# SANCHEZ RESERVOIR REHABILITATION

Phase I Assessment & Upgrade
Rio Grande Basin Roundtable

FINAL REPORT

We are pleased to report that the Substantial Completion Date of the Phase I Assessment & Upgrade was June 30, 2012. All tasks were completed on time and within budget and Sanchez Ditch and Reservoir Company (SDRC) has been reimbursed for expenses in accordance with CWCB contract number PDA 12IBC000013.

SDRC greatly appreciates the excellent support provided by CWCB and its staff as we administered this project. This Final Report summarizes how the various tasks were performed and assesses the degree to which each Deliverable was accomplished.

**Objectives of this Phase I project** were to: Ensure the continued safety of SDRC employees; create safe and efficient access to allareas of the Gate Tower; determine the viability of the current tramway-and-tower configuration andidentify the best configuration for next 50-75 years of operation; automate essential reservoir operations for remote control; establishsystems for capturing, managing, reporting, and tracking accurate reservoir data; reduce cost ofoperation and maintenance; and preserve the benefits of flood control, irrigation, recreation, wildlife andfishery.

We feel we have met all of these objectives.

**Task 1 – Evaluate/Upgrade Gondola and Tramway**

After researching other potential contractors we chose to work with Tramway Engineering, Ltd., of Glenwood Springs, Colorado. This small consulting firm has specialized in aerial cableways for over 25 years, providing aerial ropeway engineering services to all of the ski resorts in Colorado. Their principal, Charles R. Peterson (Chuck), served as a contract inspector for the Colorado Passenger Tramway Safety Board and he is a member of the committee that writes the American National Standards for Aerial Ropeways. We felt he was the right person to provide inspection services for the Gondola and Cableway system which at this time is the only means of regular access to the Gate Tower.

In March 2011 we received a letter from Mr. Peterson and we accepted his proposal. On April 6 SDRC President, Jerry Lorenz, and Manager Travis Robinson, met with Chuck. Mike Gibson, Chairman of the Rio Grande Basin Roundtable and Nicole Langley our Administrative Project Coordinator, joined us. We discussed the history, operations, maintenance, and upgrade options for the 100-year-old cableway, and Chuck began Tramway Engineering's analysis.

Mike Gibson accompanied SDRC management to the Gate Tower for the inspection of the cableway, carrier, cables and drive systems for the cableway and the gondola. Mike's questions and observations (Mike is also an engineer) were helpful, and discussions with Chuck confirmed the general opinion that despite some potential hazards, the fact remains that this system is still continuing to serve, after all these years, without ever once having had a safety incident. Continued long term dependence on the gondola-tramway system, however, presents some human risks for which SDRC could encounter significant liability.

In his April 22 report, Mr. Peterson summarized his findings and recommendations. His analysis identified observed safety, operational and maintenance issues that needed to be addressed. That report, in its entirety, is included in Appendix A.

This analysis was instrumental in advising the future decisions of SDRC with respect to the current, short term, and future functionality of the gondola and tramway system. Its recommendations also informed SDRC on the immediate upgrades needed to improve safe access to the Gate Tower for repairs, upgrades, and continued operation of Sanchez Reservoir.

**Task I matching component – safety upgrades:** SDRC implemented the recommended safety upgrades to the gondola and tramway system. Using local labor, Travis Robinson designed and helped fabricatea guard system, replaced the wooden deck, removed some old hardware and replaced the bearings, and installed the guard system and a new and more efficient braking system. Direct costs and labor for the Tramway Engineering study and for implementing the safety upgrades came to a total of approximately $26,000 – in matching funds -- just under the amount anticipated in the Project Budget.

**Task I Deliverable –** Tramway Engineering, Ltd. reviewed the upgrades and determined that the gondola-tramway system hasnow been brought into compliance with generally accepted standards of operation typically required of industrial/corporate people-moving systems in Colorado. The useful life of this system has been extended for another ten years or so, allowing safe transport to the Gate Tower while other long-term strategies for the Sanchez system are developed.

The favored long-term alternative selected by SDRC was to abandon the use of the gondola-cableway system as soon as practically possible. Although it has historically provided reliable access to the Gate Tower, it is poorly designed and poses a safety hazard to the operator and the tower. No portion of the existing cableway is salvageable. Installing a new cableway would require the replacement of the ropes, carrier, tower support saddle and anchorage.

In addition, the new cableway would have to include a new unloading platform on the tower to allow for safe access from the cableway to the tower top.

Four options for access to the Gate Tower were considered: (1) Build a bridge to the tower from the dam as shown on the original drawings; (2) Continue to use an aerial cableway; (3) Build a ladder or stairway to the tower top and then use a boat to ferry theoperator from the shore to the tower base; and (4) Relocate the valves to a more accessible location.

Tramway Engineering estimated the potential cost of replacing the current system with a new gondola system, and this option was discarded as not cost effective or practical.

**Conclusion --** For the long term, remote operation of the valves will not only provide for more efficient management of the reservoir waters, it will greatly reduce the need to use the gondola-tramway system, and therefore is the preferred option.

Working with Tramway Engineering, Ltd. was a pleasure. Chuck was thorough, quick to deliver his report, and his fee was very reasonable. His analysis played a major role in the ultimate decision for finding the best long-term solution to the Gate Tower and cableway system.

**TASK 2 – Cylinder Repair and Replacement – (Matching funds)**

This task, funded with matching funds by SDRC, was completed earlier than the other tasks by Prime Field Service LLC (Prime).

Prime removed a corroded cylinder in one of the 30" gates in the lower part of the Gate Tower and took it back to their plant in Salt Lake City to be refurbished. They re-fabricated a part, repaired and re-chromed the cylinder, re-chromed the plunger packing area, replaced the existing rubber, and repainted the exterior with epoxy paint.

**Task 2 Funding --** The cylinder was replaced in the Gate Tower by a subcontractor of Prime's, R.H. Construction. There were no incidents or delays of note, and this task was completed in a safe and timely way for under $6,100 in matching funds, as anticipated in the Project Budget.

**Task 2 Deliverable –** Restored the full function of the hydraulic cylinder and gate and improved the ability of SDRC to meet irrigation needs at high levels of reservoir storage. This will improve the ability of SDRC to more efficiently store and release water for irrigation, improve flood control capabilities, maintain dam safety requirements, and reduce maintenance expense.

**Task 3 – Replace and Automate Hydraulics, Establish Security**

**Task 3.1 – Hydraulic Operators**

SDRC chose Prime Machine, Inc. (Prime) to replace the hydraulic system because they have worked at the Reservoir before and are familiar with the requirements. Also they came highly recommended by Nathan Coombs, Manager of the Conejos Water Conservancy District, for their excellent work at Platoro Reservoir.

All phases of this task required good coordination and collaboration between two companies -- Prime, located in Salt Lake City, and Colorado Digital Labs (CDL), located just 14 miles away in Fort Garland. Initially Prime provided a hydraulic unit which was not compatible with CDL specs for solar-powered automation, and the unit had to be exchanged. This was resolved, causing a little delay but no other problems.

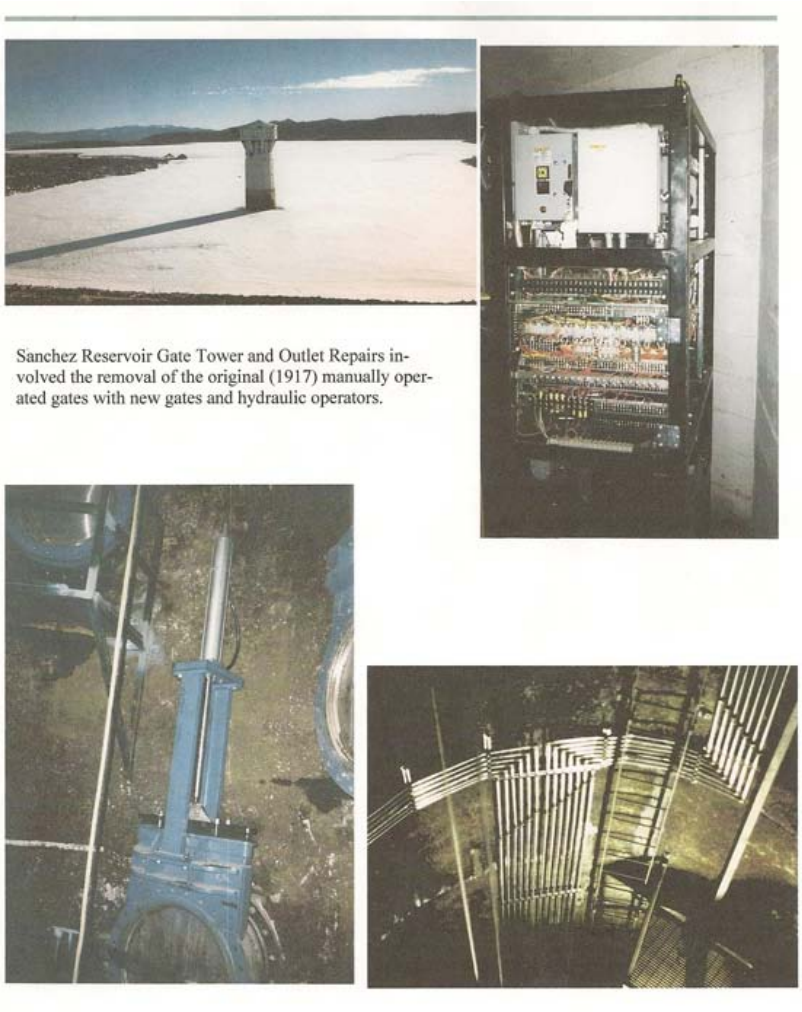
Prime Machine benchmarks for this Task 3.1 were met, as follows:

a) Mobilized at the Prime Machine shop and at Sanchez Reservoir. Installed a new 90-foot ladder and used safety harnesses to facilitate installation.

b) Removed the old hydraulic system; coordinated with Colorado Digital Labs to ensure the new system meets requirements for electronic automation and remote control; engineered the new hydraulic system; and produced schematics.

c) Installed the new hydraulic system with motor and RAMs. Collaborated with Colorado Digital Labs to provide on-site training on the operation of the new hydraulic system. Coordinated with Colorado Digital Labs to create an onsite users' manual for the new hydraulic system.

d) Demobilized.



Sanchez Reservoir Gate Tower and Outlet Repairs involved the removal of the original (1917) manually operated gates with new gates and hydraulic operators.

**Task 3.2 – Solar System and SCADA**

CDL's first task was to install solar power at the Reservoir to operate the Sanchez system and then to design and install automated and remote control systems for the new hydraulic activation system.

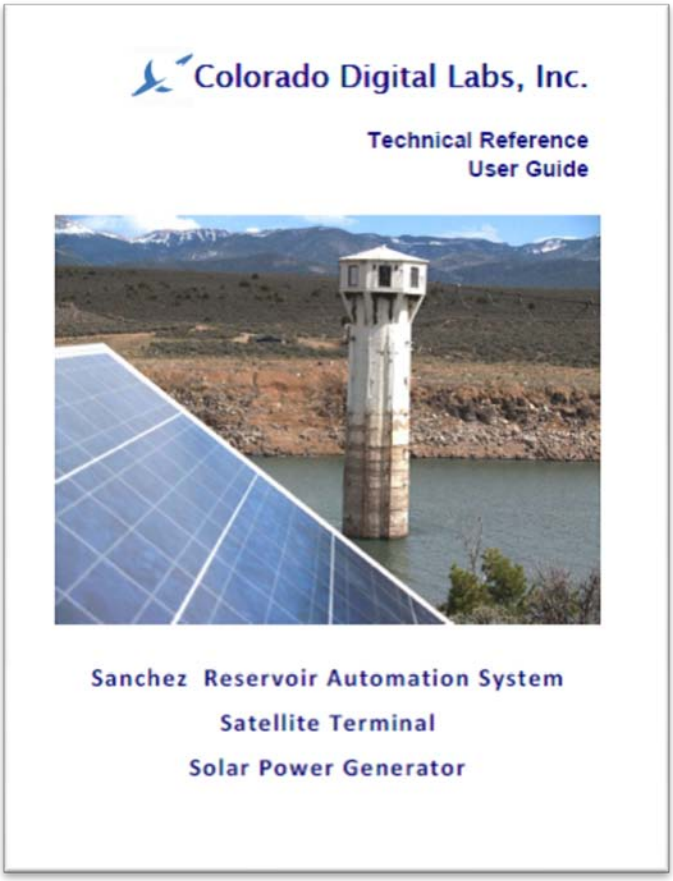

**The Task 3.2 objective,** by automating the new hydraulic system,was to enable remote electronic observation and operation of the reservoir from the SDRC office in San Acacio, about ten miles away.

In several meetings, Manager Travis Robinson met with Steve Navratil of CDL to discuss the project, prior to design work. Once final design was complete, the emphasis of this task was to determine the hardware and develop the components and software for the system.

The involvement of a third company, AMCI, had been anticipated as a provider of some parts of the telemetry/automation system, but the extent of their involvement was not known until the project got underway. Integrating those systems into the Prime/CDL system became quite a challenge, and some of the "off the shelf" expectations had to be abandoned, with massive amounts of programming and coordination between CDL and AMCI required. The end result was a SCADA system which met SDRC's objectives, providing a simple and user-friendly hardware/ software interface to Prime's new hydraulic system.

After installation, CDL conducted several training sessions with SDRC management and provided a user's manual with full specifications and documentation on all components of the system.

This task was completed in time and at the anticipated budget of $26,900.



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**Contents**

**Task 3.2 Deliverable –** The completion of Tasks 3.1 and 3.2 released SDRC from one hundred years of dependence on the gondola and tramway system to access the Gate Tower for daily operation of Sanchez Reservoir. In addition, the automated system provides accurate measurement and control of releases, greatly improving the efficiency of SDRC's water management.

Although there had never been an accident or a safety issue at the reservoir, the ability to manage daily operations from the office or from a cell phone greatly reduces the company's exposure to risk and provides much needed assurances with respect to human safety.

**Task 3.3 Vandal Proofing**

Because of the remote location of the project, SDRC has taken measures to increase security and to protect these new installations.Prime Machine and CDL both installed vandal-proof protections on their systems and CDL has limited access to the solar system controls by installing them in a metal industrial container box. Motion-sensitive lighting and camera systems in critical locations also augment security. Custom built steel enclosures protect critical equipment and the placement of important systems is such that they are not accessible. SDRC's upgrades of the gondola included the installation of locks to prevent tampering.

The SCADA system is heavily protected by preventing or limiting access and by security codes that make it impossible for any unauthorized person to gain access to the system.

The total budget of $5,000 was spent on these various measures.

**Deliverable –** Equipment, installations, hardware and software have been secured against human tampering, theft, or vandalism.


## Task 4 – Feasibility of Configuration

Smith Geotechnical Engineering, Inc. conducted a*Feasibility Study for Outlet Rehabilitation*in order to evaluate the current configuration of Gate Tower and Gondola in terms of current, continued, and long term operational viability. The objective of this feasibility study was to determine the best means of upgrading the existing reservoir operating system, or, if the current system was deemed to be not viable, presenting other alternatives. Smith Geotechnical's study presented four alternatives, including the "do nothing" alternative, which was discarded. By analyzing all elements of the current architecture, SDRC was provided adequate criteria to determine whether keeping this configuration was advisable.

**Objective –**The Feasibility Study was conducted in order for SDRC to identify the best available alternative, the one which would best assure ease of access to and efficient operation of Sanchez Reservoir for the next 50-70 years.

Smith Geotechnical Engineering, Inc. was selected for this study because they have worked on the reservoir for many years, and they are familiar with its layout and condition. Duane Smith, principal of the company, has established a solid record of reliable and knowledgeable service to SDRC, and his analysis proved once again the very high standards and integrity which SDRC has come to rely on from Smith Geotechnical.

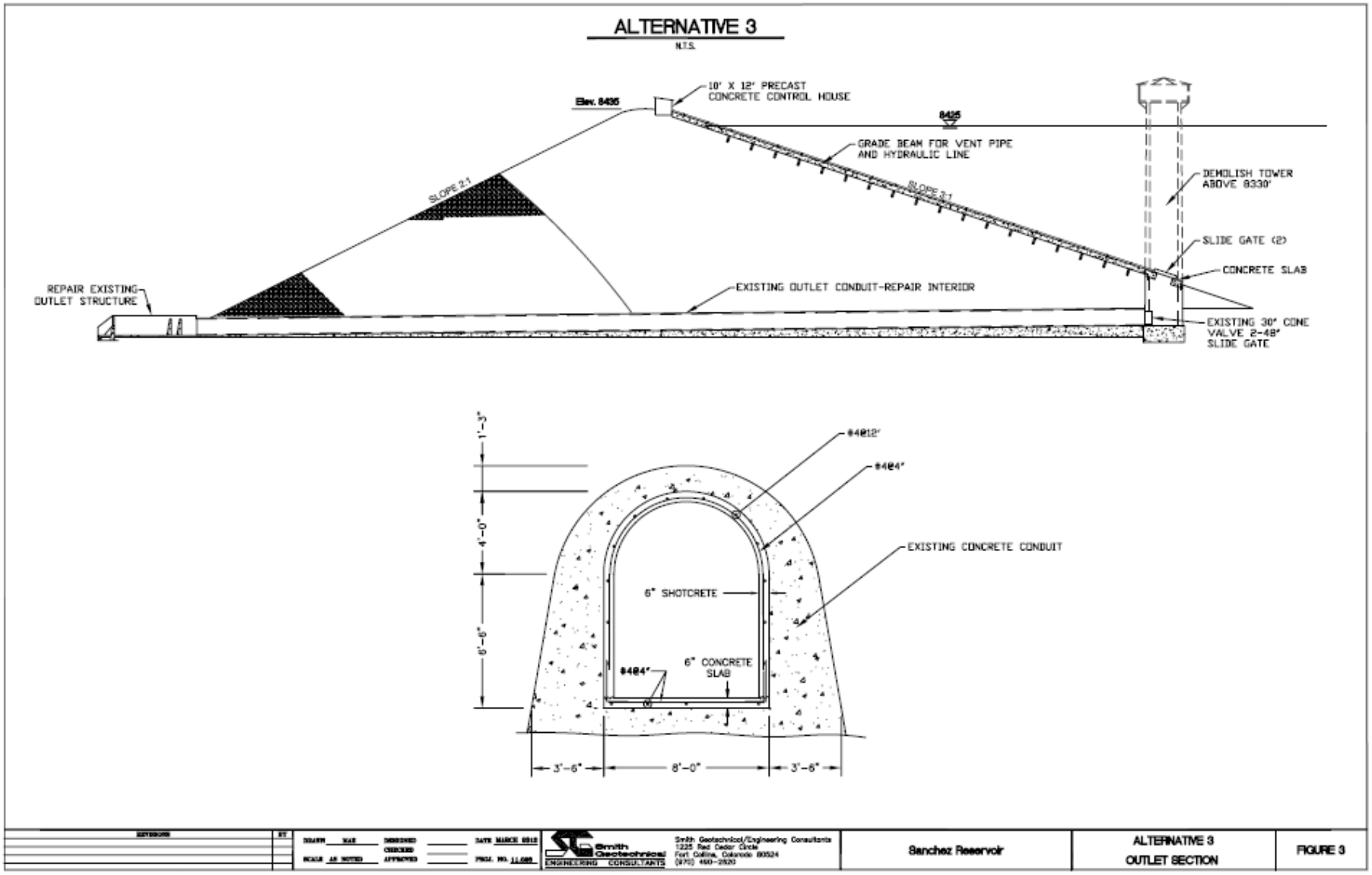
Smith Geotechnical conducted a thorough inspection of the Tower, taking core samples and assessing the structural integrity of the tower, the outlet conduit, and all operational aspects of the current configuration; They developed repair/replace alternatives with cost analysis for each option; They produced an economic analysis and produced the final Feasibility Study. All of this was done at the very low cost of $13,500, per the proposal budget.

The three alternatives were (1) Coat the tower with shotcrete or epoxy; repair and coat the outlet conduit, and modify and automate the gates; (2) Upgrade the tower and eliminate all of the double gates and replace the slide gates; and (3) Demolish the tower and repair and upgrade the outlet conduit, replacing the current gates with hydraulically controlled cone valve.

The Smith Geotechnical's financial analysis concluded by proposing a 45%-55% split between CWCB's WSRA grant program and its Water Project Loan program. Duane facilitated negotiations with Kirk Russell and with Anna Mauss, on the loan side; and Nicole Langley, administrative coordinator of the project, on the grant side. Nicole coordinated a joint working session with advisory members of the Rio Grande Basin Roundtable, Chairman Mike Gibson, Duane, Kirk, Anna, and SDRC management to discuss the alternatives and the proposed financing plan, and the grant and loan strategy.

**Deliverable -** These discussions and the Phase I Feasibility Study led to Management's decision in favor of Alternative #3, to demolish the Gate Tower, and to SDRC's next proposal, *Phase II Outlet Rehabilitation and Gate Tower Replacement.*

On May 22, 2012, the Board of Directors and Stockholders of SDRC held a special meeting to consider the findings of the Feasibility Study, to look at the three alternatives, and to consider management's recommendation to accept Alternative #3. They also reviewed the proposed grant/loan financing strategy. At that meeting the Board and members of SDRC voted to demolish the Gate Tower. They also approved the funding strategy and voted to proceed for Phase II grant funding from CWCB.


ALTERNATIVE 3
N.T.S.
10' X 12' PRECAST CONCRETE CONTROL HOUSE
Elev. 8435
8435
GRADE BEAM FOR VENT PIPE AND HYDRAULIC LINE
SLOPE 2:1
SLOPE 3:1
DEMOLISH TOWER ABOVE 8330'
SLIDE GATE (2)
CONCRETE SLAB
REPAIR EXISTING OUTLET STRUCTURE
EXISTING OUTLET CONDUIT-REPAIR INTERIOR
EXISTING 30" CONE VALVE 2-48" SLIDE GATE
1'-3"
4'-0"
6'-6"
#4@12"
#4@4"
EXISTING CONCRETE CONDUIT
6" SHOTCRETE
#4@4"
6" CONCRETE SLAB
3'-6"
8'-0"
3'-6"
Smith Geotechnical
ENGINEERING CONSULTANTS
Smith Geotechnical/Engineering Consultants
1225 Red Cedar Circle
Fort Collins, Colorado 80524
(970) 493-2620
Sanchez Reservoir
ALTERNATIVE 3
OUTLET SECTION
FIGURE 3

**Task 4 – SDRC Administration and Final Report**

SDRC's security and safety policies do not allow any person to go to the Gate Tower unattended. This means that for every trip which any contractor or supplier needed to make to the Gate Tower, Manager Travis Robinson had to take them there, wait for them to finish, and bring them back. This required many hours of overtime.

In addition, SDRC hired Nicole V. Langley of Transforma Research & Design to coordinate the administrative elements of this project, handling a good bit of communication, all correspondence, tracking of billing and invoices, and grant administration and reporting.

As budgeted for this project, the total for this task came to $9,600, which was paid out of grant funds. This final report is submitted to satisfy CWCB's final reporting requirement. Nicole remains available for any follow-up which may be required.

This project was completed within the timeline anticipated, and there are no issues or problems remaining.

SDRC again expresses its great appreciation to the Rio Grande Basin Roundtable and to CWCB for their collaboration and administrative support to the continuing upgrade of Sanchez Reservoir.

The Sanchez Ditch and Reservoir Company

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