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GLENROCK WATER SOURCE PROJECT

LEVEL II STUDY

PHASE II

February 2000

Prepared for
Wyoming Water Development Commission

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GLENROCK WATER SOURCE PROJECT

LEVEL II STUDY PHASE II

February, 2000

EXECUTIVE SUMMARY

PREPARED FOR WYOMING WATER DEVELOPMENT COMMISSION

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GLENROCK WATER SOURCE STUDY

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1.0 INTRODUCTION

This Study is a continuation of a WWDC Level II Study completed in October of 1999 for the Town of Glenrock. That Study was called “The Glenrock Raw Water Irrigation Project-Level II Study-Phase I” and was completed by Sunrise Engineering, Inc. and Weston Engineering, Inc. In the Phase I Study, it was concluded that the development of an additional culinary water source versus the implementation of irrigation alternatives was more cost effective. A new source would need to be located in reasonably close proximity to the existing well source. Therefore, The Town of Glenrock requested that WWDC allow a continuation of the Level II Study. The continuation would fund the drilling of a test well, additional field evaluation, modeling of the distribution system, and provide a conceptual design and layout for the extension of the transmission line to the new well site.

The continuation was granted by WWDC, and the focus of the project shifted from a raw water project to a water source development project. With the shift in focus the continuation was renamed to the “Glenrock Water Source Project-Level II-Phase II.” Since Phase II is a continuation, all data, maps, and tables found within Phase I will remain pertinent and will not be reproduced.

1.1 SCOPE AND PURPOSE OF STUDY

The scope of this study can be split into three parts. The first part consists of the additional engineering services outlined above, which include drilling a test well, additional field evaluation, modeling of the distribution system, and a conceptual design and layout for the extension of the transmission line to the new well site. The second part was the actual drilling and test pumping of a new well. The third task includes the economic analysis and ability to pay of all recommended improvements, outlined in Phase I and Phase II.

1.2 ACKNOWLEDGEMENTS

Sincere appreciation is expressed to all who assisted in the collection and evaluation of information required for the completion of this water study. Special thanks is given to the Glenrock Staff particularly, David Eason and Donna Geho, along with Mr. David True and Mr. Gary Skiles with the VR Ranch.
2.0 PHASE II-ADDITIONAL SERVICES

2.1 UP-DATE ON CURRENT IMPROVEMENTS

As an update, in the Phase I Study, several areas in the distribution system were identified as needing to be replaced due to corrosive soils deteriorating the metal pipes. Since the Phase I report was completed, Glenrock has received project funding from the State Loan and Investment Board (SLIB) to aid in the replacement of the water distribution piping throughout the Oregon Estates and Scott Addition Subdivisions as outlined in Phase I. With a 50% grant from SLIB, Glenrock replaced the distribution piping in Oregon Estates during the 1999 construction season and they are scheduled to replace the water and sewer piping in the Scott Addition during the 2000 construction season.

2.2 PRESSURE REGULATING VAULT

There is a pressure regulating facility located on the edge of Town near the cemetery. The pressure reducing valve (PRV) in this facility has been an area were routinely many hours of maintenance and adjustments are made by the Town’s staff. The PRV is located on the transmission line and is buried in a concrete vault. Access into the vault is done through a typical manhole lid. According to Dave Eason, this vault is considered a confined space by OSHA’s requirements and any person entering the vault should follow the confined space safety guidelines.

In addition to reducing the pressure in the transmission line, the PRV acts as a bottleneck restricting water flow. During the summer, when water consumption is highest, the PRV is manually adjusted several times a day to insure that the storage tanks are kept full. When the water level in the tanks are at lower levels (3/4 full or less), the water pressure at the service connections nearest the tanks are lower, creating a nuisance with sprinkler systems and faucets. Therefore, adjustments are made to the PRV to allow for more water flow into the distribution system to insure that the levels in the tanks are kept as full as possible. Once an adjustment is made it is only a matter of hours before some circumstance occurs that requires the Town staff to drive to the PRV vault and manually make adjustments to the PRV. All adjustments are based on water consumption, which fluctuates with the weather, day of the week, and holidays. For example, when the weather is hot and lawn irrigation is occurring readily, the PRV is adjusted up to allow for more flow. However, when it rains the next day’s irrigation usage is affected and water is wasted over the tank’s overflows. Since the water sources are wells, the PRV is adjusted down to minimize the water being pumped and wasted over the overflows. Then, the following day the temperature returns to hot and dry, which increases the...
irrigation consumption requiring the PRV to be opened again. This cycle continues all summer and the only relief is when winter arrives bringing more consistent water usage.

It is proposed that a new PRV station be constructed. The proposed station is designed to bring the transmission line and PRV to the ground surface inside a building, eliminating the confined space hazards.

In the last few years’ advances in PRV technology has developed a control valve that also controls the flow rate. These PRV’s are called pressure flow control valves or PFC’s. Along with reducing the pressure, PFC valves are capable of increasing or decreasing the flow rate through the pipeline by itself. By installing a PFC valve the valve will be able to adjust itself to the different demands without the Town’s staff making adjustments. Therefore, it is recommended that a PFC valve be install and that this valve also be equipped with SCADA communication capabilities, allowing the Town’s staff to monitor and operate the PFC from a remote location if needed. Preliminary cost estimates for the proposed PRV station will be outlined in Section 4.0 of this report.

2.3 SCADA SYSTEM

The existing SCADA system is a combination of radio and telephone communication devices. In the Town of Glenrock’s shop there is a wall mounted board, with light bulbs on it, that receives the signal from these communication devices. The Town’s staff can view the status of the wells, storage tanks, sewer lift stations etc, depending on which light bulb is lit. This board only indicates whether that particular pump is on/off or the tank is full/filling and there is no means by which the staff can obtain additional information or operate a pump from the shop. Therefore, when the lights on the board indicate that there is a potential problem a staff member has to go to that specific site and verify the situation. In the case with the Little Deer Creek Wells, a staff member has to travel the 8-miles to check on any potential problems with the Wells.

Although this system is working as designed, it is old and outdated. With today’s technology it is possible to control, operate, and monitor all aspects of the water system from the shop. It is recommended that Glenrock install a new SCADA system. This new system should have input and output capability at all sites, allowing the Town’s staff to monitor, control, and change different parameters. Preliminary cost estimates for the new SCADA system will be addressed in Section 4.0.
2.4 COMPUTER MODEL

A computer model of the distribution system was completed using Haestad Method’s Cybernet analysis software. Pipe sizes and layout for the model were taken from plans provided by the Town of Glenrock and Joseph Popp a local licensed land surveyor.

The State Department of Environmental Quality (DEQ) requires that the normal working pressure in the distribution system shall not be less than 35 psi. The model indicated that the pressures throughout the distribution system are above the state requirement. However, a few of the junctions at higher elevations were close to the 35 psi requirement at peak system demands.

DEQ also requires that when fire protection is provided, distribution system design shall be such that fire flows can be served. The Uniform Fire Code Section 5.1 indicates, “The minimum fire flow and flow duration requirements for one- and two-family dwellings having a fire area which does not exceed 3,600 square feet shall be 1,000 gpm.” The Town of Glenrock should comply with this standard throughout the distribution system. Thus, the computer model analyzed the system’s capability to deliver fire flow demands of 1,000 gpm plus the existing peak day demands throughout the system. This analysis indicated that the majority of the system is sized adequately for fire flows. Six locations were identified where fire flows were below the 1,000 gpm requirement. All of these locations are situations were there is a long dead end pipeline.

The same fire flow analysis was completed again. However, this time the projected future peak day demands were used (2% growth rate). The same six locations as the existing fire flow analysis, had problems. Changes in the model were then made to represent future pipeline upgrades and the model was analyzed again. The following Table 2.4, identifies the location and type of improvement needed, throughout the distribution system, to meet future fire flow demands.

| TABLE 2.4 |
| PROPOSED DISTRIBUTION SYSTEM IMPROVEMENTS |
| Birch St. and Sunup Rd | Replace 2000-feet of 6’ with 8” waterline |
| Grove St. and 4<sup>th</sup> Ave | Install 400-feet of 6” waterline |
| Arapaho Trail and Shoshoni Trail | Replace 950-feet of 6” with 8” waterline |
| Deer St. and Keller Drive | Proposed future 8” loop 950-feet |
3.0 CONSTRUCTION OF TEST WELL

This section is intended to summarize the report that was completed by Weston Engineering, Inc. The full content of that report can be found in Appendix C of the full report.

Two goals were established from Phase I for the new test well. One was that the target capacity of the new well was 1,000 gpm. Secondly, the new well needed to be drilled in a location that produced quality water without impacting any senior water rights of nearby creeks, streams, springs or wells.

In Phase I, based on Weston Engineering’s comparison of all possible sites, the Section 9 site was recommended. After Phase II was underway, additional information was found and the Section 9 site was renamed to Test Well No. 5 Site to maintain continuity with four previous test wells that were completed in the 1980’s.

3.1 DRILLING & TEST PUMPING

The drilling contract was awarded to D.C. Drilling of Lusk, Wyoming. Drilling on Test Well No. 5 started October 18, 1999 and ended November 9, 1999. The initial drilling program called for full penetration of the Casper Formation, the Madison Limestone, and the Flathead Sandstone. The static water level was found to be 163.5-feet below the ground surface. Drilling was eventually terminated in the Madison Limestone at a depth of 1,174-feet. The following exert, from Weston Engineering’s report, explains the reason for the termination.

"A large cavern was encountered from 1,151 to 1,158-feet and the large quantities of water produced resulted in the inability to circulate cuttings out of the borehole at 1,174-feet. Because circulation was effectively lost and the well produced the targeted production rate of 1,000-gpm drilling was stopped at 1,174-feet. ...The formations encountered by the borehole were the Chugwater, Goose Egg, and Casper Formations and the Madison Limestone."

Two different pump tests were completed on Test Well No. 5 to determine the capabilities of the aquifer. The first test was the step-test. On November 18, 1999, a submersible test pump was installed with the intake set at a depth of 240-feet. Throughout the step test, the discharge capacity was increased every 30 minutes. The discharge rate started at 250 gpm and was increased as follows 500, 752, 1,000, 1,220 gpm. The 1,220 gpm discharge rate was the maximum output capacity of the pump and motor. The specific capacity of the well ranged from 19.19 to 40.32 gpm/ft. Three other water parameters were measured throughout the step test. These parameters were temperature, conductivity, and pH. The
temperature fluctuated between 498 and 538 F, the pH decreased from 7.8 to 7.3, and the conductivity increased steadily from 490 to 510 micromhos/cm.

The second test was the Constant-Discharge Drawdown Test. The following information was taken from Weston Engineering’s report about the Constant-Discharge Drawdown Test.

"Because the design pumping rate for the project is 1,000 gpm, the test well design did not facilitate installation of a pump capable of producing significantly greater quantities of water. After pumping the well at a rate of 1,000 gpm for seven days, the drawdown in the well was approximately 57 feet. The flow rate was then increased to 1,150 gpm, the maximum pumping rate of the equipment, for the duration of the 14-day test. The drawdown at the end of the pump test was approximately 71 feet."

3.2 AQUIFER IMPACT MONITORING & WATER QUALITY

Three observation locations were monitored during and after the pump tests. These locations are identified as Test Well No. 1, Test Well No. 4, and Little Deer Creek upper and lower weirs. Test Well No. 1 was monitored to determine when Little Deer Creek Well No. 1 was pumped to supply water to Glenrock. Water level measurements were taken and recorded by pressure transducers and dataloggers every 100 minutes. This data was then compared with calculated effects caused by pumping of Little Deer Creek Wells Nos. 1 and 2, changes in barometric pressure, precipitation, and estimated times when temperatures melted snowpack. The results indicated the following,

"...Although water level fluctuations were observed in all of the monitoring stations, it was determined that pumping of the Little Deer Creek Wells and changes in barometric pressure, along with precipitation events, are the major cause of the observed water level changes in Little Deer Creek. Water level fluctuations observed in Test Well No. 4 are attributed to changes in barometric pressure and precipitation events. ... Data obtained during this test well program indicates that test pumping of Test Well No. 5 did not impact the Casper Aquifer in the vicinity of Test Well No. 4 and did not cause diminished flows in Little Deer Creek."

Several water quality field and laboratory analyses were completed on water from Test Well No. 5. The results from these tests indicated that,

"...the water sampled during the pumping test does no exceed any of the primary or secondary EPA drinking water standards, including standards
for metals, pesticides, herbicides, radionuclides, volatile organic compounds (VOC's) and trihalomethanes. The water is hard, with the water type being calcium-magnesium-bicarbonate. All of the analyzed constituents were below the MCLS. "The water from Test Well No 5 is of a quality that meets EPA standards for drinking water and is suitable for municipal use."

3.3 TRANSMISSION LINE EXTENSION ANALYSIS

Once Test Well No. 5 was successfully drilled, field investigations were undertaken to investigate the best route to convey the water produced by Test Well No. 5 to the Town of Glenrock.

The transmission line will be installed at a depth of 5.5-feet in accordance with WDEQ standards. The information covered in Table 3.3 represents the characteristics of the proposed transmission line.

<table>
<thead>
<tr>
<th>Table 3.3 Proposed Transmission Line Characteristics</th>
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</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
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<tr>
<td><strong>Diameter</strong></td>
</tr>
<tr>
<td><strong>Material</strong></td>
</tr>
<tr>
<td><strong>Estimated Beginning Elevation</strong></td>
</tr>
<tr>
<td><strong>Estimated Ending Elevation</strong></td>
</tr>
<tr>
<td><strong>Estimated Available Head</strong></td>
</tr>
<tr>
<td><strong>Estimated Pressure at Surge Tank</strong></td>
</tr>
</tbody>
</table>

Test Well No. 5 and the majority of the proposed transmission line is located on state land under the direction of the Board of Land Commissioners. Near the existing Little Deer Creek Wells the proposed transmission line crosses land owned by the VR Ranch. The anticipated length of pipeline that will be on VR Ranch property is less than 0.3-miles of the 1.9-mile pipeline.

The VR Ranch leases all the state land where the proposed transmission line will be constructed. In order to construct the transmission line, easements will be required from the Board of Land Commissioners and the VR Ranch. Before the Land Commissioners will approve an easement they will insure that the leasee (VR Ranch) is in agreement. Discussions with the VR Ranch has indicated that they desire a small volume of water for stock watering in that area. In that same immediate area, Test Well No.2 has the capability of providing that source utilizing power that would be brought to the site by this proposed project.
4.0 COST ANALYSIS OF WATER SYSTEM IMPROVEMENTS

4.1 CULINARY WATER SYSTEM IMPROVEMENT COSTS

The purpose of this section is intended to combine the cost associated with the recommended improvements from Phase I and Phase II. First, each recommended improvement will be categorized into a funding category, WWDC, SLIB, Drinking Water State Revolving Loan Fund (DWSRF), or others, depending on possible funding eligibility. Table 4.1 summarizes the improvements and which funding agency supports those types of improvements.

<table>
<thead>
<tr>
<th>RECOMMENDED IMPROVEMENTS &amp; FUNDING ELIGIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Tank Rehabilitation</td>
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<tr>
<td>PRV Station</td>
</tr>
<tr>
<td>Test Well No. 5 Completion</td>
</tr>
<tr>
<td>Transmission Line Extension</td>
</tr>
<tr>
<td>SCADA System</td>
</tr>
<tr>
<td>Various Distribution System Improvements</td>
</tr>
</tbody>
</table>

As outlined in the Table 4.1, the total WWDC-eligible improvement costs are $1,648,000. WWDC typically provides 60% grant and 40% loan dollars (or a cash contribution from the community) for approved improvements.

If Glenrock determines to complete Test Well No. 5 and ask for Level III funding from WWDC, they will be required to reimburse 40% of the test well drilling costs accumulated during Level II. The Level II drilling costs were calculated to be $167,000, therefore, Glenrock’s 40% reimbursement will be $66,800. Total project loan monies will be (40%) (1,648,000) + $66,800 = $726,800.

As stated in Phase I, projects funded by SLIB are typically 50% grant and 50% loan or cash contribution of the community. The total distribution system improvement costs are estimated at $350,000.
4.2 END USER FEES AND MONTHLY RATES

Since both WWDC and SLIB will allow a community to seed other loan sources for the non-grant amount of a project, it is logical that the Town of Glenrock would pursue the lower interest rate loan through the Drinking Water State Revolving Loan Fund (DWSRF) (currently 5%) or private banks. However, Glenrock may also choose to fund the non-grant amount through their own savings. Two end user rate increases, using different interest rates, are given below for both WWDC and SLIB eligible improvements. The following calculations are based on 924 connections.

The WWDC eligible improvements shown above result in an end user rate increase of $6.30/month, based on a loan amount of $726,800, a loan term of 20-years, and an interest rate of 7.25%. If lower financing terms can be arranged the end user rate increase may only be $5.25/month, based on the same loan amount of $726,800, a loan term of 20-years, and an interest rate of 5%. The Test Well No. 5 drilling reimbursement is included with the loan amount.

The SLIB eligible improvements shown above result in an end user rate increase of $1.55/month, based on a loan amount of $177,500, a loan term of 20-years, and an interest rate of 7.25%. If lower financing terms can be arranged the end user rate increase may only be $1.30/month, based on the same loan amount of $177,500, a loan term of 20-years, and an interest rate of 5%.

The Town of Glenrock will decide which, if any, of these projects will be pursued. At the time this decision is made, specific terms and interest rates will be negotiated with the funding entity.
5.0 CONCLUSIONS AND RECOMMENDATION

5.1 CONCLUSIONS OF WATER SYSTEM EVALUATION

The purpose of this study (Phase II of a WWDC-Level II Study) has been three parts. The first part consists of additional engineering services, which included specifications for drilling a test well, additional field evaluation and modeling of the distribution system, and a conceptual design and layout for the extension of the transmission line to the new well site. The second part was the actual drilling of the test well. The third part included the economic analysis and ability to pay of all recommended improvements, outlined in Phase I and Phase II of this WWDC-Level II Study. The conclusions of this evaluation are summarized below according to which funding agency may potentially fund the improvements.

5.1.1 WWDC-ELIGIBLE IMPROVEMENTS

Test Well No. 5

Under the direction of Weston Engineering Inc., the drilling of a test well began on October 7, 1999 at site No. 5. The results of the drilling produced a test well 1,174-feet deep that penetrated the Casper Formation and Madison Limestone. The capacity of the well was tested over a two-week period at rates of 1,000 and 1,150 gpm. Water levels at Test Wells No. 4 along with two weirs located in Little Deer Creek were monitored for potential impacts during the two-week pump test. According to Weston Engineering's report, “the test pumping of Test Well No. 5 did not impact the Casper Aquifer in the vicinity of Test Well No. 4 and did not cause diminished flows in Little Deer Creek.” Weston’s report also concluded that the water produced from Test Well No. 5 meets EPA’s requirements for municipal use.

Transmission Line Extension

Based upon the drilling results of Test Well No. 5, in order to convey water to Glenrock, the existing transmission line will need to be extended. The proposed transmission line extension will run from Test Well No. 5 to the surge tank at Little Deer Creek Well No. 1. The line size is proposed to be a 14-inch PVC line approximately 1.9-miles long. The transmission line will be gravity flow the entire length and will cross a ravine and Deer Creek. The transmission line will be constructed on State Land leased by the VR Ranch and private property owned by the VR Ranch.
Additional Water System Needs

Based upon additional evaluations and the computer model of the distribution and transmission line systems, several WWDC-eligible improvements are recommended. These improvements include the replacing of the existing PRV vault with a new PRV building. Thus, eliminating the confined space hazard the vault creates and installing a pressure flow control valve (PFC) instead of a PRV. The PFC valve will eliminate the bottleneck created by the current PRV and allow the flow through the valve to fluctuate without manual manipulation. The PFC valve will help insure that the storage tanks are full and eliminate the need for the Town’s staff to manually adjust the PRV several times a day.

The current communication and warning devices for the water system are old and outdated. These devices are connected to the Town’s wells, one of the storage tanks, and various pumps and locations throughout the system. The communication and warning system is currently made-up of telephone and radio devices with only output capability. Newer technology, a SCADA system, allows the operator to monitor, control, and manipulate the pump or control switch from a remote location.

In Phase I, the need for repainting of the Indian Hills storage tank was identified. This improvement will be considered along with the other WWDC eligible improvements for Level III funding.

Improvement Costs

The improvement costs associated with completing Well No. 5, extending the transmission line to Well No 5, replacing the existing PRV vault and SCADA system, and repaint the Indian Hills storage tank (75,000 gallons) is $1,648,000.

If the Town of Glenrock decides to pursue Level III funding with WWDC, 60% of the improvement can be covered through a WWDC grant the remaining 40% is Glenrock’s responsibility. WWDC loans can be acquired at 7.25% interest for 20 or 30-years. DWSRF loan monies are also available at 4% interest. Reimbursement of 40% of the test well construction cost are also Glenrock’s responsibility if the decide to pursue Level III funding. The test well costs were $167,000 and Glenrock’s 40% obligation would be $66,800. This represents a total of $726,800 that the Town would need to acquire funds for.
5.1.2 SLIB-ELIGIBLE IMPROVEMENTS

A computer model of Glenrock’s distribution system was completed and analyzed. The computer model indicated that fire flows of 1,000 gpm could not be reached in six areas of Glenrock when peak demands were present. Typically, these six areas were located at the end of a non-looped waterline. The installation of approximately 400-feet of 6-inch and 3,900-feet of 8-inch waterlines is recommended to loop or upsize the water lines to meet fire flow requirements. The cost for these improvements is estimated at $350,000, of which 50% could likely be paid for with a SLIB grant. The remaining 50% is Glenrock’s responsibility. Financially, it may be in the best interest of the Town of Glenrock to make some of these improvements as growth occurs in that particular area of town.

5.2 RECOMMENDED WATER SYSTEM IMPROVEMENTS

Given Glenrock’s current need to provide an additional source of water, it is recommended that Test Well No. 5 be completed into a culinary water well. The transmission line must then be extended to the well site.

As outlined above in Section 5.1, there are other immediate water system improvements needed. These needs consist of repainting of the Indian Hills storage tank, updating the SCADA system, and replacing the PRV station. Thus, the need to ask for WWDC-Level III funding for these five improvements is recommended immediately.