher O&M with motors only. • Higher vandalism potentially.

Potential Risks

None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,200,000
Savings	$ 0

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Proposal No. 1e

Description

Proposal No. 1e. Site Security

Proposal Description: This proposal includes providing additional site security at the proposed facility to prevent vandalism. Such items include installing a 7-foot chain-link fence and gates topped with three strands of barbed wire, a precast concrete storage shed and providing a new vehicle path to the river.

The security fencing will be approximately 800 feet long.

The precast concrete storage shed is assumed to be a 12-foot wide by 24-foot long shed. The shed would have an 8-foot wide overhead door and a 3-foot wide steel hinged door. The shed would be constructed on a 1-foot thick concrete slab. Walls and roof of the shed are assumed to be 8 inches thick.

A vehicle access to provide recreational access to the river would consist of clearing and grubbing an area along the proposed Navajo Nation Municipal Pipeline (NNMP) for a 12-foot wide access road approximately 2,000 feet long. A Multi-plate arch culvert (possibly 5x20) will be added to pass the approximately 400 cfs of the sluice channel.

Critical Items to Consider: Coordinate locations of fence and access road with water users and appropriate departments of the Navajo Nation. Coordinate size and details shed with water users.

Ways to Implement: See above.

Changes from the Baseline Concept: See above.

Advantages	Disadvantages
• Equipment storage. • Reduce vandalism. • Improve river access.	• Hampers access. • Right-of-way for structure.

Potential Risks

None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,322,000
Estimated Additional Cost	$ 122,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Proposal No. 1f

Description

Proposal No. 1f. Modify Existing Trashrack

Proposal Description: Proposal 1f eliminates the trash rake and conveyor at this location and modifies the existing trashracks to catch the large debris.

Critical Items to Consider: The approach velocity to the trashracks exceeds the recommended approach velocity for the trash rake that is in the baseline design (single boom rake unit). The angle at which the flow approaches the trashracks may also present problems for the trash rake. If a trash rake was installed at this location, a larger trash rake would be necessary.

The trashracks need to be modified and the work involved may be very labor intensive. The cost of the modification to the trashracks may be similar to fabricating new trashracks.

Ways to Implement: Remove trashracks from the location and take to a shop. Have a contractor remove 49 trash bars from each panel so that the spacing between the trash bars is 12 inches versus the existing 2 inches between each trash bar. By increasing the spaces between the trash bars, the amount of debris that collects at this structure will be reduced to a manageable quantity that the O&M staff is able to redirect or manually remove.

Changes from the Baseline Concept: Eliminate the trash rake and conveyor and modify or replace the trashracks.

Advantages	Disadvantages
• Eliminate need for maintenance on the conveyor and rake. • Less entrapment of small debris. • Eliminate need for security. • Increased ability to pass bed load.	• More trash in concrete sluice canal.

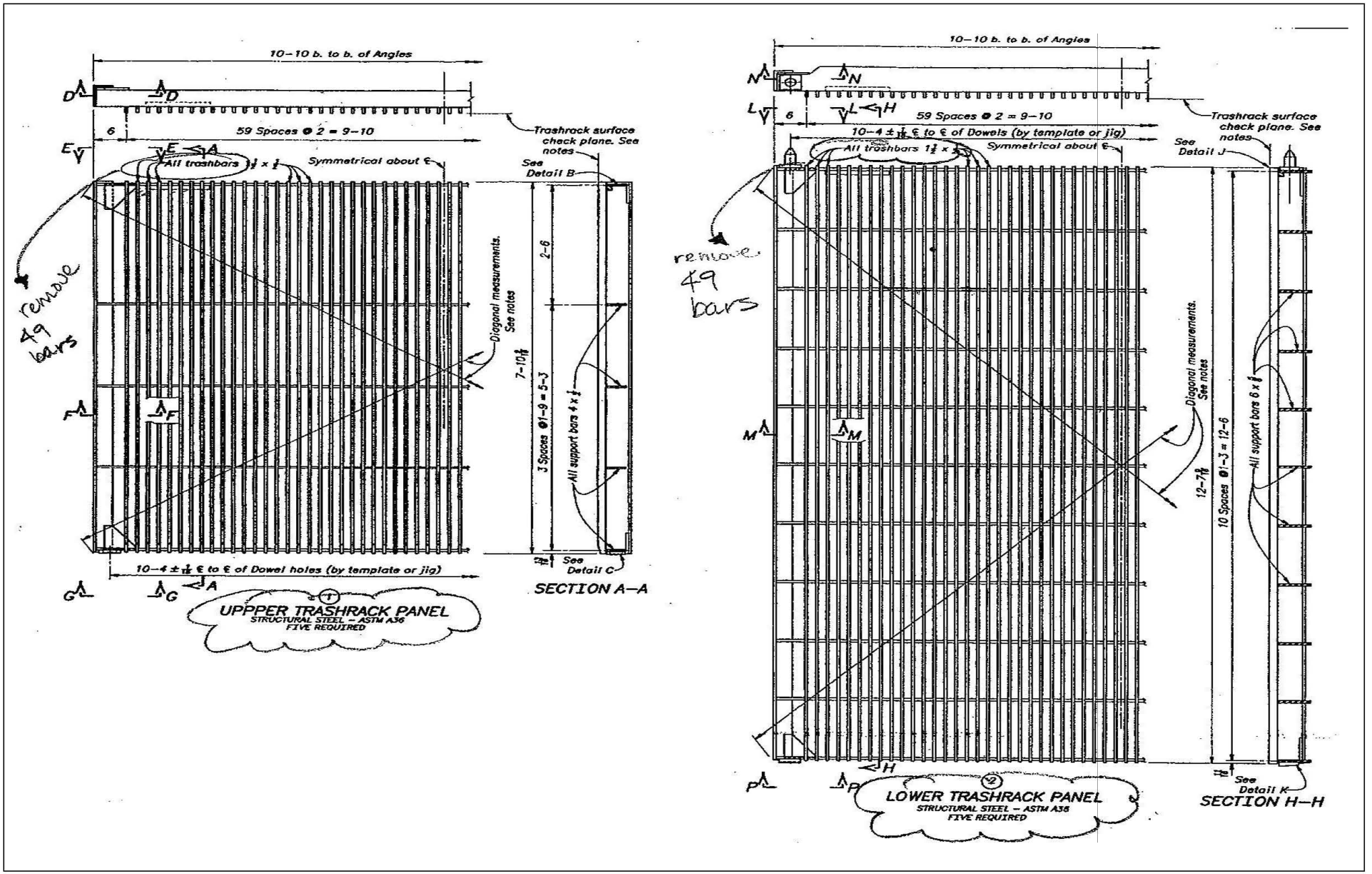
Potential Risks

Due to the high amount of trash being conveyed by the river during high flows, it is possible that this site will allow an excessive amount of trash to pass. Therefore, the team recommends implementing Proposal No. 1g in conjunction with this proposal.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,235,000
Estimated Additional Cost	$ 35,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Figure 6. Changes to Existing Trashrack



Proposal No. 1g

Description

Proposal No. 1g. Build Second Trashrack and Vehicular Access

Proposal Description: This proposal provides for a structure and trashracks in the canal and a trash rake at the structure.

The debris will collect on the deck necessitating the need to manually push the debris off the deck but will eliminate the need for a conveyor. The larger debris will be caught at the Headwork trashracks and smaller debris will be removed from the canal using a single boom trash rake. The deck will be accessible to vehicular traffic.

Critical Items to Consider: A new structure will need to be constructed; including trashracks and installation of a trash rake. The O&M crew will need to periodically visit the site and push accumulated debris off the deck. Depending on the time of the season, this could be a daily maintenance task.

Due to the size of the material being transported by the river during high runoff, the team strongly recommends that proposal 1f be accepted in combination with this proposal.

Ways to Implement: Design a deck and structure to accommodate the trash rake and vehicular traffic. Install trash rake and racks. Power needs to be brought to the location to operate the trash rake. Provide a skid steer to push debris off deck.

Changes from the Baseline Concept: Move trash rake from headworks structure to a location in the canal that is upstream of the traveling fish screens. Eliminate conveyor and provide a "Bobcat" to push debris off deck.

Advantages	Disadvantages
• Reduce rake cycle time. • More storage area for trash. • Provide right side access. • Better flow condition for rake. • O&M access in dry during non-irrigation season. • Concentrate security in one location.	• Increased O&M.

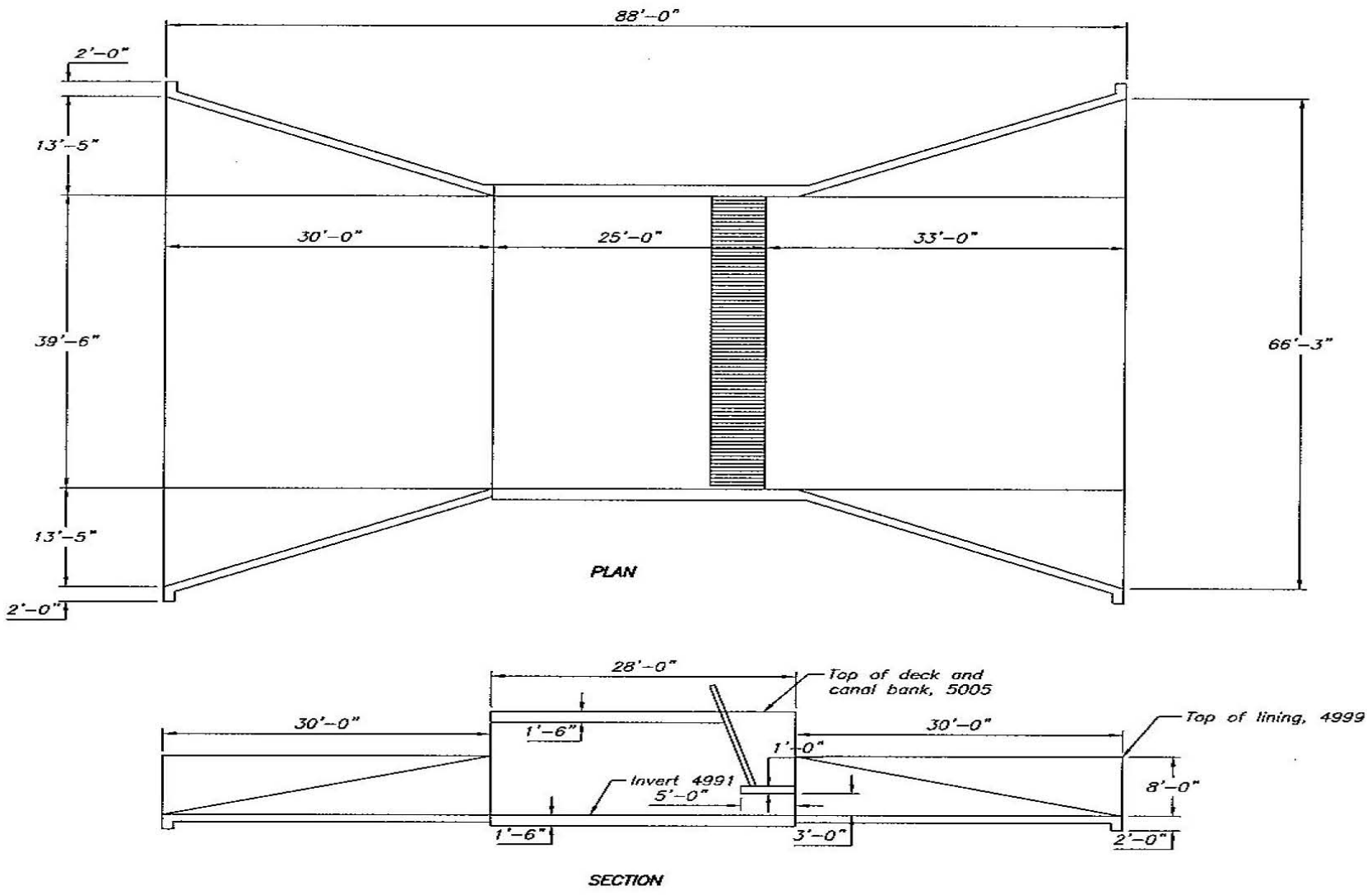
Potential Risks

None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 3,051,000
Estimated Additional Cost	$ 851,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Figure 7. Site Layout for Proposal No. 1g



Proposal No. 1h

Description

Proposal No. 1h. Minimize Automation

Proposal Description: This proposal includes removing a majority of the high-tech facility automation. Running the facility either in a continuous mode or on timers is recommended. The automation of the fish screens constructed in the Grand Junction, Colorado are requiring sophisticated equipment and programming to operate properly. The VE team recommends the fish screen cleaners be set to operate in a continuous mode or at most on a timer. Also the baseline's proposal automation of the existing radial gates at the diversion headworks and the existing canal radial gates should be eliminated. The proposed hydraulic trash rake typically comes with a timer for operation. The VE team recognizes that there may be some merit to having some automation controls between the canal gaging station and the existing sluice gate. This automation would attempt to keep the sluice gate positioned to maintain the desired canal flow.

Critical Items to Consider: None identified.

Ways to Implement: See above

Changes from the Baseline Concept: See above

Advantages	Disadvantages
• Minimize O&M on automation program. • Decrease down time. • Reduce specialized labor. • Reduce need for upgrades. • Reduce down time due to weather. • Reduce consequences of vandalism.	• Eliminate canal flow control (consistency of operation). • Increases wear on mechanical equipment.

Potential Risks

None identified.

Cost Item	Nonrecurring Costs
Original Baseline Concept	$ 2,200,000
Value Concept	$ 2,100,000
Estimated additional cost	$ 100,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Proposal No. 2

Description

Proposal No. 2. Use a Weir Wall in Lieu of Fish Screens

Proposal Description: This proposal consists of a weir wall constructed in the canal in lieu of the proposed fish screen. The weir would skim the top 3-inches of flow and would be approximately 550 feet long to provide a canal flow of 230 cfs. The sluice gates, upstream and downstream, will be provided to allow sluicing of sediment from behind the wall. The existing sluice gate would be automated from the existing gagging station. This is required because it is critical to maintain a consistent water level in order to sustain the canal flow. To enhance maintenance capabilities, a 10:1 access ramp will be provided.

Critical Items to Consider: Continual screening of fish to prevent unintentional diversion into the canal may be problematic due to high bed and debris loads frequently present in the San Juan River. Use of a weir concept would allow only the upper portion (< 4%) of the water column to spill over into the afterbay for canal diversion. This will effectively minimize fish entrainment and also minimize potential downtime of screening due to cleaning and other required maintenance activities.

Two sources (wild, hatchery) and four size classes of Colorado pikeminnow are of concern to this screening project: 1) larvae (<20 mm total length [TL]) that may be produced as a result of natural spawning, 2) young-of-year (ca. 70 mm TL) from hatchery stockings, 3) juvenile (ca. 170 mm TL) from hatchery stockings, and 4) sub-adult and adult fish surviving from previous hatchery stockings or wild origin and migrating upstream from habitats occupied in downstream reaches. For razorback sucker sub-adult and adult fish are the primary concern. All razorback suckers currently occupying the San Juan River upstream of Hogback Diversion are derived from hatchery stockings and size of fish stocked exceeds 200 mm TL. Regardless of origin (wild, hatchery), response of either species to downstream drift (larvae) or movement will be similar. Larvae will be susceptible to loss over the weir into the afterbay due to minimal swimming capabilities. However, studies conducted by Upper Colorado River Basin researchers on Colorado pikeminnow and razorback sucker larvae indicate that drift is primarily in the lower portions of the water column. Thus, loss to the afterbay will be minimal. Larger sized individuals with concomitant increased swimming ability will be more capable of avoiding displacement over the weir into the afterbay.

In addition to minimizing fish entrainment into the canal, the weir concept that includes an afterbay may support an additional function as a fish acclimation area for pre-release of hatchery-reared Colorado pikeminnow (70 and 170 mm TL size classes) and razorback sucker (>200 mm TL). Survival of hatchery-reared fish is improved by temporary retention in confined holding environments, free of predation and competition pressures, prior to release to the river.

This proposal is a behavioral barrier instead of a positive barrier. Therefore, it will be necessary to further consult experts familiar with these fish species to ensure that there are no situations where there would be a high percentage of fish being carried over the weir. However, the team

feels this option will potentially provide better fish exclusion over a traditional screening facility that may have intermittent operation.

Due to the size of the material being transported by the river during high runoff, the team strongly recommends that proposal 1f be accepted in combination with this proposal.

Ways to Implement: Pre-release acclimation – approval/coordination with water users to hold water and operate after irrigation diversions cease, inclusion of 'sluice'/exit gate in weir to drain afterbay to sluice return channel, maintenance of water level in afterbay, screening/netting of canal gate to avoid entrainment of stocked fish.

Changes from the Baseline Concept: Many.

Advantages	Disadvantages
• Simplify by minimizing operation and automation. • Provide holding/acclimation area for fish stocking. • Minimal mechanical equipment. • Minimal maintenance. • Less sediment impact. • Site security easier to provide and maintain.	• Water is not screened, allows some fish take.

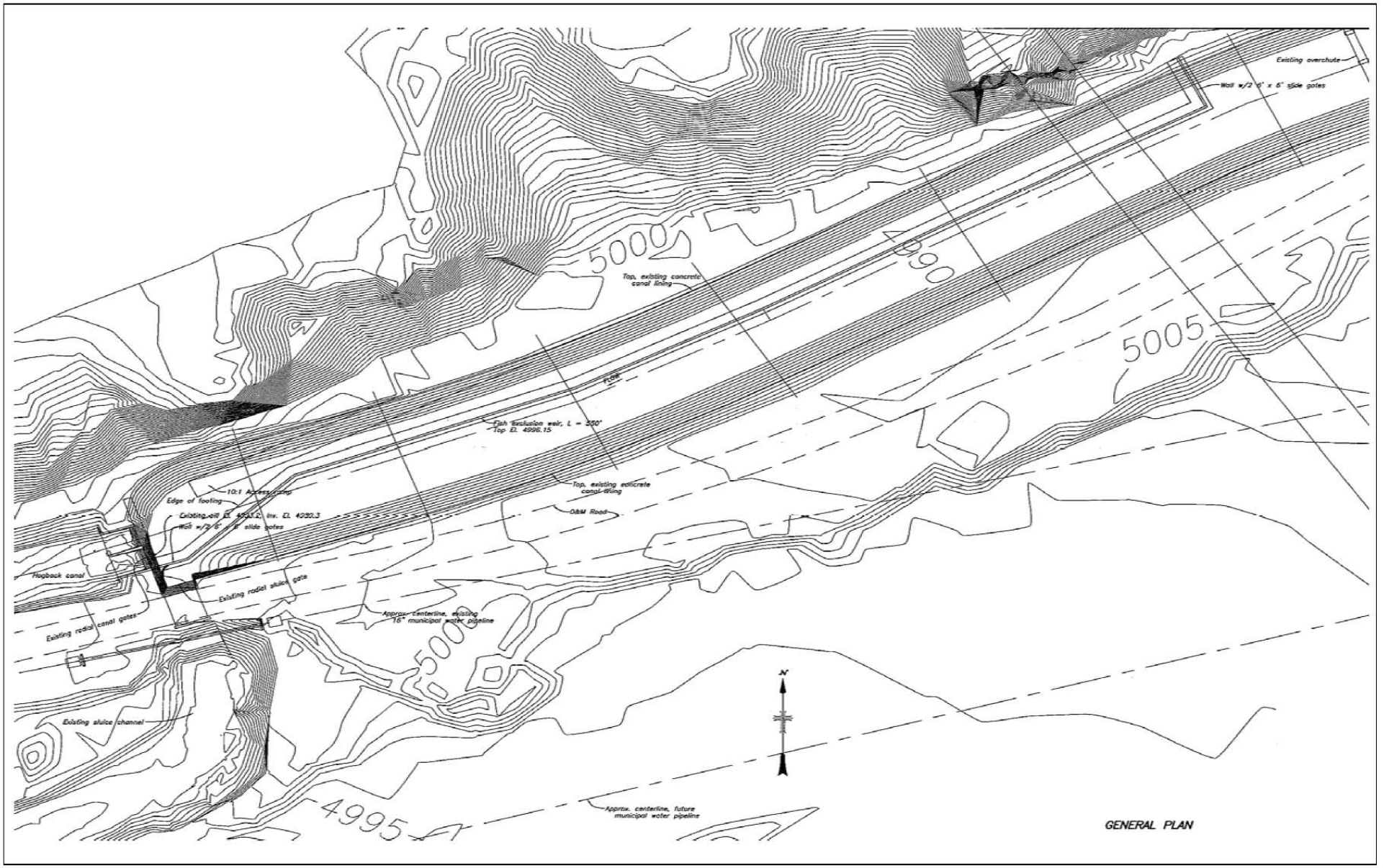
Potential Risks

Tighter future regulations could preclude the viability of this concept. Future retrofitting of this concept would be substantial.

Cost Item	Nonrecurring Costs	
Original Baseline Concept	$	2,200,000
Value Concept	$	1,000,000
Savings	$	1,200,000

NOTE: Cost of the study ($15,000) should only be deducted once from all accepted proposals.

Figure 7. Site Layout for Proposal No. 2



Disposition of Ideas

During the Creative Phase of the Value Engineering Study, the team is encouraged to offer any and all ideas on how to solve the problem. Criticism is strictly prohibited to provide an environment in which everyone can feel comfortable in offering thoughts and ideas without feeling evaluated on their professional capabilities by the ideas they offer. Also, it has been demonstrated that one person's "stupid" idea can often be the spark for someone else's "brilliant" idea. No ideas are evaluated during this phase of the study. Therefore, a few of the ideas presented are humorous and flippant; some could even be misconstrued into being offensive. A full listing of the ideas is presented to demonstrate the openness of the environment in which the ideas were offered.

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Control water temperature to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Control oil/biological contaminates to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Control salinity to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Provide food/space/oxygen/cover to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Exclude fish to remove need to protect the fish.	Rejected as this does not offer solutions to protect the endangered fish.
Prevent predation to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Reduce flow velocity to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Provide water to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Avoid mechanical devices to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Prohibit fishing and eliminate human predation to protect the fish.	Rejected as it does not address the problem of keeping the endangered fish out of the canal.
Trap and transport fish to alternate site to repatriate the fish.	Rejected as this does not offer solutions to protect the endangered fish.
Use canal to deliver water.	Rejected as this does not offer solutions to protect the endangered fish.
Use pipe to deliver water.	Rejected as this does not offer solutions to protect the endangered fish.
Use truck delivery to deliver water.	Rejected as this does not offer solutions to protect the endangered fish.
Use helicopter delivery to deliver water.	Rejected as this does not offer solutions to protect the endangered fish.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Seed clouds to deliver water.	Rejected as inefficient with regards to the baseline project.
Relocate farmers to eliminate the need to deliver water.	Rejected as inefficient with regards to the baseline project.
Divert further down river and pump to deliver water.	Rejected as this does not offer solutions to protect the endangered fish.
Divert water from further upstream where specific species do not exist to deliver water.	Rejected as inefficient with regards to the baseline project.
Drill wells, pump and store water for delivery.	Rejected as inefficient with regards to the baseline project.
Develop an infiltration gallery to create water supply from which water would be delivered	Rejected as inefficient with regards to the baseline project.
Provide a path to the river for the fish to be repatriated.	Rejected as does not offer changes to the baseline project.
Collect and transport fish to the river to be repatriated.	Rejected as inefficient with regards to the baseline project.
Train fish to respond to stimuli and get them to act in a beneficial manner (stay out of canal).	Rejected as inefficient with regards to the baseline project.
Use electronic field do repel fish from canal headworks.	Rejected as inefficient with regards to the baseline project.
Use pheromones to guide fish away from canal headworks.	Rejected as inefficient with regards to the baseline project.
Use bait to guide fish away from canal headworks.	Rejected as inefficient with regards to the baseline project.
Provide water current/flow to guide fish away from canal headworks.	Rejected as does not offer changes to the baseline project.
Put a concrete barrier in the canal to block fish and abandon canal.	Rejected as defeating the need for water delivery to the project lands.
Install shock “collars” on fish to keep them out of the canal	Rejected as inefficient with regards to the baseline project.
Install weir wall to skim only the top layer of water to keep fish out of canal.	Developed as Proposal No. 2.
Remove obstacles to improve fish survival.	Rejected as defeating the need for water delivery to the project lands.
Use screens to block fish from canal.	Rejected as does not offer changes to the baseline project.
Use steel panels to block fish from canal.	Rejected as defeating the need for water delivery to the project lands.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Abandon project and restore existing trashracks.	Rejected as defeating the need for water delivery to the project lands.
Acoustically scare fish away from canal headworks.	Rejected as inefficient with regards to the baseline project.
Remove food/oxygen/space/cover to eliminate fish from canal.	Rejected as inefficient with regards to the baseline project.
Induce temperature barrier to keep fish out of canal.	Rejected as inefficient with regards to the baseline project.
Remove trash to pass water	Rejected as does not offer changes to the baseline project.
Build a bypass to pass water.	Considered but rejected when it was noted that the screens could be lifted to bypass water.
Use a siphon to pass water.	Rejected as this does not offer a solution to protect the endangered fish.
Use an inverted siphon to pass water.	Rejected as this does not offer a solution to protect the endangered fish.
Use baffles to distribute and improve flow.	Rejected as does not offer changes to the baseline project.
Remove sediment to improve flow.	Rejected as does not offer changes to the baseline project.
Release more water to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Dam river to store and create a greater water gradient to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Line canals and ditches to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Remove vegetation to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Induce a higher head to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Straiten out canal curves to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Reduce fiction to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Filter water to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Reduce velocity/flow to improve flow.	Rejected as does not offer changes to the baseline project.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Shorten screen approach vector to improve flow.	Rejected as does not offer changes to the baseline project.
Conduct better canal maintenance to improve flow.	Rejected as this does not offer a solution to protect the endangered fish.
Use air to suspend sediment.	Rejected as does not offer changes to the baseline project.
Higher water velocity (possibly at an intermittent interval) to suspend sediment	Rejected as does not offer changes to the baseline project.
Mechanical agitation to suspend sediment.	Rejected as inefficient with regards to the baseline project.
Hydraulic agitation to suspend sediment.	Rejected as inefficient with regards to the baseline project.
Screen and rake to remove trash.	Rejected as does not offer changes to the baseline project.
Net to remove trash.	Rejected as inefficient with regards to the baseline project.
Deflect to keep trash out of canal.	Rejected as inefficient with regards to the baseline project.
Kill vegetation to eliminate trash in river and canal.	Rejected as inefficient with regards to the baseline project.
Patrol river to remove human dumping from entering river and canal.	Rejected as inefficient with regards to the baseline project.
Kill and remove fish from river to keep dead fish from becoming trash.	Rejected as inefficient with regards to the baseline project.
Manually remove trash (possibly prison labor).	Rejected as inefficient with regards to the baseline project.
Use baffles to use maximum screen usage.	Rejected as does not offer changes to the baseline project.
Use punch plate as baffles to maximum screen usage.	Rejected as inefficient with regards to the baseline project.
Vary screen spacing to maximize screen usage.	Rejected as inefficient with regards to the baseline project.
Angle the screen plates to maximize screen usage.	Rejected as inefficient with regards to the baseline project.
Install concrete veins in canal to train water to maximize screen usage.	Rejected as inefficient with regards to the baseline project.
Install “glory hole” gallery to remove trash.	Rejected in favor of a different idea.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Use slow approach/ high sweep concept to minimize impingement.	Rejected as does not offer changes to the baseline project.
Divert upper surface only to minimize impingement.	Rejected in favor of a different idea.
Use periodic back flow to minimize impingement.	Rejected as inefficient with regards to the baseline project.
Install wave action machine to minimize impingement.	Rejected as inefficient with regards to the baseline project.
Hire personnel and truck, paid by RIP to regulate velocity.	This idea was not developed due to the lack of recourses. VE team refers idea to Design team to develop or reject.
Provide mechanical assistance to regulate velocity.	Developed as a portion Proposal No. 1c
Conduct preventative maintenance to minimize downtime and regulate velocity.	Rejected as does not offer changes to the baseline project.
Can automation (high tech) to minimize maintenance, downtime and regulate velocity.	Developed as Proposal No. 1h
Simplify, use weir to eliminate majority of mechanical devices that cause downtime.	Rejected in favor of a different idea.
Reduce trash to regulate velocity.	Rejected as does not offer changes to the baseline project.
Provide a generator set to operate equipment 100% of time to eliminate possible outages.	Rejected as does not offer changes to the baseline project.
Provide a solar panel to operate equipment 100% of time.	Rejected as inefficient with regards to the baseline project.
Eliminate mechanical devices that require electricity to operate equipment.	Rejected as inefficient with regards to the baseline project.
Install water wheel to generate electricity to operate equipment.	Rejected as inefficient with regards to the baseline project.
Eliminate trash to remove the need to centralize trash.	Rejected as inefficient with regards to the baseline project.
Install River veins to train water and trash away from headworks to remove need to centralize trash.	Rejected as inefficient with regards to the baseline project.
Burn trash pile where it falls to remove the need to dispose of trash.	This idea was not developed due to the lack of recourses. VE team refers idea to Design team to develop or reject.
Use front-end loader with claw to centralize trash and burn on site.	Developed as a portion of Proposal No. 1c

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Hire Waste-Management to dispose of trash.	Rejected as inefficient with regards to the baseline project.
Divert trash in stream to eliminate the need to centralize trash.	Rejected as inefficient with regards to the baseline project.
Modify existing headworks to act as log boom and build second trashrack in canal.	Developed as a portion of Proposal No. 1f.
Move river access so vehicular traffic is not along canal to enhance security.	Developed as a portion of Proposal No. 1e.
Realign sluice or approaches to aid fish survival.	Developed as a portion of Proposal No. 1a.
Use remote automation to operate equipment.	Rejected as inefficient with regards to the baseline project.
Use timers to operate equipment	Rejected as inefficient with regards to the baseline project.
Hire personnel and provide phone to operate equipment.	Rejected as inefficient with regards to the baseline project.
Use short wave radio to operate equipment and notify staff.	Rejected as inefficient with regards to the baseline project.
Use water users as alarm system to notify staff.	Rejected as dose not offer changes to existing conditions.
Simply system to eliminate the need to notify staff.	Developed as a portion of Proposal No. 1h.
Use sky hook helicopter to hold structure in place.	Rejected as impractical
Use chipper on site to dispose of trash.	Rejected as inefficient with regards to the baseline project.
Use tension cables to support structure.	Rejected as impractical
Conduct maintenance only during daylight hours and eliminate need to illuminate facility.	Rejected as problems to not occur only in daylight hours and need to be fixed quickly.
Provide a mobile light plant to illuminate facility and reduce potential for vandalism.	Developed as a portion of Proposal No. 1c.
Provide motion sensors to enhance security.	Rejected as inefficient with regards to the baseline project.
Construct a massive concrete and steel structure to enclose site and enhance security.	Rejected in favor of Proposal No. 1e.
Enforce gun control laws to enhance security.	Rejected in favor of Proposal No. 1e.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Hire guards 24/7 to enhance security.	Rejected in favor of Proposal No. 1e.
Install fences around site to enhance security.	Developed as a portion of Proposal No. 1e.
Install a pre-fabricated solid concrete building/ shed to enhance security.	Developed as a portion of Proposal No. 1e.
Install security cameras to enhance security.	Rejected in favor of Proposal No. 1e.
Use a security (junkyard) dog to enhance security.	Rejected in favor of Proposal No. 1e.
Camouflage facility to enhance security.	Rejected as impractical.
Put equipment into an underground vault to enhance security.	Rejected in favor of Proposal No. 1e.
Use a concrete wall in lieu of fence to encompass facilities and enhance security.	Rejected in favor of Proposal No. 1e.
Install cathodic protection to reduce deterioration.	Rejected as unnecessary.
Metalize ferrous surfaces to reduce deterioration.	Rejected as unnecessary.
Use non-ferrous materials to reduce deterioration.	Rejected as inefficient with regards to the baseline project.
Paint all ferrous surfaces to reduce deterioration.	Rejected as this idea does not offer changes to the baseline project.
Use stainless steel materials to reduce deterioration.	Rejected as inefficient with regards to the baseline project.
Use aluminum materials to reduce deterioration.	Rejected as inefficient with regards to the baseline project.
Provide adequate replacement parts to replace deteriorated parts as they deteriorate.	Rejected as unnecessary.
Use a dog leg in the screen layout to enhance operation of facilities.	Rejected as inefficient with regards to the baseline project.
Minimize on-site work and prefabricate structural steel to facilitate construction.	This idea was not developed by the VE team but is referred to the Design team for possible development.
Schedule construction with irrigation season, labor availability and fund availability to facilitate construction.	This idea was not developed by the VE team but is referred to the Design team for possible development.

Disposition of Ideas (Continued)

Value Study Elements Considered as Potential and Their Disposition	
Idea	Disposition
Use Shotcrete to prevent erosion.	Rejected as this does not offer solutions to protect the endangered fish.
Install gates to create access.	Developed as a portion of Proposal No. 1e.
Install wooden bridge to create access.	Rejected as inefficient with regards to the baseline project.
Use railcar bridge to create access.	Rejected as inefficient with regards to the baseline project.
Install access from highway to create access.	Rejected as inefficient with regards to the baseline project.
Dump debris back into channel to eliminate the need to dispose of trash.	Rejected as inefficient with regards to the baseline project.
Install bulkhead gates to bypass water.	Considered but rejected when it was noted that the screens could be lifted to bypass water.

List of Consultants

Consultant or Contact	Topic or Information
Rick Christensen Mechanical Engineer US Bureau of Reclamation Denver TSC Phone: 303-445-2858	Regarding Trashrack and Trash Rake
Brent Meffort Hydraulic Engineer US Bureau of Reclamation Denver TSC Phone: 303-445-2149	Regarding use of the Weir Wall proposal
Gary Mackey Atlas Polar Toronto, Ontario Phone: 416-751-7740	Regarding Trash Rake models and capabilities
Rocky Mountain Standby Power Kim Grand Junction, CO	Regarding a quote for a mobil light plant
Jim Langston US Bureau of Reclamation Grand Junction, Co Phone: 970-248-0610	Regarding information on Skid Steers
Bub Burdick US Fish and Wildlife Service Phone: 970-245-9310 extension 12	Regarding price information for gate actuators

Design Team Presentation Attendance List
June 11, 2007 – 12:30 p.m.

Name/Title/Discipline	Address/Phone-Fax Numbers/E-mail
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Value Study Team Presentation Attendance List
June 15, 2007 – 9:30 a.m.

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