FEASIBILITY STUDY

FOR

SANCHEZ RESERVOIR OUTLET REHABILITATION PLAN

PREPARED FOR

SANCHEZ DITCH and
RESERVOIR COMPANY
P.O. BOX 215
SAN ACACIA, CO 81150

FOR

THE COLORADO WATER
CONSERVATION BOARD

PROJECT NO. 11.028
JULY 2012

FEASIBILITY STUDY APPROVAL
Pursuant to Colorado Revised Statutes 37-60-121 &122, and in accordance with policies adopted by the Board, the CWCB staff has determined this Feasibility Study meets all applicable requirements for approval.

[signature]
Signed

6/28/12
Date

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OUTLET REHABILITATION PLAN

AT

SANCHEZ RESERVOIR

OWNED BY

SANCHEZ DITCH & RESERVOIR COMPANY
P.O. BOX 215
SAN ACACIA, CO 81150

PREPARED BY

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Sponsored by the

Sanchez Ditch and Reservoir Company

in conjunction with the

Colorado Water Conservation Board

July 6, 2012

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Feasibility Study
for the
Outlet Rehabilitation Plan
at
Sanchez Reservoir

PROJECT SPONSOR

The Sanchez Ditch and Reservoir Company (SDRC) is a Colorado Mutual Ditch Company and a Non-profit Corporation. Articles of Incorporation and Bylaws are included in Appendix C.

The company's facilities, built about the turn of the century, are located in Costilla County, south and west of the town of San Luis. They consist of Sanchez Reservoir (capacity 104,000 acre feet), Stabilization Reservoir (capacity 300 acre feet), approximately 38 miles of concrete lined ditch, approximately 15 miles of earthen ditch, approximately 23 miles of canal, and a diversion structure at the inlet of Culebra Sanchez Canal.

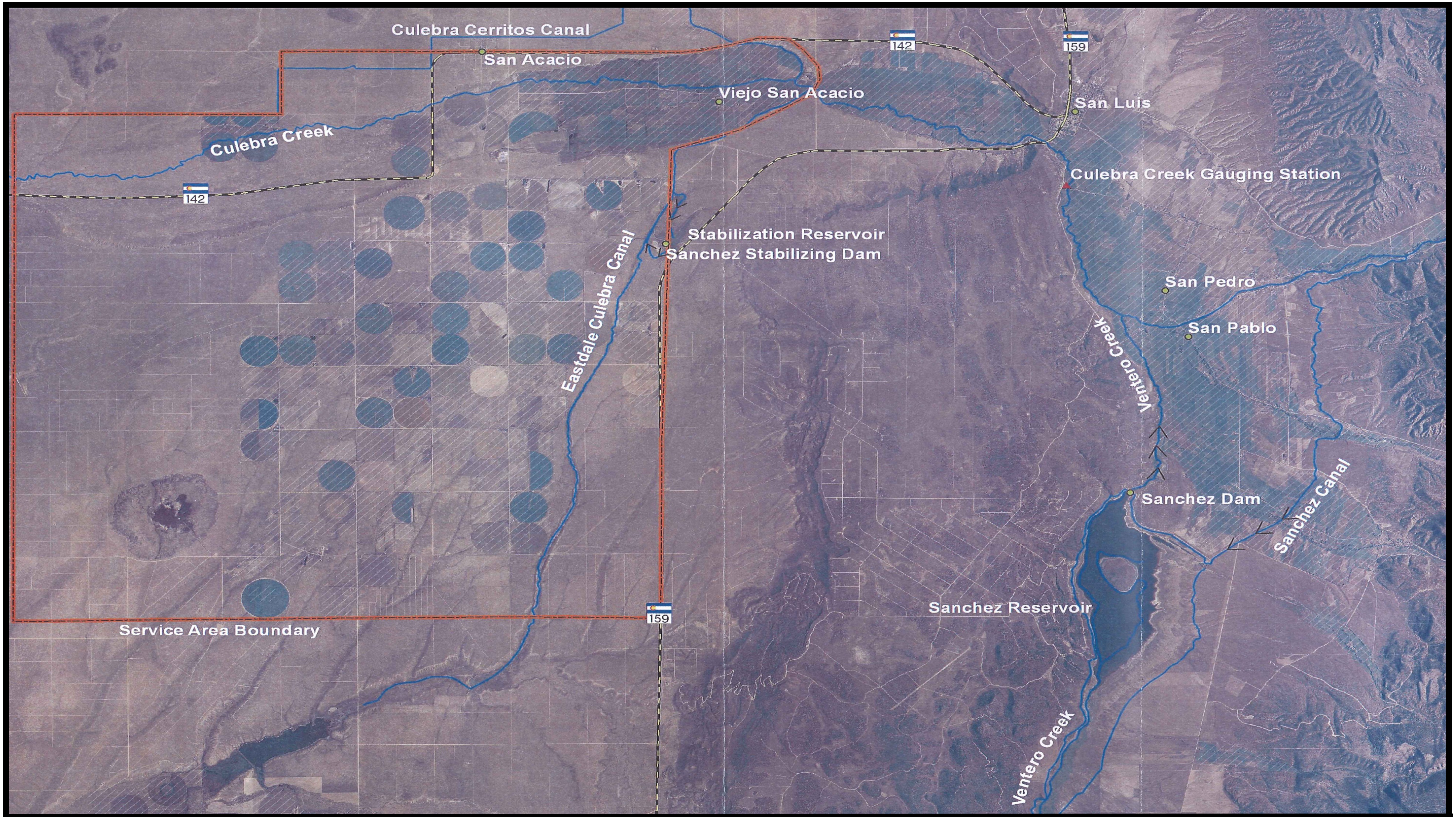
PROJECT SERVICE AREA-LAND OWNERSHIP

The service area of the Sanchez Ditch and Reservoir company includes 13,424 acres of crop land and 18,392 acres of farm land (farm land being that land used in rotation and generally not irrigated due to lack of water). Sanchez Reservoir serves 34 individual shareholders with a total of 21,802.716 shares.

Crops grown in the service area includes potatoes, wheat, barley, oats, alfalfa, and hay mixtures. The service area boundaries are shown in Figure 1.

WATER RIGHTS

The company's decreed water rights and appropriations begin in 1856 and go through 1934 for a cumulative total of 373.950 cfs. A list of the company's water rights are shown in the following table.



REPRINTED FROM REPORT: *SANCHEZ RESERVOIR REHABILITATION PHASE 1 ASSESSMENT & UPGRADE*	Smith Geotechnical ENGINEERING CONSULTANTS	SANCHEZ DITCH & RESERVOIR SERVICE AREA	**FIGURE 1**

Sanchez Ditch and Reservoir Company Water Rights

Priority	Ditch Name	Decreed cfs
8	San Acacia	23.250
42	Island	1.500
60,61	Culebra-Eastdale No. 1	48.625
1934-4ST	Sanchez Res. Storage Priority	
1934-11	Culebra-Eastdale No. 1	228.075
1934-5ST	Sanchez Res. Storage Priority	
1934-21	Culebra-Cerritos	37.500
24	Cordillera	35.000
	Total	373.950

Appendix F contains a complete list of priorities and the Sanchez Ditch and Reservoir Company's position on the priority list. Appendix G contains the deed listing all water rights acquired form The San Luis Power and Water Company.

NEED FOR THE PROJECT

The SDRC is undertaking this project to continue to provide irrigation water to its shareholders to irrigate their crops.

The Sanchez Reservoir Gate Tower was constructed in 1910. The gate tower is approximately 135 feet in height with eight sets of 30-inch diameter valves located at different elevations in the tower.

Each set of the existing valves consists of a steel thimble through the concrete tower wall with a sluice gate mounted on the outside flange of the thimble. The water exits the gate tower, through two 48-inch diameter wedge gate valves and one 30-inch diameter fixed cone valve which discharges into the a 10 ½ foot high concrete outlet conduit which is approximately 600 feet in length.

The two 48-inch slide gates and the cone valve located in the outlet conduit are new valves that were replaced in 1997. The three 30-inch diameter valves and operators, located at about elevation 8345 feet, were replaced in 1997; the three 30-inch diameter valves and operators located at about elevation 8375 feet were repaired; and the two 30-inch diameter valves and operators located at about elevation 8330 feet are buried under silt and were not repaired.

The outlet conduit was not repaired in 1997 when the tower controls, valves, and ladders were rehabilitated. A typical outlet conduit section is shown in the Photograph 3 with a the tower shown in Photograph 1. The lower portion of the conduit is deteriorated, has been eroded, and has reinforcing steel exposed in many locations. Repair of portions of the conduit is deemed necessary to maintain its structural integrity and to maintain the safety of the dam.

The exterior of the gate tower was coated by the SDRC in 1993. This coating has generally debonded and peeled off the tower and does not appear to have reduced the deterioration of the concrete. This can be seen in Photographs 2. The tower deterioration needs to be addressed to ensure the structural integrity of the tower is maintained over the next 75 years.

PHOTOGRAPH 1 - TOWER

Due to continued deterioration of the Tower and the outlet conduit and due to changing system needs, the SDRC has initiated this study to formulate a plan to upgrade the system. The areas of concern and the tasks outlined to address these concerns are as follows.

Task 1 - Evaluate/Upgrade Gondola and Tramway. This will address the safety and structural integrity concerns of the gondola and provide for the long term use of the system.

Task 2- Cylinder Repair and Replacement. One of the lower 30 inch intake control gates will be repaired to increase the reservoir discharge capacity.

Task 3 - Replace and Automate Hydraulic Control System. This will upgrade the gate control system to automate essential reservoir operations; provide a secure and safe “vandal proof” control system; provide for remote control operation; and, provide a system for capturing, managing, reporting, and tracking the reservoir operations.

<u>Task 4 - Feasibility of Outlet Configuration</u>. This study will evaluate the long term viability of the control tower and outlet conduit with regard to maintenance, structural integrity, and durability. Options for alternatives to the current configuration of gates and operators in the gate control tower will explored.

These tasks are outlined in the proposal report submitted to the **Rio Grande Basin Roundtable** and the **CWCB Water Supply Reserve Account Grant Application**. As outlined in the grant proposal, Tasks 1 through 3 will be conducted by other contractors/suppliers and Task 4 will be completed by **Smith Geotechnical Engineering, Inc. (SGE).**

TOWER INSPECTION

The exterior surface of the outlet tower was visually inspected by Duane H. Smith, P.E. on November 1, 2011. For the exterior of the tower, this inspection was from a distance due to the tower's inaccessibility. The lower portion of the interior of the tower was inspected by entering through the outlet conduit and then through one of the 48 inch gates.

The main area of concern is for the deterioration and damage on the exterior of the tower. The tower has experienced light to severe deterioration of the concrete, especially in the zone of water level fluctuations. This can be seen in Photograph 2. Some of the spalling appears to as deep as several inches and is due to the freezing of water in the concrete. This appears to be combined with the "pop out" of large aggregate in the mix that most likely is not bonded well by the cement.

PHOTOGRAPH 2 - OUTLET TOWER DETERIORATION

The concrete surface has spalled due to moisture intrusion and freeze thaw. The concrete in the tower would not be air entrained, based on the date of construction. Concrete without air entrainment is highly susceptible to freeze-thaw action and the deterioration noted would not be unexpected. Also, the quality and quantity of the cement used would not be expected to be high thus the strength would not be expected to be very high. Cores were not removed from the tower itself but cores of the concrete were taken from the outlet conduit as shown in Photograph 4. Based on these cores, we have ascertained the strength of the concrete is generally expected to be less than 2,500 psi. The cement to aggregate bond of the concrete in the cores was not good and damage due to freeze-thaw would be expected.

The design of concrete mixtures today to withstand the level of freeze-thaw action the tower experiences is still a challenge. The use of air entraining agents and the minimum strength requirement of 4,500 psi is the norm today. The low quality of the concrete mix on the tower can not be expected to adequately resist deterioration under the conditions to which it is subjected.

The only way to eliminate or reduce future the spalling and deterioration is to minimize the water penetration into the concrete. Since the concrete does not have air voids that allow for expansion of the moisture as it freezes, the moisture has to be minimized as much as possible. The complete elimination of moisture penetration is not possible and thus future maintenance of the tower can be expected. The goal would be to use a protective system that minimizes the deterioration to an acceptable level and extends to life of the tower.

The inspection of portion of the interior of the tower does not indicate deterioration of the concrete. Based on this inspection and our inspection of the tower when work was done in 1997, we do not believe concrete in the interior requires any repair. Excessive cracking of the concrete has not been observed and leakage through the joints is not apparent.

TOWER STRUCTURAL ANALYSIS

The tower was analyzed for ice, wind, and seismic loads. The analysis methods used were simplified and intended to produce order of magnitude results. This analysis was to determine the general structural capacity in comparison with the magnitude of the applied loads. Based on the performance of the tower, it appears to be designed adequately for the normal loads applied. However, there are conditions that could be applied that the tower has not experienced; a significant earthquake event and full reservoir. To our knowledge the reservoir has never been full to the spillway level. The maximum reservoir level of record is elevation 8412 feet which is 13 feet less than full reservoir condition. The normal high water level condition during an average year is usually less than 50,000 acre-feet which corresponds to an elevation of 8404 feet.

The reservoir full with ice would create a much greater overturning moment at the base and a much greater concrete and steel stress at the tower to base slab interface than it has seen in the past. Using the ice load of 10 kips per linear foot, as recommended by the Bureau of Reclamation, with a water elevation at 8425 feet, the Factor of Safety against overturning was calculated to be greater than 1.7. The maximum bending stress due to the ice load is approximately 250 psi which is very low.

The analysis of the wind load on the tower, using the full tower height, indicates a Factor of Safety against overturning greater than 6.5. This is very conservative as the water/silt around the tower would never be below elevation 8340.

The analysis of the earthquake loads on the tower, without consideration of hydrodynamic loads, was determined to be a Factor of Safety against overturning of 3.6. The concrete and steel stresses at the base of the tower walls would be approximately 140 psi under the loading assumed. This analysis was conducted using a horizontal and vertical seismic load equal to 5% of the tower and base slab weight. This is based on the Corps of Engineers Manual EM 1110-2-1902 which indicates this as an appropriate loading for a dam in this region. A more detailed analysis may yield different results. However, for the current level of study we believe this analysis is appropriate to determine the general magnitude of loads and order of magnitude of the potential problems with the tower. Before any structural changes are made, a more detailed study would be recommended.

Based on our analyses of the tower and our past and current inspections, we believe the tower is adequate structurally and can provide a long term level of use if the exterior is properly protected against further damage and deterioration from freeze-thaw.

OUTLET CONDUIT INSPECTION

The outlet conduit was inspected visually by Duane Smith, P.E. of SGE on November 1, 2011. Photograph 3 shows the general condition and shape of the conduit.

The conduit was subsequently inspected and cores removed from the lower reaches on November 22, 2011 by personnel from SGE and SDRC in a joint effort. More cores were planned but the removal of the cores proved somewhat difficult due to water and as the wedge anchors used did not hold well.

This is believed to be due to the poor quality of the concrete and also due to the unbonded cementitious material in the concrete.

Two 3 inch diameter cores were removed from the conduit and subsequently tested for compressive strength. The strength of the two core shown in Photograph 4 were 1,244 psi and 2,212 psi. Note the debonding of the aggregate in the core on the right, which was the higher strength core.

PHOTOGRAPH 3 - OUTLET CONDUIT

Based these cores, we have ascertained the strength of the concrete is generally expected to be less than 2,500 psi. Based on our visual inspection of the cores, we have determined the cementitious portion contained a significant percentage of non-pozzolanic material that did not hydrate. A large amount of loose powdery type non-hydrated residue was found throughout the cores. This material appears to inhibit bonding of the cement-aggregate mixture. There is visual evidence that the aggregate was most likely dirty which inhibits bonding and decreases the strength. The aggregate gradation and distribution was also poor and not uniform and appears to be gap graded.

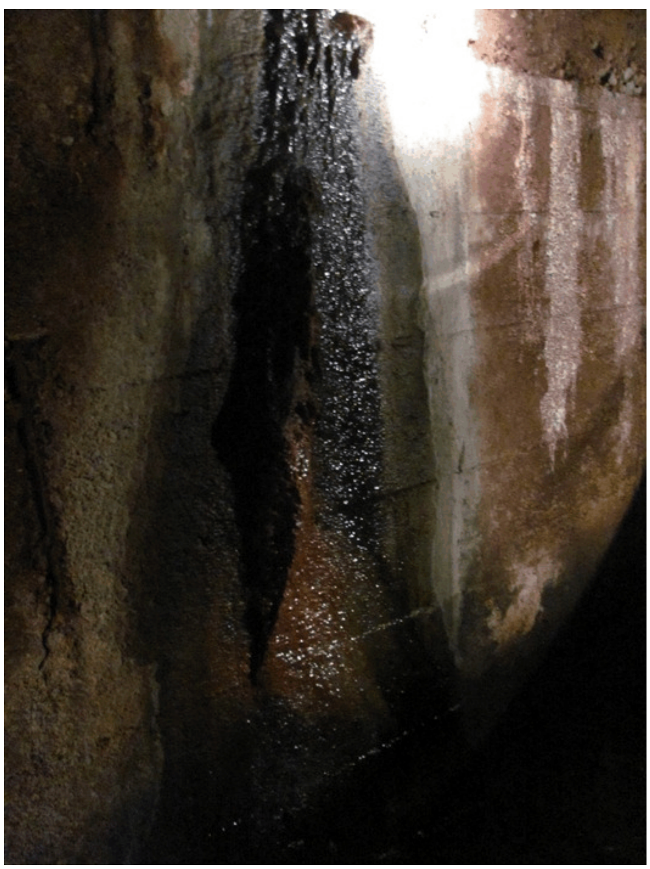
The outlet conduit on the downstream end, where freeze thaw has taken place, has deteriorated significantly and eroded. Photograph 5 shows the erosion of the concrete that has resulted. Most of the outlet conduit walls and roof, as can be seen in Photograph 3, are not eroded significantly or cracked. The majority of the outlet appears to be structurally sound as no significant movement or stress cracks were noted in this inspection. This is surprising due to the size and thickness of the walls and roof section, the low strength of the concrete, and the poor reinforcing steel placement.

Other problems noted by our inspection includes leakage at several of the construction joints, especially on the sidewalls, and reinforcing steel placement problems . Photograph 6 shows leakage at a sidewall joint and Photograph 7 shows minor staining from leakage at an overhead joint. There are several areas where the reinforcing steel does not have proper cover and is at the face of the concrete or actually exposed as in Photograph 9. Photograph 8 shows a patch which appears to have been applied during the original construction, most likely to cover the reinforcing steel where it was exposed on the face. There are many areas, especially on the lower end of the conduit, that have a surface patch that appears to have been applied to cover the reinforcing steel. It would appear shifting of the reinforcing steel during concrete placement was a major problem, at least for a portion of the project. We do not see the same type of problems on the tower.

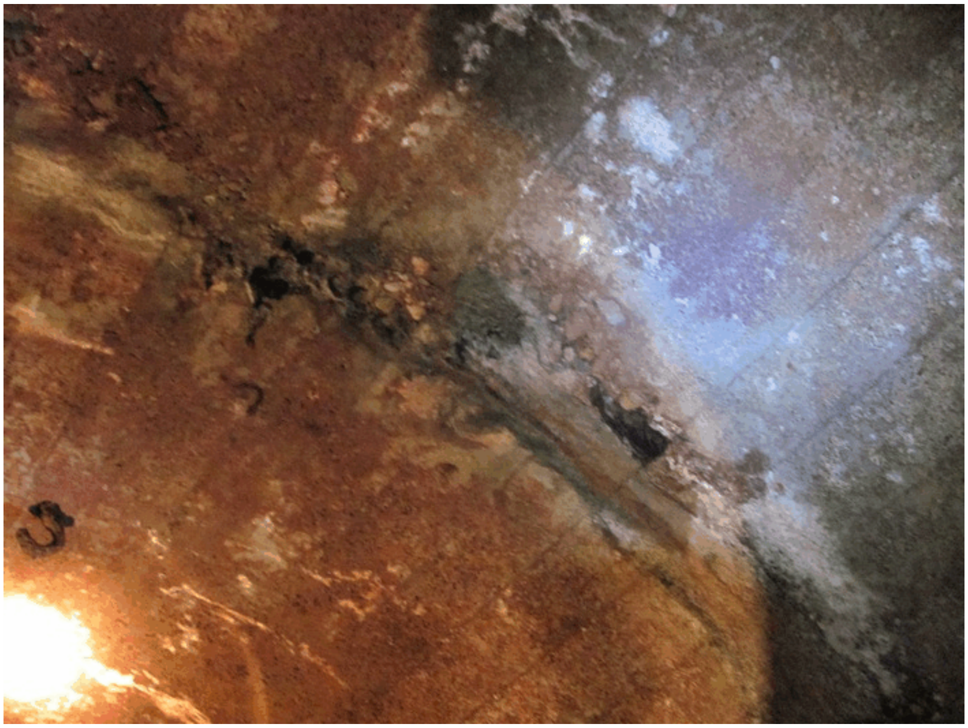
The floor slab is deteriorated from erosion due to discharge flows. The erosion appears to have removed from 1-inch to as much as 3-inches from the floor slab. This erosion would be expected with the low strength of the concrete and poor bonding noted in the cement-aggregate matrix. The floor does not appear to be cracked significantly and the only seepage noted in the floor is near the upstream end of the conduit as shown in Photograph 10. Clear water is discharging from the hole at an estimated rate of approximately 3 to 5 gallons per minute. We attempted to fill the hole with water plug grout and also with a polyurethane foam and were unable to plug hole long enough for it to set. There is enough pressure that we were unable to jamb the hole with rags without them being blown out.

PHOTOGRAPH 4 - OUTLET CONDUIT CORES

PHOTOGRAPH 5 - CONCRETE EROSION



PHOTOGRAPH 6 - LEAKAGE AT CONSTRUCTION JOINT



PHOTOGRAPH 7 - CONSTRUCTION JOINT

PHOTOGRAPH 8 - CONCRETE SURFACE PATCH

PHOTOGRAPH 9 - REINFORCING STEEL EXPOSED

PHOTOGRAPH 10 - HOLE IN FLOOR SLAB

PHOTOGRAPH 11 - OUTLET DISCHARGE STRUCTURE

The discharge structure at the downstream end of the outlet is deteriorated and in disrepair. As can be seen on Photograph 11, a portion of the walls on the right side have major structural damage that needs to be repaired. The right side is also where seepage builds up and is collected in steel troughs from holes drilled through the walls. The floor of the structure is also eroded and needs repair.

OUTLET CONDUIT STRUCTURAL ANALYSIS

Structurally, the outlet conduit does not appear to have experienced movement or stress cracking even though the concrete strength is low. Most of the problems noted appear to be construction related and due to poor cement quality and poor placement of the reinforcing bars.

A simplified analysis of the conduit was conducted using the Bureau of Reclamation ENGINEERING MONOGRAPH No. 14 and the Corps of Engineers ENGINEER MANUAL EM-1110-2-2902. This analysis assumed the concrete strength is 2,500 psi and the reinforcing steel strength is 33,000 psi. Reinforcing bars, as we know them today, came about in 1900. Specifications were first developed in 1910, which is the same year the drawings are dated. Structural bars were made in 33 ksi, 40 ksi, and 50 ksi bars. Information by the Concrete Reinforcing Steel Institute notes the 33 ksi bars were normally used.

Our analysis would indicate the conduit stresses range from acceptable, for the downstream conduit section, to being as much as 25% greater stress level than acceptable on the upstream portion of the conduit. The concrete compressive stresses are within an acceptable level throughout but the steel tensile stresses are greater than we would allow under current design standards. The steel stresses are not at yield but are within 15% to 20% of the yield stress at the critical upstream section. The shear stresses are within acceptable levels throughout the conduit.

With regard to the actual stresses on the conduit, a lot is dependent of the actual load on the conduit which can vary significantly with the soil type and the method of construction and backfill. There may be arching over the conduit and the load from the full height of the embankment fill is not being applied to the conduit. This can happen when the backfill directly over the conduit is placed at a lower density than on either side. The only way to determine this would be to install pressure monitoring devices adjacent to the conduit to determine the actual pressure on the conduit.

Our analysis is based on many assumptions and using simple solutions to the stress analysis. Limited strength information is available for both the concrete and reinforcing bars. This analysis is not intended to provide a definitive solution but to determine an order of magnitude type analysis to determine if the structural design is close or is significantly deficient. Based on our analysis and also the visual inspection, we do not believe the conduit design is deficient. The main deficiencies are with regard to construction problems previously noted and the deterioration due to freeze-thaw.

ALTERNATIVES EVALUATED

A range of alternatives were considered including; 1) Alternative 1 - Repair the Tower and Conduit including the Tasks 1, 2, and 3 outlined on page 4 to upgrade the gates and control system; 2) Alternative 2 - Repair the Tower and Outlet Conduit as outlined in Alternative 1 except replace the existing tower gates with four larger gates at elevation 8340 feet to 8350 feet; 3) Alternative 3 - Demolish Tower Alternative which includes repairing the outlet conduit, demolishing the tower above elevation 8330 feet and replacing the tower and existing gates with a new intake structure; and, 4) Alternative 4 - Do Nothing Alternative. We have also included an Additional Alternatives which considers enhancements to the Tower Access. This could be added to Alternatives 1 and 2 to enhance the access to the existing Operator House.

A description of the five alternatives follows:

1. Repair Alternative 1

This alternative considered rehabilitating the current outlet components. This would require a repair of the tower exterior, the outlet conduit, the gondola, and upgrading the gate control system.

The work required to repair the Tower would include 1) sand blasting the exterior of the tower to remove previous coatings, loose concrete, dirt and organic growth to provide a sound substrate, and 2) applying a structural/protective coating to strengthen the tower and increase its useful life. The coatings considered were both cementitious such as shotcrete and an epoxy type sprayed on coating. The coatings to be applied were assumed to be applied from the roof to an elevation of approximately 8340 feet which is just above the silt level.

For the repair of the outlet conduit, we have considered options to add to the structural integrity by increasing the wall section with shotcrete or the option to repair, build up the deteriorated sections, and apply an epoxy coating. Both alternatives would require the outlet be sandblasted or water blasted and any loose concrete and deteriorated reinforcing steel be chipped out. If an epoxy coating is used the deteriorated areas will have to be patched with grout before coating with epoxy. A sketch of this option is shown on Figure 1 in Appendix B.

An alternative considered was to replace the outlet conduit with a 7 foot diameter pipe placed in the conduit with the annular space grouted. This would increase the structural integrity and eliminate the freeze-thaw problems. However, a hydraulic analysis of this option indicated the outlet capacity would be reduced as the discharge would become outlet controlled and the back pressure from the tunnel would increase water depth in the tower and reduce the overall capacity. This option was thus abandoned and not considered to be a feasible alternative with the existing valve arrangement.

Included in the repair option would be the removal and replacement of the deteriorated portions of the downstream outlet works structure. The right side of this structure is in disrepair and portions of the concrete walls have failed. This will increase the long term stability of the dam as measures can be added to properly collect and filter the seepage that exits into this structure as seen in Photograph 11. The repair on the structure includes excavating the area adjacent to the right side wall for the installation of a drain and filter system. The new wall will be backfilled with granular materials to intercept the seepage, collect it in the drain, and discharge it downstream through a measuring weir for seepage monitoring. The right side wall will be demolished and replaced. Riprap, made from the rock that will be excavated, will be placed in the downstream channel to control erosion of the ditch.

Repair of the Gondola, the one 30 inch gate, and the control system is being conducted by others contracted by the SDRC. As described in the Grant Application the work expected is as follows:

1. Tramway Engineering, Ltd. will determine current, short-term, and future functionality the Gondola system; implement safety recommendations for current and near term continued use of the Gondola-Tramway system; and improve safe access to the Gate Tower for repairs, upgrades, and continued operation of Sanchez Reservoir.

2. Prime Field Service, LLC will remove and repair cylinder & plunger on one 30" gate in the lower part of Gate Tower; fabricate and re-chrome cylinder and plunger packing area; and R.H. Construction will install the repaired cylinder.

3. Prime Machine, Inc. will remove the existing hydraulic activation system and install a new hydraulic activation system, coordinating with Colorado Digital Labs, which will design and install automated and remote control systems. This Task will be accomplished by collaboration between both companies to achieve the objectives of SDRC, secured by installing "vandal-proofing" security systems.

2. Repair Alternative 2

This alternative considers rehabilitating a portion of the outlet components and replacing and eliminating some of the existing gates. This would also require a repair of the tower exterior, the outlet conduit, the gondola, and upgrading the gate control system much as is described in Alternative 1. The variation would be to eliminate the existing 30 inch valves and replace them with four 36" x 36" gates located at the 8340 to 8350 levels**.** This will require removing the gates at these elevations, cutting out the existing thimbles and replacing them with square thimbles for the 36" x 36" gates. The new thimbles will be grouted into place with reinforcing steel drilled and grouted into the existing concrete. Figure 2 in Appendix B shows the configuration proposed.

This alternative eliminates the double gate scenario on the tower which significantly reduces the head loss through the gates and also places the gates at lower elevations where there is more head.   The gates at the entrance of the outlet conduit will provide a second level of defense in case of a failure of a gate in the tower. The double gate system in the tower is not seen as necessary to the operational safety of the system.

The work outlined for Alternative 1 would generally be the same for the repair of the tower and outlet conduit and would include the following work by the specialty contractors as listed in Alternative 1.

1. Tramway Engineering, Ltd. will determine current, short-term, and future functionality the Gondola system; implement safety recommendations for current and near term continued use of the Gondola-Tramway system; and improve safe access to the Gate Tower for repairs, upgrades, and continued operation of Sanchez Reservoir.

2. Prime Machine, Inc. will remove the existing hydraulic activation system and install a new hydraulic activation system, coordinating with Colorado Digital Labs, which will design and install automated and remote control systems. This Task will be accomplished by collaboration between both companies to achieve the objectives of SDRC, secured by installing "vandal-proofing" security systems.

3. Alternative 3 - Demolish Tower

This alternative would require demolition of the tower above approximately elevation 8335 feet. The tower would be removed by sawing a notch on the reservoir side and setting explosive charges to topple the tower into the reservoir. The tower would then be saw cut at a predetermined elevation to provide a uniform joint.

After the tower is removed, a slab would be placed over the top of the remaining portion of the tower to allow the installation of two new slide gates. The slide gates would be installed and operated by hydraulic cylinders located on the slab that supports the gates. Placing the cylinders at the crest of the dam was considered but due to potential alignment problems for a 300 foot long stem, it was determined a submerged cylinder would have to be used. A concrete grade beam would be constructed on the dam face from the gates to the crest to support the hydraulic lines and also a the gate vent pipe.

To abolish the gate tower and change the bottom portion of the tower into a more conventional outlet, will require the following work be completed:

1. Install a sheetpile cofferdam to elevation 8340 feet to allow dewatering and removing the silt from around the tower. There may be other options to doing this but for the feasibility stage we believe the cost to install sheetpiling should be included.
2. Demolish the tower to elevation 8335 feet.
3. Dewater and remove silt as required to facilitate installation of the concrete cap slab over the tower.
4. Saw cut the tower walls to a uniform elevation.
5. Construct a concrete slab over the top of the tower at approximately elevation 8335 feet.
6. Install thimbles in the concrete slab for the installation of the two sloped gates. The gates will include one 5' x 6' gate and one 30" x 30" gate for a total capacity of approximately 1500 cfs at maximum pool of 4825 feet. The 30" gate would be used for normal operation.
7. Construct an 18" x 24" concrete grade beams on the face of the dam to support the hydrailic lines and the gate vent pipe.
8. Install a precast concrete control house on the upstream face of the dam above the high water level. The control house will contain operators and the controls for gate operation.
9. Rehabilitate the outlet conduit as outlined in Alternative 1.

Figure 3 in Appendix B shows the details of this alternative.

This alternative has several challenges as the reservoir would have to be drained or nearly drained. Due to the known silt level, we expect to have to drive sheet piling around the outlet tower and remove a portion of the silt to facilitate the work. This will be a significant undertaking that will require providing access to the tower for a crane or excavator with a pile driver attached. This can be accomplished with a barge or by the placement of fill along the dam face to construct a road along the dam face to near the tower. The lower the water can be drawn down the closer the road and crane can be to the work area and the smaller the crane required. We would anticipate the water needs to drawn down to about 8340 feet to be practical for the installation.

4. Do Nothing Alternative

This alternative will most likely work for a period of years but ultimately will lead to reduced storage as failure of various components occurs. Increased seepage through the conduit walls, continued deterioration of the tower and the lower portion of the outlet conduit due to freeze-thaw, and loss of adequate control of the gate system were the gondola to fail would all lead to restrictions and reduced storage. Also, any of these potential events could lead to an emergency situation where the **SDRC** would incur significant expense and potential liability event if a minor failure event were to occur.

We believe the "DO NOTHING ALTERNATIVE" is not feasible due to the potential future liability and the large future cost from loss of storage as the appurtenant structures deteriorate further. The situation is not static and the structures will not remain in their current condition.

5. Additional Alternative/Options

In addition to the alternatives above, we have investigated two different scenarios to improve the tower access by the installation of a pedestrian bridge or the installation of a ladder on the outside of the tower. We have also investigated coating the tower and outlet conduit with a sprayed on epoxy coating/

Pedestrian Bridge Option. The bridge alternative will consist of three 100 foot span sections. The bridge will be supported on concrete piers that will be supported on drilled pier foundations. The concrete piers would be expected to be drilled to a depth of approximately 20 feet and are expected to be 5 foot in diameter, with two required for each bridge support. The total span is approximately 300 feet and will require three 100 foot spans and thus two pier supports installed between the dam crest and the tower as shown on Figure 4 in Appendix B.

Ladder Option. A second alternative, which is considered for emergency access only, would be to install a ladder on the outside of the tower. The ladder would be a prefabricated ladder with a SAFE-T-CLIMB rail for fall protection. The fall protection device is a cam locked on to a center rail that grips the rail. When pressure is applied to the cam, as would happen in a fall, the cam locks onto the rail preventing the decent of the person climbing.

The ladder would be installed by drilling and attaching anchors to the tower. A platform with railing and a caged ladder section would be required at the top of top of the tower to allow access to the existing Operator House.

This configuration is proposed rather than a spiral stairway due problems with ice loads and damage as the reservoir level fluctuates in the winter. Also, access to a stairway from a boat is problematic as the water level fluctuates. Access would inevitably be over the handrail as accessing a landing would not always be possible as the water level changes.

As noted, we believe this installation would be suitable for emergency access only as weather conditions could make the use difficult. Wind with large waves could make docking a boat at the ladder very difficult. Also, if the gates were required to be operated when there was skim ice on the reservoir, access could be dangerous to impossible depending on the ice thickness.

Epoxy Grout Repair. We have considered the option to use an epoxy coating on both the tower and the outlet conduit rather than the application of shotcrete. For both structures this is seen as a viable option. However, the life span of this option may not be as great as the shotcrete and the coating adds little to no additional structural capacity. The lack of additional structural capacity is not relevant for the tower but should be a consideration for the outlet conduit.

In the outlet conduit, chipping of the deteriorated concrete, repair of reinforcing steel, and sandblasting of the areas that are to be coated will be required. For the tower, surface preparation by sandblasting may be all that is required prior to placing the coating. Some of the larger holes may need to be patched first but the bulk of the tower can be sealed by spraying on the coating.

COST ESTIMATES

An Opinion-of-Cost has been developed for each of the alternatives described above. A complete breakdown of the cost estimates are included in Appendix A. The costs have been determined by determining the scope of work expected, determining the quantities of work associated with each alternative, and determining the expected unit cost of each item of work. The costs associated with the item of work expected have been determined generally in two ways: one being estimating the labor and material costs, and the second method by obtaining costs from contractors that have expertise with work proposed.

We have obtained costs from contractors such as Hayward Baker, Yenter, Premier Coatings, Zak Dirt, Sterling Crane, Dale's Environmental, Big R Bridge, Utility Maintenance Construction, Municipal Treatment Equipment, Contech Construction Products, North-Honeywell Safety Products, Thompson Fabricating, Restruction Corporation, and Penhall Company.

TABLE 1
TOTAL PROJECT COST SUMMARY
SHOTCRETE COATING

ITEM	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
1. Construction Cost	$ 1,325,900	$ 1,555,900	$ 1,528,000
2. Contingency ~ 20%	$ 242,500	$ 284,400	$ 279,000
3. Engineering Fees	$ 187,500	$ 227,500	$ 225,000
TOTALS	$ 1,755,800	$ 2,067,800	$ 2,032,000

TABLE 2
TOTAL PROJECT COST SUMMARY
ALTERNATIVES
EPOXY COATING

ITEM	ALTERNATIVE 1A Epoxy Coating	ALTERNATIVE 2A Epoxy Coating	ALTERNATIVE 3A Epoxy Coating
1. Construction Cost	$ 1,060,900	$ 1,288,900	$ 1,324,400
2. Contingency @ 20%	$ 195,600	$ 237,600	$ 244,100
3. Engineering Fees	$ 176,000	$ 213,900	$ 219,700
TOTALS	$ 1,432,500	$ 1,740,400	$ 1,788,200

SELECTED PROJECT

The **SDRC** has chosen Alternative 3, which is to demolish the tower, as the best alternative to meet their goals. Alternative 3 provides for the demolition of the gate tower; the installation of new control gates and operators; lining the existing outlet conduit with shotcrete; and, repairing the downstream outlet structure. Alternative 3 is not the lowest cost alternative but is an alternative that adequately repairs the outlet conduit and removes the long term maintenance associated with the outlet tower. Alternative 3A, using an epoxy coating to protect the outlet conduit, has a lower estimated cost but does not add to the structural integrity and is expected to have a shorter service life. Our recommendation is to protect the outlet conduit with shotcrete in lieu of using an epoxy coating.

Based on the estimated cost for Alternative 3, the following financial plan has been developed based on the expected loan from the CWCB. The **SDRC** has applied for a grant through the Colorado Water Conservation Board, Water Supply Reserve Account and the Rio Grande Basin Roundtable. This grant, for $914,400, was submitted and approved in June, 2012. The **SDRC** also received a grant in May, 2011 for $95,000 with matching funds by **SDRC** of $33,160 to conduct the Feasibility Study and to make repairs to and upgrade the gondola, gate cylinder repairs, and for establishing a security system.

SDRC plans to apply for the balance of the total estimated project cost of $2,032,000 from the CWCB Construction Fund. The loan request to the CWCB will be for $1,117,600 plus $11,176 which is the loan origination fee. This report does not include an analysis of the grant program and the **SDR**C grant request, but is part of the application for the loan on the balance of the project not funded by the grant program.

FINANCIAL PLAN

The **SDRC** has chosen Alternative 3 for a total estimated cost of $2,032,000. The **SDRC** plans to apply for a $1,128,776 loan from the Colorado Water Conservation Board (CWCB). The loan amount requested would be at an interest rate of 1.75% with a 30 year loan period.

Revenue for operations and payment of loans is derived from assessment. Assessments are presented to stockholders and approved at the annual stockholders meeting on the first Wednesday in March of each year. The 2012 assessment has been set at $9.99 per share for 21,802.716 shares with an additional $1.52 per share for 20,790.486 shares for the yearly payment of the current CWCB loans. In 2009, 2010 and 2011 the assessments were $8.99 per share for 21,802.716 shares with an additional assessment of $1.52 for 20,790.486 shares for the yearly payment of the current CWCB loans.

For the loan requested in this application, the stockholders in the Sanchez Ditch & Reservoir Company (20,790.486 shares) will be increased to cover the additional loan and construction interest payments. The San Acacia water users (1,012.23 shares) do not share in the obligations for the repairs to Sanchez Reservoir.

The fund requirements for both the SDRC (Grant Payments), and the CWCB through the end of construction of the project are shown in Table 3

TABLE 3
FUND REQUIREMENT SCHEDULE

YEAR	TOTAL FUNDS REQUIRED	GRANT SDRC	CWCB LOAN
2013	$ 125,000	$ 56,250	$ 68,750
2014	$1,400,000	$ 630,000	$ 770,000
2015	$ 507,000	$ 228,150	$ 278,850

The funds shown in Table 3 are at a ratio of 45% Grant money to 55% loan from the CWCB. The funds shown in Table 3 required for 2013 are the engineering design costs. For 2014, the funds required include the engineering costs for design and construction, 100% of the construction cost for the tower renovation, and a portion of the cost for the outlet conduit work. In 2015 the funds required include engineering construction costs and the remaining amount to complete the outlet conduit work.

The financial condition of the company is solid at the present time. The company has no other obligations other than those listed in the financial statement found in Appendix I. The SDRC has two previous loans from the CWCB with remaining balances of $71,558.47 and $194,458.88. The yearly payment to the CWCB is $31,385.92 with the first loan to be retired in 2017 and the second loan in 2022. None of the loans are delinquent and they have no other outstanding obligations.

Following is a summary of the companies income and expenses based on their financial statements from 2009, 2010 and 2011 which are included in Appendix I.

	2011	**2010**	**2009**
Current Assets	**$ 152,040.60**	**$ 119,435.76**	**$ 139,037.64**
Total Assets	**$ 789,259.26**	**$ 781,511.79**	**$ 793,888.67**
Current Liabilities	**$ 27,458.62**	**$ 31,092.56**	**$ 25,485.27**
Long term Liabilities	**$ 243,917.20**	**$ 243,917.29**	**$ 280,752.03**
Total Liabilities	**$ 271,375.91**	**$ 276,009.85**	**$ 306,237.30**
Total Income	**$ 234,050.00**	**$ 239,343.35**	**$ 236,730.81**
Total Expense	**$ 223,668.22**	**$ 219,613.08**	**$ 229,375.73**
Net Income	**$ 10,381.78**	**$ 19,730.27**	**$ 7,355.08**

Table 4, included herein, shows the debt service requirements for the **SDRC.** This table and repayment plan has been developed by the CWCB and has been agreed upon by the **SDRC**. The debt service and payments shown in Table 4 include the current two loans from the CWCB and the new loan application. The previous loans, as shown, have been restructured by the CWCB to speed up their repayment while at the same time delaying repayment for the new loan. This repayment structure was initiated by the CWCB to minimize the increases in assessments for the **SDRC** stockholders.

As can be seen from Table 4, the assessments are projected to rise from their current level of $1.52 per share to a maximum of $2.97 per share of stock by 2017. This is an increase of 95% from the current level. The increase in assessments due to the Project will remain stable until 2027 when it will drop to $2.70 per share and continue at that level until the loan repayment is complete in 2046.

Based on the records we have from the Colorado State Engineer for 1965 - 2009 (Appendix E), during an average year the **SDRC** releases and uses approximately 15,000 acre-feet of water. The total project cost per acre-foot of water used is thus approximately $3.42 per acre-foot per year.

TABLE 4

Estimated debt service schedule based on $1,128,776 loan ($1,117,600 loan + $11,176 service fee) @ 1.75% Interest Rate

Total Project	$2,032,000
Grant (45%)	$914,400
Loan (55%)	$1,117,600
1% Loan Service Fee	$11,176
Total Loan Amount	**$1,128,776**

	153623			153755A			New						
	PMT #	($ x1000)	Extra ($ x1000)	PMT #	($ x1000)	Extra ($ x1000)	PMT #	Interest ($ x1000)	Principal ($ x1000)	Reserve/ IDC ($ x1000)	Total Debt Service	Debt Service Per Share (20,790.486 shares)	
2012	19	11.5		14	20.0						31.5	$1.52	
2013	20	11.5	5.0	15	20.0						36.5	$1.76	Start Construction
2014	21	11.5	5.0	16	20.0						36.5	$1.76	
2015	22	11.5	5.0	17	20.0						36.5	$1.76	Finish Construction
2016	23	11.5	5.0	18	20.0					10.0	46.5	$2.24	IDC Payment
2017	24	11.5	-11.5	19	20.0	15.0	1	19.8	0.0	5.6	60.4	$2.91	Start new loan interest only payment
2018	25	11.5	-11.5	20	20.0	15.0	2	19.8	0.0	5.6	60.4	$2.91	Final 153623 loan payment
2019				21	20.0	15.0	3	19.8	0.0	5.6	60.4	$2.91	
2020				22	20.0	15.0	4	19.8	0.0	5.6	60.4	$2.91	
2021				23	20.0	-20.0	5	19.8	36.4	5.6	61.8	$2.97	Start new loan full payment
2022				24	20.0	-20.0	6	19.8	36.4	5.6	61.8	$2.97	
2023				25	20.0	-20.0	7	19.8	36.4	5.6	61.8	$2.97	Final 153755A loan payment
2024							8	19.8	36.4	5.6	61.8	$2.97	
2025							9	19.8	36.4	5.6	61.8	$2.97	
2026							10	19.8	36.4	5.6	61.8	$2.97	
2027							11	19.8	36.4		56.2	$2.70	
2028							12	19.8	36.4		56.2	$2.70	
2029							13	19.8	36.4		56.2	$2.70	
2030							14	19.8	36.4		56.2	$2.70	
2031							15	19.8	36.4		56.2	$2.70	
2032							16	19.8	36.4		56.2	$2.70	
2033							17	19.8	36.4		56.2	$2.70	
2034							18	19.8	36.4		56.2	$2.70	
2035							19	19.8	36.4		56.2	$2.70	
2036							20	19.8	36.4		56.2	$2.70	
2037							21	19.8	36.4		56.2	$2.70	
2038							22	19.8	36.4		56.2	$2.70	
2039							23	19.8	36.4		56.2	$2.70	
2040							24	19.8	36.4		56.2	$2.70	
2041							25	19.8	36.4		56.2	$2.70	
2042							26	19.8	36.4		56.2	$2.70	
2043							27	19.8	36.4		56.2	$2.70	
2044							28	19.8	36.4		56.2	$2.70	
2045							29	19.8	36.4		56.2	$2.70	
2046							30	19.8	36.4		56.2	$2.70	

OPINION OF FEASIBILITY

The selected alternative is technically and financially feasible. There are no significant roadblocks which would keep the Sanchez Ditch and Reservoir Company from successfully completing this project.

The Benefit to Cost Ratio is much greater than 1.0 and the cost per acre-foot of water is also favorable. The following summary provides a breakdown of the unit costs and benefit to cost ratio.

Following is a cost to benefit analysis of the project.

Total Project Cost including interest

$19,800 x 30 years + $36,400 x 26 years + $10,000 = $1,550,400

Total Cost per Share of Stock

$1,550,400 ÷ 20,790.486 = $ 74.57

Cost Per Share of Stock Per Year

$ 62.72 ÷ 30 years = $2.49

Cost Per Acre-foot Of Water Delivered Yearly

$ 1,550,400 ÷ 30 ÷ 15,000 A-Ft = $ 3.44

The current value of the water is expected to be in the range of $3,500 per acre foot based on the rental rate. Over the 30 year life of the loan the value would be expected to be much higher than the current value of the water. Using the average yield of 15,000 acre-foot per year rather than storage capability, the benefit to cost ratio would be as follows.

Benefit/Cost = [$3,500 x 15,000 A-Ft] ÷ $ 1,550,400 > 33

IMPLEMENTATION SCHEDULE

The following schedule is proposed for implementation of the project. It is possible schedule

Task		Target Completion Date
1.	Feasibility Study Approval by CWCB	8/21/12
2.	CWCB Contracts Finalized	12/1/12
3.	Begin design	1/1/13
4.	Design completed	6/1/13
5.	Design documents submitted to SEO	6/15/13
6.	Design approval By SEO	12/1/13
7.	Project out for bid	5/1/14
8.	Bids due - contract awarded	6/1/14
9.	Start construction	9/1/14
10.	Tower and outlet structure completed	12/1/14
11.	Outlet conduit completed	2/1/15
12.	SEO approval for refilling	3/1/15

SOCIAL, ECONOMIC, AND PHYSICAL IMPACTS

The project will have no long term negative social impacts. There will be some impact on fishing and general recreational use of the reservoir during construction. Lowering of the water level will impact and reduce access to the reservoir and will generally reduce recreational opportunities during the construction period. This impact would be expected the be less than one year in duration.

The project will have a positive long term economic impact by providing irrigation water for 13,400 acres of shareholders' crops and recreational opportunities for area residents.

The project will have no significant physical impacts other than the removal of the Tower from the reservoir which is visible to the public.

PERMITTING

All easements and rights of way are now held by the company. No local construction permits or easements are expected to be required for this repair project.

The company and the Engineer believe no Environmental Assessment (EA) or Environmental Impact Statement (EIS) will be required. The Corps of Engineers - Department of the Army (DA) will be notified of the scope of work but we believe the work will not fall within their jurisdiction.

The only alternative investigated that may require permitting is Alternative 3. This alternative includes blasting and removing a portion of the outlet tower and potentially the removal of silt from the reservoir around the tower. The blasting will require safety and security measures but no special permits are expected associated with the blasting. The draining of the reservoir, which would be expected to transport silt, and the potential for the need to remove silt from around the outlet may require review by the Department of the Army.

COLLATERAL

The Sanchez Ditch and Reservoir Company has the following collateral it can offer for the CWCB loan, in this order of preference:

1. The revenue from assessments as allowed by the Company By-Laws and Articles of Incorporation.

2. The physical structure including the dam and appurtenant structures.

3. Company assets including equipment, land, and buildings.

INSTITUTIONAL CONSIDERATIONS

The Sanchez Ditch and Reservoir Company has applied to borrow $1,128,770 from the Colorado Water Conservation Board Construction Fund. The loan from the CWCB is contingent upon CWCB approval, and the successful negotiation of a contract between the CWCB and the Sanchez Ditch Company. The Company has applied for and received approval for a grant of $914,400 through the **Rio Grande Basin Roundtable** and the **CWCB Water Supply Reserve Account.**

APPENDIX A

Opinion of Cost

Tables 1 through 4

TABLE A-1
REPAIR ALTERNATIVE 1
REPAIR TOWER, OUTLET & GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 20,200.00	$ 20,200
2.	Mobilization, Demobilization	1	L.S.	$ 94,100.00	$ 94,100
3.	Repair Tower - shotcrete coating				
	Scaffolding	1	L.S.	$ 72,200.00	$ 72,200
	Sandblasting	5000	S.F	$ 11.00	$ 55,000
	Shotcrete Application (6")	115	C.Y.	$ 1,700.00	$ 195,500
	Crane	14	Days	$ 2,200.00	$ 30,800
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 367,000
4.	Repair Outlet Conduit - Shotcrete				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Shotcrete Application (6")	275	C.Y.	$ 1,700.00	$ 467,500
	Reinforcing Steel	17	Tons	$ 1,900.00	$ 32,300
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 772,200
5.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>				**$ 1,325,900**
	CONTINGENCY >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 242,400**
	ENGINEERING DESIGN + CONSTRUCTION >>>>>>>>>>>				**$ 187,500**
	TOTAL>>				**$ 1,755,800**

TABLE A-2
REPAIR ALTERNATIVE 2
REAPIR TOWER & OUTLET & REPLACE GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 23,700.00	$ 23,700
2.	Mobilization, Demobilization	1	L.S.	$ 110,500.00	$ 110,500
3.	Repair Tower - shotcrete coating				
	Scaffolding	1	L.S.	$ 72,200.00	$ 72,200
	Sandblasting	5000	S.F	$ 11.00	$ 55,000
	Shotcrete Application (6")	115	C.Y.	$ 1,700.00	$ 195,500
	Crane	14	Days	$ 2,200.00	$ 30,800
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 367,000
4.	Repair Outlet Conduit - Shotcrete				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Shotcrete Application (6")	275	C.Y.	$ 1,700.00	$ 467,500
	Reinforcing Steel	17	Tons	$ 1,900.00	$ 32,300
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 772,200
5.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
6.	Replace Tower Gates				
	Demolition Existing Gates	100	Hrs	$ 55.00	$ 5,500
	Grout Exisitng Gate Openings	30	C.F.	$ 84.00	$ 2,500
	Thimble - supply	4	Each	$ 4,600.00	$ 18,400
	Grout New Thimbles Inplace	240	C.F.	$ 55.00	$ 13,200
	Rebar/epoxy coated - supply	1300	L.B.	$ 0.75	$ 1,000
	Rebar - drill, place, epoxy grout	40	Hrs	$ 55.00	$ 2,200
	3' x 3' Slide Gate - supply	4	Each	$ 22,000.00	$ 88,000
	3" Stainless Steel Stem - supply	440	L.F.	$ 31.00	$ 13,600
	Install Gates, Stem & Supports	100	Hrs	$ 55.00	$ 5,500
	Galvanized Trashrack -supply	2450	L.B.	$ 6.00	$ 14,700
	Install Trashracks	100	Hrs	$ 55.00	$ 5,500
	Electric Operator - supply	4	Each	$ 8,000.00	$ 32,000
	Install Electrical Operator	4	Each	$ 2,000.00	$ 8,000
					$ 210,100
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>				**$ 1,555,900**
	CONTINGENCY >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 284,400**
	ENGINEERING DESIGN + CONSTRUCTION >>>>>>>>>>>				**$ 227,500**
	TOTAL>>>				**$ 2,067,800**

TABLE A-3
REPAIR ALTERNATIVE 3
DEMOLISH TOWER & REPLACE GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 23,200.00	$ 23,200
2.	Mobilization, Demobilization	1	L.S.	$ 108,500.00	$ 108,500
3.	Demolish Tower				
	Demolition - blasting	1	L.S.	$ 55,500.00	$ 55,500
	Demolition - saw cutting tower	1	L.S.	$ 16,700.00	$ 16,700
	Sheetpile Cofferdam	3600	S.F.	$ 13.50	$ 48,600
	Silt removal-Vacumn Truck	5	Days	$ 2,200.00	$ 11,000
	Crane	5	Days	$ 2,400.00	$ 12,000
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 157,300
4.	Tower Modifications				
	Concrete Slab	31	C.Y.	$ 1,300.00	$ 40,300
	Concrete Grade Beams - 18"x24"	35	C.Y.	$ 900.00	$ 31,500
	Crane	10	Days	$ 2,400.00	$ 24,000
	5' x 6' Slide Gate + Thimble	1	Each	$ 49,600.00	$ 49,600
	2.5' x 2.5' Slide Gate +Thimble	1	Each	$ 24,400.00	$ 24,400
	Galvanized Trashracks -supply	2200	L.B.	$ 7.00	$ 15,400
	Install Trashracks	24	Hrs	$ 56.00	$ 1,300
	Vent Pipe	320	L.F.	$ 11.00	$ 3,500
	Install Gates	72	Hrs	$ 56.00	$ 4,000
	Hydraulic Cylinder	1	L.S.	$ 71,000.00	$ 71,000
	HPU unit to Operate Gates + S.S. pipe	1	Each	$ 111,000.00	$ 111,000
	Install Cylinders + Piping	120	Hrs	$ 56.00	$ 6,700
	Precast Concrete Control House -10' x 12'	13	C.Y.	$ 900.00	$ 11,700
					$ 394,400
5.	Repair Outlet Conduit - Shotcrete				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Shotcrete Application (6")	275	C.Y.	$ 1,700.00	$ 467,500
	Reinforcing Steel	17	Tons	$ 1,900.00	$ 32,300
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 772,200
6.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>				**$ 1,528,000**
	CONTINGENCY >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 279,000**
	ENGINEERING DESIGN + CONSTRUCTION >>>>>>>>>>>				**$ 225,000**
	TOTAL>>>				**$ 2,032,000**

TABLE A-1A
REPAIR ALTERNATIVE 1
REPAIR TOWER, OUTLET & GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 14,700.00	$ 14,700
2.	Mobilization, Demobilization	1	L.S.	$ 68,500.00	$ 68,500
3.	Repair Tower - epoxy coating				
	Scaffolding	1	L.S.	$ 72,200.00	$ 72,200
	Sandblasting	6000	S.F.	$ 11.00	$ 66,000
	Epoxy Coating/supply & place	6000	S.F.	$ 22.00	$ 132,000
	Portable Winch/Crane	21	Days	$ 1,200.00	$ 25,200
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 308,900
4.	Repair Outlet Conduit - epoxy coating				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Epoxy Coating/supply & place	14725	S.F.	$ 22.00	$ 324,000
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 596,400
5.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>				**$ 1,060,900**
	CONTINGENCY >>>>> >>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 195,600**
	ENGINEERING DESIGN+CONSTRUCTION >>>>> >>>>>>				**$ 176,000**
	TOTAL >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 1,432,500**

TABLE A-2A
REPAIR ALTERNATIVE 2
REAPIR TOWER & OUTLET & REPLACE GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 17,900.00	$ 17,900
2.	Mobilization, Demobilization	1	L.S.	$ 83,200.00	$ 83,200
3.	Repair Tower - epoxy coating				
	Scaffolding	1	L.S.	$ 72,200.00	$ 72,200
	Sandblasting	6000	S.F.	$ 11.00	$ 66,000
	Epoxy Coating/supply & place	6000	S.F.	$ 22.00	$ 132,000
	Portable Winch/Crane	21	Days	$ 1,200.00	$ 25,200
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 308,900
4.	Repair Outlet Conduit - epoxy coating				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Epoxy Coating/supply & place	14725	S.F.	$ 22.00	$ 324,000
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 596,400
5.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
6.	Replace Tower Gates				
	Demolition Existing Gates	100	Hrs	$ 55.00	$ 5,500
	Grout Exisitng Gate Openings	30	C.F.	$ 84.00	$ 2,500
	Thimble - supply	4	Each	$ 4,600.00	$ 18,400
	Grout New Thimbles Inplace	240	C.F.	$ 55.00	$ 13,200
	Rebar/epoxy coated - supply	1300	L.B.	$ 0.75	$ 1,000
	Rebar - drill, place, epoxy grout	40	Hrs	$ 55.00	$ 2,200
	3' x 3' Slide Gate - supply	4	Each	$ 22,000.00	$ 88,000
	3" Stainless Steel Stem - supply	440	L.F.	$ 31.00	$ 13,600
	Install Gates, Stem & Supports	100	Hrs	$ 55.00	$ 5,500
	Galvanized Trashrack -supply	2450	L.B.	$ 6.00	$ 14,700
	Install Trashracks	100	Hrs	$ 55.00	$ 5,500
	Electric Operator - supply	4	Each	$ 8,000.00	$ 32,000
	Install Electrical Operator	4	Each	$ 2,000.00	$ 8,000
					$ 210,100
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>>				**$ 1,288,900**
	CONTINGENCY >>>>> >>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 237,600**
	ENGINEERING DESIGN+CONSTRUCTION >>>>> >>>>>>				**$ 213,900**
	TOTAL >>>				**$ 1,740,400**

TABLE A-3A
REPAIR ALTERNATIVE 3
DEMOLISH TOWER & REPLACE GATES
Sanchez Reservoir Outlet

TASK	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 18,400.00	$ 18,400
2.	Mobilization, Demobilization	1	L.S.	$ 85,500.00	$ 85,500
3.	Demolish Tower				
	Demolition - blasting	1	L.S.	$ 55,500.00	$ 55,500
	Demolition - saw cutting tower	1	L.S.	$ 16,700.00	$ 16,700
	Sheetpile Cofferdam	3600	S.F.	$ 13.50	$ 48,600
	Silt removal-Vacumn Truck	5	Days	$ 2,200.00	$ 11,000
	Crane	5	Days	$ 2,400.00	$ 12,000
	Dam Face Construction Access Road	1500	C.Y.	$ 9.00	$ 13,500
					$ 157,300
4.	Tower Modifications				
	Concrete Slab	31	C.Y.	$ 1,300.00	$ 40,300
	Concrete Grade Beams - 18"x24"	35	C.Y.	$ 900.00	$ 31,500
	Crane	10	Days	$ 2,400.00	$ 24,000
	5' x 6' Slide Gate + Thimble	1	Each	$ 49,600.00	$ 49,600
	2.5' x 2.5' Slide Gate +Thimble	1	Each	$ 24,400.00	$ 24,400
	Galvanized Trashracks -supply	2200	L.B.	$ 7.00	$ 15,400
	Install Trashracks	24	Hrs	$ 56.00	$ 1,300
	Vent Pipe	320	L.F.	$ 11.00	$ 3,500
	Install Gates	72	Hrs	$ 56.00	$ 4,000
	Hydraulic Cylinder	1	L.S.	$ 71,000.00	$ 71,000
	HPU unit to Operate Gates + S.S. pipe	1	Each	$ 111,000.00	$ 111,000
	Install Cylinders + Piping	120	Hrs	$ 56.00	$ 6,700
	Precast Concrete Control House -10' x 12'	13	C.Y.	$ 900.00	$ 11,700
					$ 394,400
5.	Repair Outlet Conduit - epoxy coating				
	Chipping/Patching/Sealing Joints	360	Hrs	$ 55.00	$ 19,800
	Patching Materials - grout/rebar/epoxy	1	L.S.	$ 5,600.00	$ 5,600
	Sandblast	14725	S.F	$ 11.00	$ 162,000
	Epoxy Coating/supply & place	14725	S.F.	$ 22.00	$ 324,000
	6" Floor Slab + rebar	85	C.Y.	$ 1,000.00	$ 85,000
					$ 596,400
6.	Outlet Structure Rehabilitation				
	Demolition- Right Side Only	16	Hrs	$ 300.00	$ 4,800
	Saw cutting	1	L.S.	$ 2,800.00	$ 2,800
	Concrete - right side walls and floor slab	50	C.Y.	$ 900.00	$ 45,000
	Sand Backfill	315	C.Y.	$ 20.00	$ 6,300
	Earth Backfill	100	C.Y.	$ 10.00	$ 1,000
	Slotted Drain Pipe	75	L.F.	$ 20.00	$ 1,500
	Excavation - Rock	220	C.Y.	$ 30.00	$ 6,600
	Excavation - Earth	100	C.Y.	$ 20.00	$ 2,000
	Riprap - excavated rock - place only	120	Tons	$ 20.00	$ 2,400
					$ 72,400
	TOTAL CONSTRUCTION COST >>>>>>>>>>>>>>>>>>>>				**$ 1,324,400**
	CONTINGENCY >>>>> >>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 244,100**
	ENGINEERING DESIGN+CONSTRUCTION >>>>> >>>>>>				**$ 219,700**
	TOTAL >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>				**$ 1,788,200**

TABLE A-4A
ADDITIONAL ALTERNATIVES
BRIDGE ACCESS TO TOWER
Sanchez Reservoir Outlet

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 5,300.00	$ 5,300
2.	Mobilization, Demobilization	1	L.S.	$ 24,600.00	$ 24,600
3.	Bridge Installation				
	100' x 10' Spans - ConTech Prefab Bridge	3	Each	$ 85,000.00	$ 255,000
	Spread Footing @ Dam Crest	3	C.Y.	$ 1,000.00	$ 3,000
	4 - 5' Diameter x 20' Pier Foundations	80	L.F.	$ 150.00	$ 12,000
	Bridge Pier Columns- 2x3'x35', 2x4'x60'	75	C.Y.	$ 850.00	$ 63,750
	Set Bridge Spans	96	Hrs	$ 50.00	$ 4,800
	Crane	6	Days	$ 2,000.00	$ 12,000
					$ 350,550
		TOTAL CONSTRUCTION COST > >>>>			**$ 380,450**
		CONTINGENCY @ 10% >>>>>>>>>>>>			**$ 35,000**
		ENGINEERING >>>>>>>>>>>>>>>>>>			**$ 21,000**
		TOTAL>>>>>>>>>>>>>>>>>>>>>>>>>			**$ 436,450**

TABLE A-4B
ADDITIONAL ALTERNATIVES
EXTERIOR LADDER ACCESS TO TOWER
Sanchez Reservoir Outlet

ITEM	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	SUBTOTALS
1.	Insurance, Bonds	1	L.S.	$ 700.00	$ 700
2.	Mobilization, Demobilization	1	L.S.	$ 3,400.00	$ 3,400
3.	Ladder Installation				
	SAFE-T-CLIMB Device	100	L.F.	$ 40.00	$ 4,000
	Ladder	100	L.F.	$ 112.00	$ 11,200
	Intermediate Platforms	3	Each	$ 2,500.00	$ 7,500
	Ladder with safety cage @ Gate House	15	L.F.	$ 200.00	$ 3,000
	Installation	150	Hrs	$ 50.00	$ 7,500
					$ 33,200
		TOTAL CONSTRUCTION COST > >>>>			**$ 37,300**
		CONTINGENCY @ 10% >>>>>>>>>>>>			**$ 3,400**
		ENGINEERING >>>>>>>>>>>>>>>>>>			**$ 6,000**
		TOTAL>>>>>>>>>>>>>>>>>>>>>>>>>			**$ 46,700**

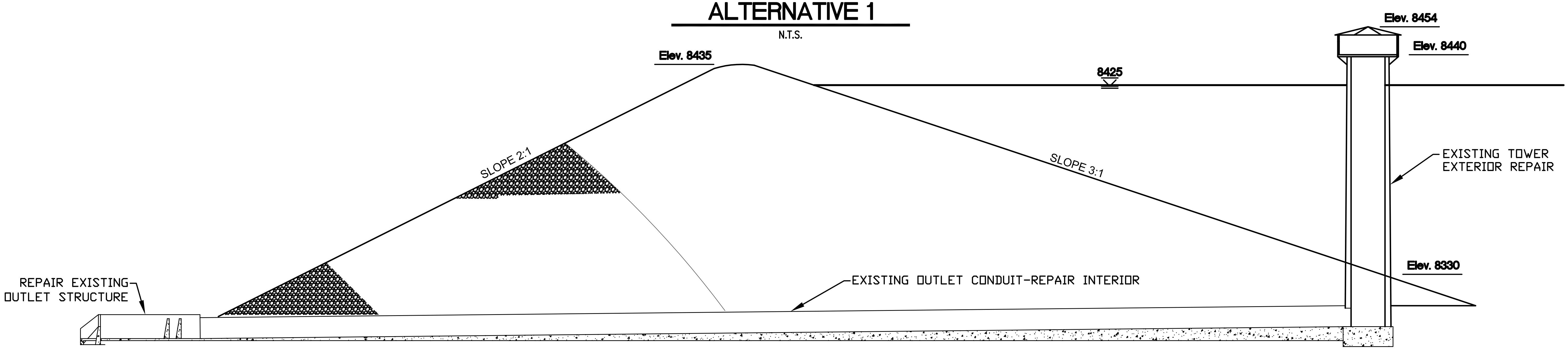
APPENDIX B

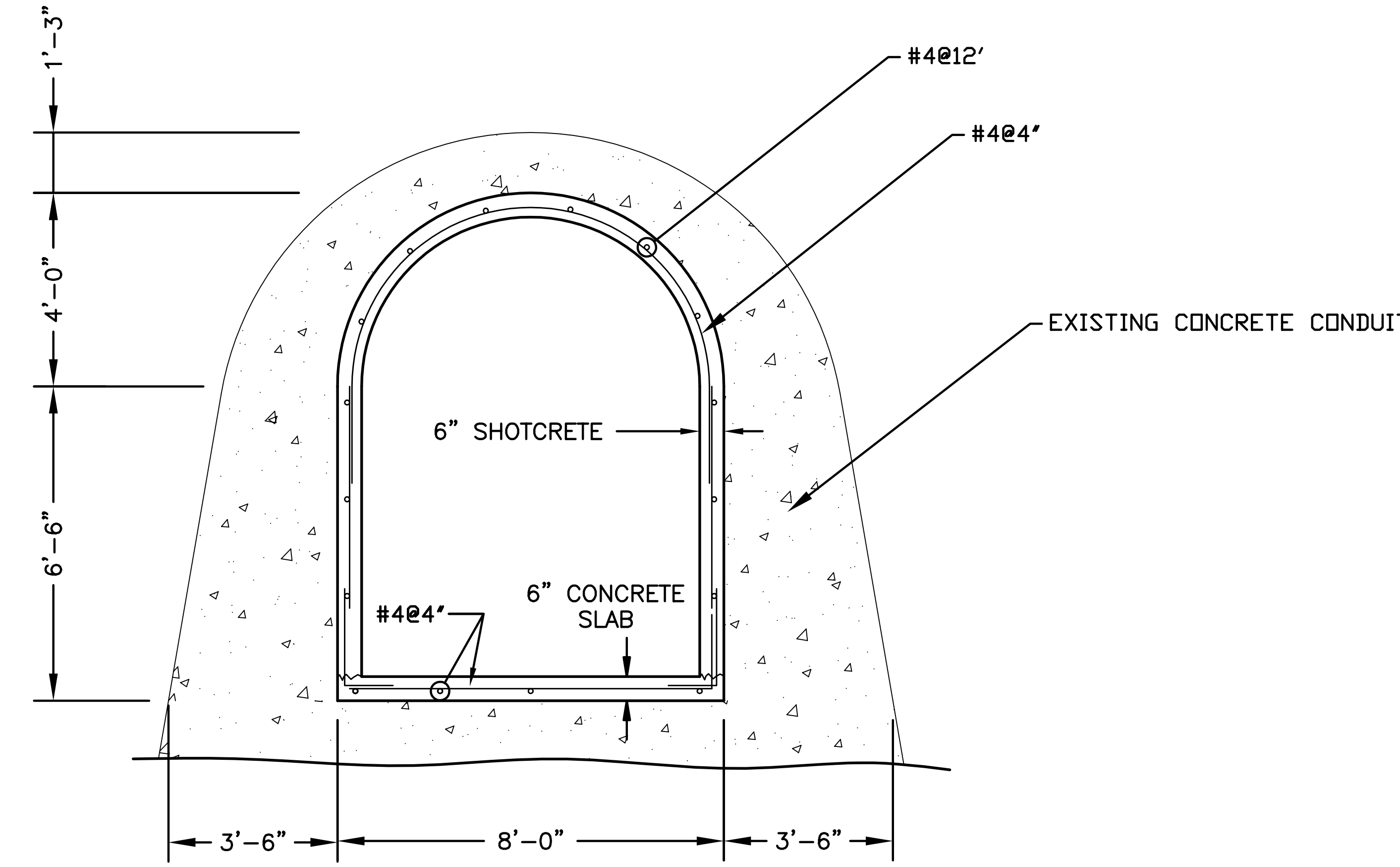
Figures of Alternatives

Figures 1 - 4

ALTERNATIVE 1

N.T.S.





REVISIONS	BY			
		DRAWN MAE	DESIGNED	DATE MARCH 2012
			CHECKED	
		SCALE AS NOTED	APPROVED	PROJ. NO. 11.028

Smith Geotechnical ENGINEERING CONSULTANTS

Smith Geotechnical/Engineering Consultants
1225 Red Cedar Circle
Fort Collins, Colorado 80524
(970) 490-2620

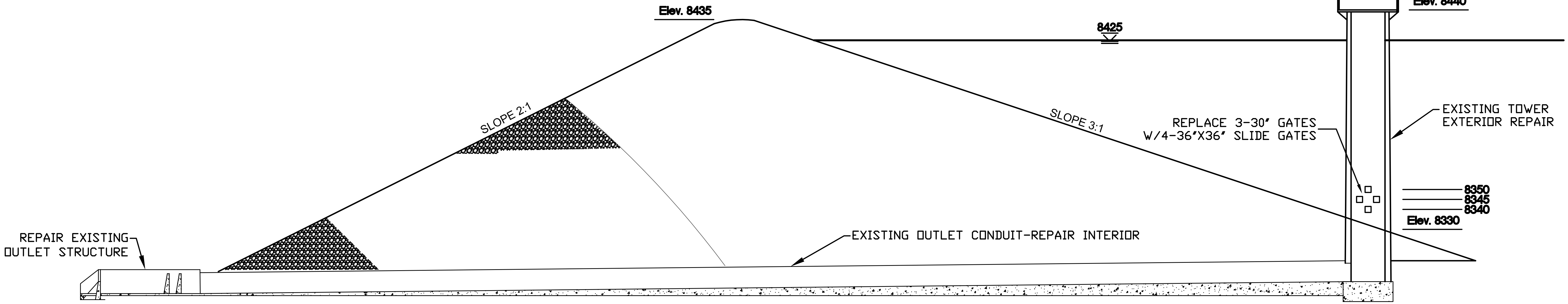
Sanchez Reservoir

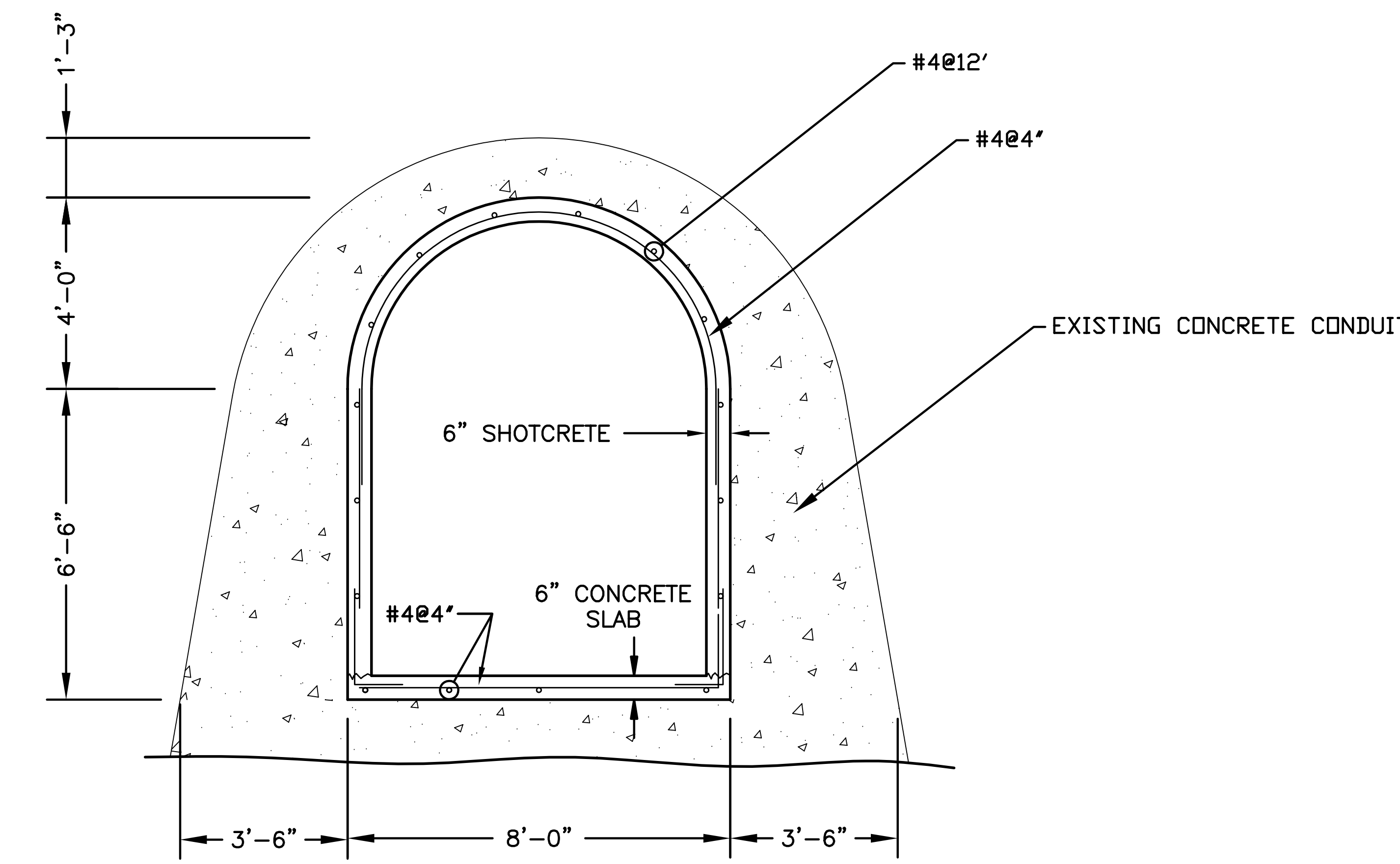
ALTERNATIVE 1
OUTLET SECTION

FIGURE 1

ALTERNATIVE 2

N.T.S.





REVISIONS	BY

DRAWN MAE DESIGNED CHECKED APPROVED DATE MARCH 2012
SCALE AS NOTED PROJ. NO. 11.028

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1225 Red Cedar Circle
Fort Collins, Colorado 80524
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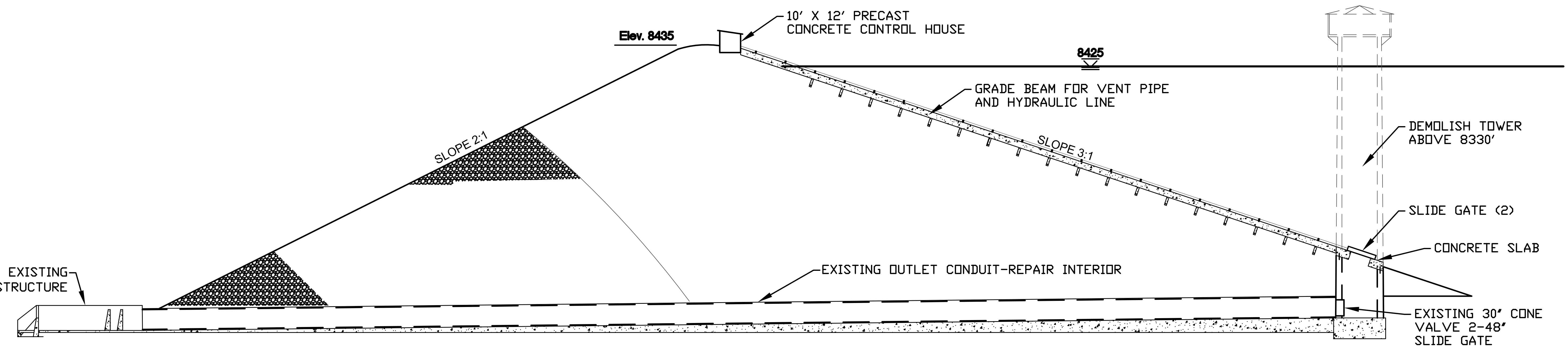
Sanchez Reservoir

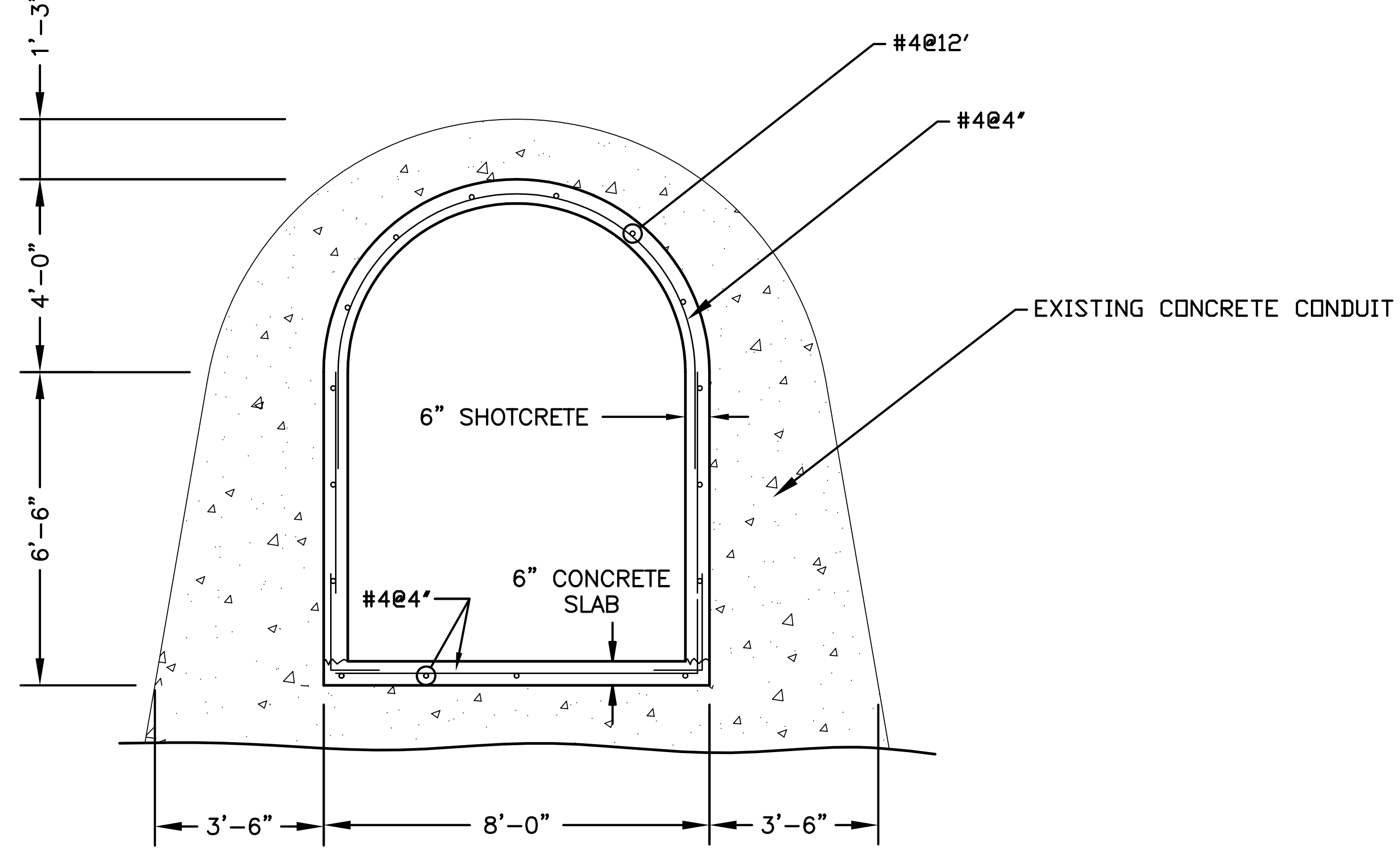
ALTERNATIVE 2
OUTLET SECTION

FIGURE 2

ALTERNATIVE 3

N.T.S.

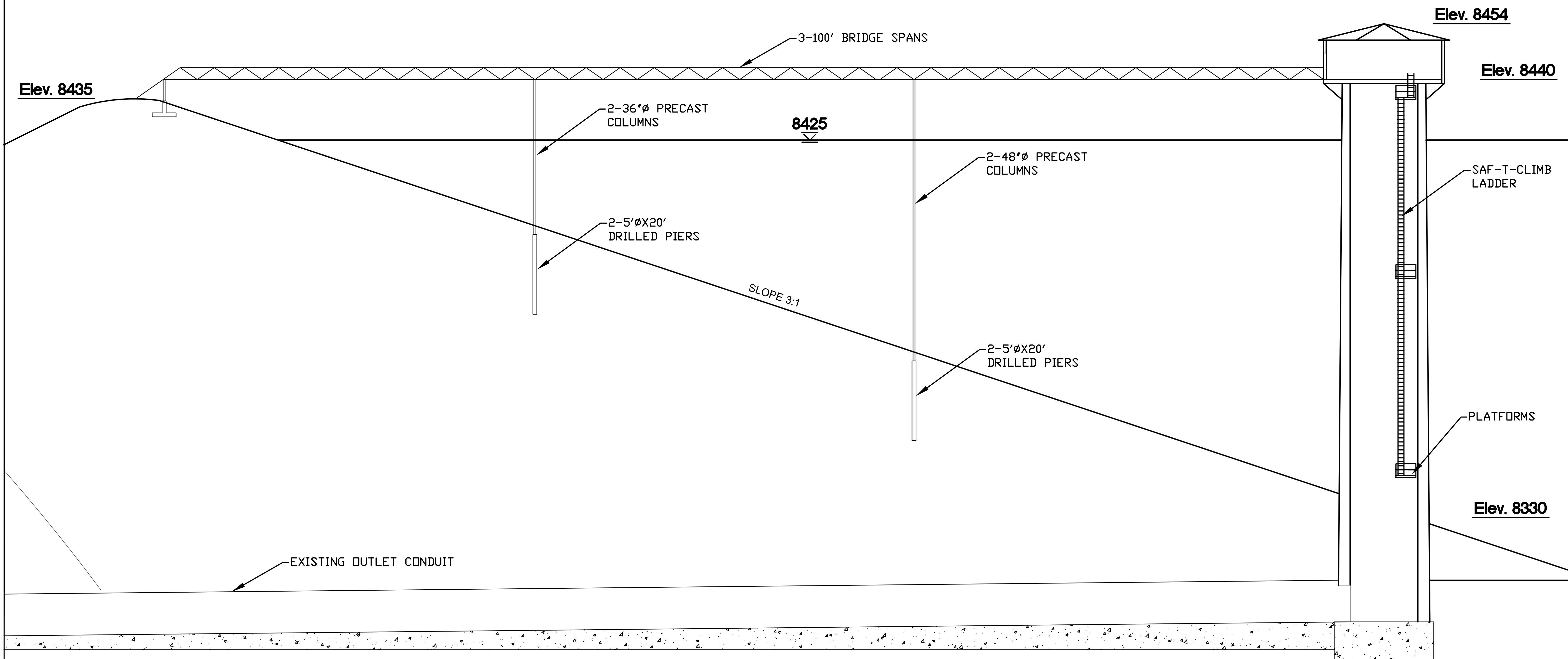




REVISIONS	BY	DRAWN MAE	DESIGNED	DATE MARCH 2012	Smith Geotechnical ENGINEERING CONSULTANTS	Smith Geotechnical/Engineering Consultants 1225 Red Cedar Circle Fort Collins, Colorado 80524 (970) 490-2620	Sanchez Reservoir	ALTERNATIVE 3 OUTLET SECTION	FIGURE 3
		SCALE AS NOTED	CHECKED / APPROVED	PROJ. NO. 11.028					

BRIDGE AND LADDER OPTION

N.T.S.



REVISIONS	BY			
		DRAWN MAE	DESIGNED	DATE MARCH 2012
			CHECKED	
		SCALE AS NOTED	APPROVED	PROJ. NO. 11.028

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Sanchez Reservoir

ACCESS OPTIONS

FIGURE 4