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ROLLING HILLS MASTER PLAN
LEVEL I STUDY – EXECUTIVE SUMMARY
JANUARY 2012

PREPARED FOR:
WYOMING WATER DEVELOPMENT COMMISSION

PREPARED BY:
CIVIL ENGINEERING PROFESSIONALS, INC.

IN CONJUNCTION WITH:

WESTON
GROUNDWATER ENGINEERING

WLC
ENGINEERING • SURVEYING • PLANNING

CBI

INTEGRATED TECHNOLOGIES, LLC
AUTOMATION FOR BUSINESS AND INDUSTRY

KILLMER & ASSOCIATES, PC

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WYOMING

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WYOMING
Background
The original public water system for the Town of Rolling Hills was constructed by the developer of the subdivision approximately 30 years ago. The original system consisted of Well No.1 and the adjacent water storage tank. As the development grew, Well No. 2 was added and a booster pump station to improve pressures to the higher elevations served by the water system. Rolling Hills was incorporated as a Town in the State of Wyoming in 1984. The Wyoming Water Development Commission (WWDC) funded the siting, drilling and development of Well No.’s 4, 5, and 6 and the drilling and redevelopment of Well No. 2 for the Town of Rolling Hills. The system currently consists of: four wells providing potable water (Well No.’s 2, 4, 5, and 6); Well No. 1 is used for wholesale water sales; two welded steel water storage tanks; and two booster stations to provide water to the residents of Rollins Hills.

The Town of Rolling Hills applied to the WWDC for funding to complete a Level I Water System Master Plan in 2009. The project was approved and funded by the Legislature in April 2010 and Civil Engineering Professionals, Inc. (CEPI) was retained by the WWDC in June 2010 to complete the water system Master Plan. The scope of services for the master plan included water system growth projections, completion of accurate aerial mapping, development of a comprehensive Geographic Information System (GIS) database for the water system, hydraulic modeling and system analysis, and recommendations for needed improvements to meet current and projected development in the Town of Rolling Hills. The Master Plan was needed to address the successful long term operation of the water system, and to complete the hydraulic modeling and GIS data base for the system.

Service Area Description and Growth Area
The Town of Rolling Hills currently provides water to the customers located inside the corporate boundaries and several residential and commercial properties adjacent to the corporate limits. There are some undeveloped parcels west and south of the existing town development which could be served by the Rolling Hills water system. The largest area of growth for the water system is the existing developed residences along Monkey Road. These homes currently have individual water wells. Over the past 20 years, the Town of Rolling Hills’ population has increased at an average rate of approximately 1.5-percent per year. However, this trend dramatically changed over the last ten years. The 2000 US Census population for the Town of Rolling Hills was 449 people; the 2010 Census estimates for the Town of Rolling Hills is 440 people, a decrease of nine people. The growth assumed for the study and the evaluation of the water system was that all of the undeveloped and developed properties within the service area boundary which are currently not served by the water system would be developed and provided potable water service from the water system. This resulted in a growth rate of approximately 2.75-percent per year over the twenty year planning horizon. This level of development may not be realistic but it provides for a conservative estimate of the water system’s ability to provide water service to the surrounding area.

Water Consumption
During the past three years, the total water usage has ranged from 19.8 million gallons per year to 22.7 million gallons per year in the Town of Rolling Hills. The usage increased by approximately 6-percent the first year and approximately 7-percent the second year for a total of a 13-percent increase over the three year period. This results in an average water
consumption of approximately 58,000 gallons per day (gpd). The three demand factors normally considered in evaluating a water system are:

- **Average Day Demand (ADD)** – the average water consumption per day for a water system. ADD is calculated by dividing the total water production/consumption in a water system over a year by 365 days. The ADD for this study was established by averaging the 2008 to 2011 water billing records while accounting for the unbilled customers. The current ADD for the Town of Rolling Hills is approximately 58,000 gpd or 40 gallons per minute (gpm). The average per capita water usage over the past three years is approximately 132 gallons per capita per day (GPCD). This study assumed a per capita water usage of 140 GPCD for the Town of Rolling Hills.

- **Maximum Day Demand (MDD)** - the maximum consumption of water over a 24-hour period in a water system. MDD typical occurs in the summer when water demands for irrigation are at their highest in the system. The MDD factor is calculated by dividing the MDD by the ADD. The Town of Rolling Hills does not have daily records of the water usage in the system; the monthly summer usage was analyzed to determine the MDD factor. The MDD factor assumed for Rolling Hills is 3.0 times ADD, or a MDD of 174,000 gpd or 121 gpm.

- **Peak Hour Demand (PHD)** – is defined as the maximum consumption of water during a one hour period in a water system during a single day. The peak hour demand typically occurs in the summer during high demand periods and is a result of daily fluctuations (i.e., diurnal) in water consumption. With no SCADA information and no daily consumption records, this study assumed a PHD factor of 6 times ADD or a PHD of 348,000 gpd or 240 gpm.

**Wellfield Summary**
The Town of Rolling Hills obtains water from five water supply wells. Well No. 1 is currently not used for drinking water purposes because of water quality issues. Well No. 2 is pumped during the summer months to meet water supply needs during high demand periods. Well Nos. 4, 5, and 6 are the primary wells in the water system and are used throughout the year to meet water supply demands. Overall, the physical condition of the wells is good. The wells do exhibit mineral and biological encrustation, but pumping test results indicate that the encrustation has not diminished the production capacities of the wells. Down-hole video inspection of the wells did not reveal any indication that the wells are in danger of physical failure; however, routine replacement of the drop pipe and pump cable will be necessary in the immediate future.

Analysis of the wells and the pumping test data was used to predict the production capacity of the Rolling Hills wells. The results of the analysis is summarized in Table ES-1. The total source capacity of the wells is estimated to be 170 gpm during the summer months when Well No. 2 is in operation. The capacity of the wells is greater than the estimated average day demand of 40 gpm and the maximum day demand estimate of 120 gpm.
Table ES-1 Rolling Hills Wellfield Summary

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Static Water Level (feet)</th>
<th>Pump Setting (feet)</th>
<th>Available Drawdown^ (feet)</th>
<th>Permitted Well Yield (gpm)</th>
<th>Current Well Yield (gpm)</th>
<th>Predicted Maximum Well Yield (10 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>210</td>
<td>672</td>
<td>437</td>
<td>50</td>
<td>90</td>
<td>90 (3 days) 50 (180 days)</td>
</tr>
<tr>
<td>2</td>
<td>127</td>
<td>932</td>
<td>780</td>
<td>75</td>
<td>75</td>
<td>60 (180 days)</td>
</tr>
<tr>
<td>4</td>
<td>373</td>
<td>935</td>
<td>537</td>
<td>75</td>
<td>60</td>
<td>25</td>
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<tr>
<td>5</td>
<td>325</td>
<td>741</td>
<td>391</td>
<td>75</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>310</td>
<td>783</td>
<td>448</td>
<td>80</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>355</td>
<td>371</td>
<td>170*</td>
</tr>
</tbody>
</table>

^ Available drawdown equal to pump setting minus static water level and 25 feet for pump submergence.
* Assumes Well No. 1 not pumped into system and Well Nos. 4 and 5 pumped at a combined rate of 50 gpm.

There were numerous deficiencies and concerns encountered during the evaluation of the existing wells. Proposed improvements were included in the recommended option for the water system improvements. These improvements included: installation of pressure transducers and air lines in the wells to monitor water levels in the aquifer; installation of new column pipe and cabling as necessary; installation of blow-offs and meters to provide for operational flexibility and accurate accounting of water pumped from the individual wells; and installation of a SCADA system to properly control and monitor the well operation.

**Well Siting Study**

While the existing wells meet the current average and maximum day demand, they will not meet the projected maximum day demand for the 20-year planning horizon. As part of this project, WESTON conducted a well siting study to determine the optimal location for a new water supply well capable of yielding approximately 150 to 200 gpm at a location near the new tank site in Section 16. The proposed site for Well No. 7 is approximately 3,000 feet north of Well No. 6. The proposed well would be completed in the Lance Formation. The estimated cost of the well is approximately $370,000.

**Water System Operation**

Source water for the Town of Rolling Hills is provided from four wells as detailed above. The fifth well, Well No. 1, has high turbidity and total dissolved solids levels; it is only used to fill commercial haul trucks not intended for potable use. All four of the supply wells for the Town of Rolling Hills are drilled to depths ranging from 1,500 to 1,800 feet in depth and produce water from the Lance Creek Formation. Water from the wells is pumped into the adjacent water storage tanks. Water supplied from Well No. 2 is pumped into the southern water storage tank. Water supplied from Well No.’s 4, 5, and 6 is pumped into the northern storage tank. The water storage tanks supply water for the booster pumping stations which supply water into the distribution system. The pumps in both pump stations are controlled by pressure and motor...
speed to maintain downstream pressures in the distribution system. The southern pump station (Pump Station No. 1) is equipped with two pumps; the northern pump station (Pump Station No. 2) is equipped with three pumps.

Both water storage tanks are equipped with liquid hypochlorite chlorination systems which draw water from pump station discharge piping, add hypochlorite solution with a chemical feed pump and then pump the chlorine solution into the water storage tanks. The chlorination system is manually controlled by changing the speed of the hypochlorite feed pump. The system operator checks the chlorine residual in the system at least once per day and adjusts the chlorine feed pump as necessary to maintain a proper residual chlorine level in the tanks.

Figure ES-1 on the following page provides a water supply system schematic and hydraulic profile for the Rolling Hills water system. The figure identifies all of the critical system components and the connectivity of the water system along with the capacities and elevations of the water storage tanks. The approximate elevations of the system components are identified along with the schematic piping of the system. The dashed line at the top of the figure identifies the hydraulic grade that is maintained in the system by the booster pumping stations.

**Recommended Operational Improvements**
During the completion of the study several items were identified which will improve the operation and control of the system. Many of the proposed operational improvements addressed below assume that the Town maintains the current system operation. If the Town chooses to implement the proposed improvements recommended in this study, some of the recommended improvements (i.e., pump station improvements) will not be necessary. The proposed operational and maintenance recommendations are summarized below:

- **Well Pump Equipment** – As detailed earlier in this section improvements are necessary to the existing wells to monitor water levels, provide for reliable operation, and control the operation of the existing wells.

- **Pump Station Equipment** – As detailed above, the pump stations are operated based upon pressure set-points and VFD control of the primary supply pumps. In general, with the exception of the VFD’s, the existing pumps and starters are fairly old and are not well matched. The pump design of the booster pumps should be closely reviewed and new pumps should be sized and installed to meet the system demands and work synchronously. The suction and discharge piping on both stations includes a lot of unnecessary equipment. The suction and discharge piping should be simplified and re-plumbed to provide consistent and logical piping with a low flow bypass equipped with a single 2-inch pressure relief valve. Simplifications of the pump station operation and piping would results in a more reliable and easily maintained pump station.

- **SCADA System Remote Monitoring** – With a total of four well pumps, five booster pumps, two chlorination systems and two water storage tanks in operation, remote monitoring and alarming is necessary for the efficient operation of the system. Radios should be installed in both pump stations to allow the pump stations to communicate and coordinate operation. Remote monitoring of the system coupled with an alarm system would make the operation of the system more efficient and would warn the
Town of Rolling Hills Water Supply System Schematic & Hydraulic Profile

LEGEND:
- Flow Direction
- Point of Chlorination
- Water Meter
- Water Storage Tank
- Pump/Cl₂ Building
- Elevation in Feet

Pump Station No. 1

South Storage Tank

Well #1

Well #2

Town of Rolling Hills Distribution System
Elevation 5310 to 5390

Well #3

Well #4

North Storage Tank

Well #5

Well #6

Pump Station No. 2

230,000 gal. Base = 5394 OF = 5401

98,000 gal. Base = 5401 OF = 5439

5500 Pump Station Hydraulic Grade = 5529 feet

5475

5450

5425

5400

5375

5350

5325

5300

Figure ES-1 Town of Rolling Hills Water Supply System Schematic & Hydraulic Profile
• operators in the event of a system failure (booster pump, well pump chlorination system, etc.).

• **Chlorination Equipment** – The existing chlorination system consists of tanks of hypochlorite solution and manually controlled chemical feed pumps discharging highly chlorinated water into the tanks with little mixing. The existing system is a hazard to operate with exposure to large volumes of liquid hypochlorite. Additionally, the manual control of the system coupled with limited mixing in the water storage tanks results in inconsistent chlorine residuals. New chlorination systems are recommended at both tank sites.

• **Valve Exercising and Cleaning** – It is recommended that the Town develop an exercising program to access and operate every valve in the system at least once per year.

• **Fire Hydrant Flushing** – It is recommended that the Town formalize the flushing and maintenance program for fire hydrants in the system. The fire hydrants need to be operated at least once per year to verify the proper operation. Water quality flushing should occur at least twice per year to flush all of the water mains in the system.

• **Unmetered Service Connections** – the Town recently installed meters on the Town Park, the Fire Hall, and the pathway irrigation system. However, the Town Hall and Town Shop are currently not metered. The Town should attempt to meter all of the water users and track flushing water to accurately account for produced water versus billed water usage.

**Geographic Information System (GIS) Development**

As part of the study a GIS database was developed to map the existing water system and provide an operational and planning tool for the Town of Rolling Hills. The GIS database provides high quality aerial imagery with contours and a detailed database for all of the water system components. The GIS database is a tool to be used by the Town for viewing and analyzing their water system. The GIS database is also a valuable tool for documenting the ongoing maintenance and operation of the water system. The GIS database includes all of the water features in the system (valves, hydrants, tanks, wells, etc.) with specific information regarding each feature including age, materials of construction, size, date installed and references to design drawings for the components.

**Hydraulic Model Development**

The Town of Rolling Hills hydraulic water model is a powerful tool for evaluating the Town’s water system. Utilizing the *WaterCAD* hydraulic water model and *WaterGEMS*, the Geographic Interface System (GIS) companion to *WaterCAD*, the model can accurately evaluate the performance of the water system by examining system pressures, distribution pipeline flows, fire flows, water storage tank balance, and overall system operation.

Developing the hydraulic water model included three key steps: identifying and modeling the water system infrastructure, assigning demands throughout the system, and verifying and
calibrating the model. Once the 2010 hydraulic water model was developed, it was expanded to include an analysis of the ultimate capacity of the system with all of the areas identified in the growth areas fully developed. All of the water system components were inventoried as part of the Master Plan including surveying all of the water system infrastructure. All of the valves in the water system were surveyed and inventoried; additionally, all of the fire hydrants were surveyed and 15 of the hydrants were flow tested while simultaneously monitoring pressures in the system and at the flowing hydrant. This information was utilized to calibrate the hydraulic model and verify its accuracy.

**Storage Capacity**
The Town of Rolling Hills currently has a total of 329,000 gallons of water storage available to serve the needs of the distribution system. Water storage tanks are designed to provide water storage for varying water system demands and allow for the cyclical operation of the supply system. The three components of water storage are: emergency storage, equalization storage, and fire flow storage. A summary of the calculated water storage needs for the Town of Rolling Hills is summarized in Table ES-2

<table>
<thead>
<tr>
<th>Table ES-2 Water Storage Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>Calculated Storage Required (minimum /maximum) (gallons)</td>
</tr>
<tr>
<td>Current Available Storage (Total)</td>
</tr>
<tr>
<td>DEQ Equalization Storage (ADD)</td>
</tr>
<tr>
<td>DEQ Fire Storage (750 gpm for 2 hours)</td>
</tr>
<tr>
<td>Calculated DEQ Min. Storage Required</td>
</tr>
</tbody>
</table>

**Distribution Pump Capacity**
The distribution system is basically a closed system. The elevations of the water storage tanks are not high enough to provide adequate pressure to the water distribution system by gravity flow. The pumps provide the required system pressure for the distribution system. They pump water from the water storage tanks into the distribution system utilizing variable-frequency drives (VFD’s) and hydroconstant drives to prevent over pressurizing the system. Because the distribution pumps pump from the water storage tank into the distribution system, they need to be capable of supplying ADD, MDD, PHD, and MDD with the required fire flow. The pumps are capable of supplying the current, 2020, and 2030 ADD, MDD, PHD.

**Fire Flow Assessment**
The current system is unable to provide adequate fire flow to any part of the water distribution system. The pumps are not adequately sized to provide 750 gpm. The three pumps in Pumphouse No. 2 have three different pump curves. In order for all three pumps to be running at the same time, the fire pump will be running full speed; however, the VFD’s in the other two...
pumps will significantly ramp down the flows to match the total dynamic head of the fire pump. Aside from the booster pump capacity, the distribution system is also unable to convey the required fire flows. The distribution system is fairly well looped with 6-inch diameter mains. There are two “bottlenecks” in the distribution system: the 6-inch diameter main supplying water from Pumphouse No. 2 to Cougar Road and the area in the north-east corner along Dunham Road. Improvements are needed to the booster pumping stations and the distribution system to meet the required 750 gpm minimum fire flow requirements.

**Water Supply Alternatives**
As detailed above, the Town of Rolling Hills pumps their water twice in order to supply potable water to the customers in the system. The first rule of hydraulics and water supply is to pump the water the least number of times in supplying it to the customer. The long term operational and maintenance costs of rotating equipment (e.g., pumps) normally exceed the costs of designing the system to utilize gravity to supply water to the customers. In completing the analysis of the water system three alternatives were considered:

- **Alternative 1:** Repair and/or Replacement of Existing Facilities – this alternative included replacing the existing booster pump station equipment, repairing the existing wells and adding water level monitoring, installing new tablet chlorination systems, completing the needed distribution system improvements and installation of a SCADA system. Total Estimated Cost - $604,000.

- **Alternative 2:** Install New Water Storage Tank at Higher Elevation – this alternative included installing a new water storage tank at an elevation high enough to serve the customers by gravity, replacing the existing well pumps and installing level transducers, installing new tablet chlorinators, completing the needed distribution system improvements and installation of a SCADA system. Total Estimated Cost - $1,878,000.

- **Alternative 3:** Connect to the Town of Glenrock – this alternative included installing a transmission line to connect to the Town of Glenrock’s water system, installation of a booster pump station to supply the water to a new water storage tank at a high elevation and the associated SCADA and controls system. Total Estimated Cost - $3,245,000.

Based upon the long term operational costs and a detailed net present worth evaluation, Alternative 2 was selected as the preferred alternative. The 30-year net present values of the three alternatives were $1.9 million, $1.3 million and 3.1 million respectively. A detailed cost estimate is provided in Table ES-3; Figure ES-2 provides a conceptual design of the proposed improvements.

**Water Rates**
The existing rate structure in the Town of Rolling Hills is not adequate to meet the current operation and maintenance costs of the system. The addition of the $30,000 annual debt service for the proposed system improvements will exacerbate this problem. The proposed rates structure needs to be increased by approximately 45-percent which includes an increase in the base rate of $8.00 per month and raising all the step rates by $1.00 per 1,000 gallons of usage. The current in-town water bill for 12,000 gallons of monthly water usage would go from $38.00 to $58.00 per month.
The following table presents the alternative 2 - construction cost estimate for the Rolling Hills Water System Master Plan:

### Table ES-3

#### Alternative 2 - Construction Cost Estimate

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization and Bonds</td>
<td>1</td>
<td>LS</td>
<td>$65,000.00</td>
<td>$65,000.00</td>
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<tr>
<td><strong>Transmission Pipeline</strong></td>
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<td>12-inch PVC Pipeline</td>
<td>4,240</td>
<td>LF</td>
<td>$40.00</td>
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<td>12-inch Fittings</td>
<td>3</td>
<td>EA</td>
<td>$1,200.00</td>
<td>$3,600.00</td>
</tr>
<tr>
<td>12-inch Valves</td>
<td>3</td>
<td>EA</td>
<td>$3,200.00</td>
<td>$9,600.00</td>
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<tr>
<td>8-inch PVC Pipeline</td>
<td>4,600</td>
<td>LF</td>
<td>$35.00</td>
<td>$161,000.00</td>
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<tr>
<td>8-inch Fittings</td>
<td>7</td>
<td>EA</td>
<td>$800.00</td>
<td>$5,600.00</td>
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<tr>
<td>8-inch Valves</td>
<td>6</td>
<td>EA</td>
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<td>$6,600.00</td>
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<tr>
<td>Air Release Valves</td>
<td>1</td>
<td>EA</td>
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<td>$6,500.00</td>
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<tr>
<td>Flushing Hydrant Assembly</td>
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<td>$4,500.00</td>
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<tr>
<td>Connect to Existing Pipelines</td>
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<td>Asphalt Replacement</td>
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<td><strong>300,000 Gallon Water Storage Tank</strong></td>
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<td>Earthwork</td>
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<td>CY</td>
<td>$9.00</td>
<td>$27,000.00</td>
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<tr>
<td>Yard Piping</td>
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<td>LS</td>
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<td>Foundation and Structural Fill</td>
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<td>LS</td>
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<td><strong>300,000 Gallon Water Storage Tank</strong></td>
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<tr>
<td>Fencing</td>
<td>500</td>
<td>LF</td>
<td>$35.00</td>
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<td>Base Course</td>
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<td>$11,000.00</td>
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<tr>
<td><strong>Subtotal 300,000 Gallon Water Storage Tank</strong></td>
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<td>$457,500.00</td>
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<td><strong>South Pump Station Improvements</strong></td>
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<td>Yard Piping</td>
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<td></td>
<td>$100,000.00</td>
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<td><strong>SCADA Control System</strong></td>
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<td>Ethernet Communication System</td>
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<td>$11,000.00</td>
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<td><strong>Subtotal SCADA Control System</strong></td>
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<td></td>
<td>$19,000.00</td>
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<td><strong>Construction Cost Subtotal No. 1</strong></td>
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<td>$1,292,500.00</td>
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<tr>
<td><strong>Engineering Services During Construction (10%)</strong></td>
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<td>$129,250.00</td>
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<td><strong>Construction Cost Subtotal No. 2</strong></td>
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<td>$1,421,750.00</td>
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<td><strong>Inflation to 2013 Construction (3% per year)</strong></td>
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<td>$86,600.00</td>
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<tr>
<td>Contingency (15% of CCS No. 2)</td>
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<td>$213,260.00</td>
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<td><strong>Construction Cost Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>$1,721,610.00</td>
</tr>
</tbody>
</table>

**TOTAL PROJECT COST** $1,878,000.00

- WWDC Grant Funding $1,258,260.00
- SRF Loan Funding $619,740.00
- SRF Loan Funding 25-percent Principle Forgiveness $154,935.00
- SRF Loan Funding (Interest Rate = 2.5%, term = 20 years) $464,805.00

**Annual SRF Loan Payment** $29,815.91
Figure ES-2
Alternative 2 - New Water Storage Tank at Higher Elevation

Fire Flow
- < 650 gpm
- 650 - 750 gpm
- > 750 gpm

Other Water Features
- Well
- Water Storage Tank

Existing Mains
- 6" Main
- 8" Main

Proposed Mains
- 8" Main
- 12" Main

Proposed 300,000 Gallon Water Storage Tank
Base Elev. = 5470
Overflow Elev. = 5510

Proposed Water Transmission Mains
- 8" PVC Inlet Main
- 12" PVC Outlet Main