This is a digital document from the collections of the Wyoming Water Resources Data System (WRDS) Library.

For additional information about this document and the document conversion process, please contact WRDS at wrds@uwyo.edu and include the phrase “Digital Documents” in your subject heading.

To view other documents please visit the WRDS Library online at: http://library.wrds.uwyo.edu

Mailing Address:
Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
Laramie, WY 82071

Physical Address:
Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

Phone: (307) 766-6651
Fax: (307) 766-3785

Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission (http://wwdc.state.wy.us)
Executive Summary

GREYBULL
WATER SUPPLY PROJECT
LEVEL II

Wyoming Water Development Commission

NELSON ENGINEERING
P.O. Box 1599   Jackson, Wyoming

November 1995
October 30, 1995

Mike Purcell, Director
Wyoming Water Development Commission
Herschler Building
Cheyenne, Wyoming

Re: Executive Summary and Final Report for Town of Greybull
Level II-Feasibility Study

Dear Mr. Purcell:

We are hereby submitting the final documents completed as a result of this study. Please find enclosed the following:

1. Executive Summary - 35 copies
2. Final Report - 25 copies with one unbound reproducible
3. One Project Notebook containing project documentation generated during the course of study.
4. One 3.5" high density disk containing the written report

We anticipate WWDC and the Study Sponsor will find the information in the report beneficial in planning improvements to the community's water supply and transmission system.

We appreciate the opportunity to provide engineering services for a project of this importance to the State and the Greybull/Shell Valley area. It has been a pleasure working with John Jackson of WWDC and the Town of Greybull staff.

Sincerely,

[Signature]

Frank J. Grimes PE&LS
Project Manager

enc.
EXECUTIVE SUMMARY

GENERAL

The Town of Greybull is located in Big Horn County in north-central Wyoming at the intersection of Highway 20 and Highway 14. The climate in the project area is arid with an average precipitation of about 6.8 inches/year. The economy of the study area is generally agricultural and mining operations, particularly bentonite. The Burlington-Northern Railroad has a yard on the west side of Greybull. Tourism also plays a part in the local economy since Highway 20 is a main route to the east entrance of Yellowstone National Park.

WATER SUPPLY

The Town of Greybull, the community of Shell, and intervening rural users are all served by a common water supply system. At present, the sources of supply are both surface water and groundwater. The former source is Shell Creek, and the latter source(s) are Shell Valley No. 1 and No. 2 Wells. The Point of Diversion on Shell Creek is about three miles east of Shell and the Shell Valley Wells are situated about 3,000 feet southeast of the Community of Shell.

On December 9, 1993, the United States Environmental Protection Agency (EPA) issued a Notice of Violation (NOV) to the Town of Greybull. The NOV cited the water supply system for violation of the Surface Water Treatment Rule (SWTR). Essentially, EPA indicated the Town must comply with the SWTR and provided eighteen months for implementation. The Town has continued using Shell Creek water in combination with their groundwater supply, but has initiated a study effort to evaluate the various options available to them.

AUTHORIZATION

In an effort to conduct a thorough evaluation of their water supply options, the Town of Greybull sought assistance from the Wyoming Water Development Commission (WWDC).
In June 1995, the Wyoming Water Development Commission entered into an engineering services agreement with Nelson Engineering, Inc. of Jackson, Wyoming to provide professional engineering services for completion of a Level II Feasibility Study for the Greybull Water Supply Project.

**SCOPE OF STUDY**

The purpose of this Level II study is to ascertain the most cost-effective means of providing potable water for consumers served by the system. In order to meet that intent, two objectives have been identified:

A. Determine a feasible methodology for the Town to comply with provisions of the EPA Notice of Violation.

B. Verify the capability of the existing transmission line to convey the water required to meet future needs.

**PROCEDURE**

Nelson Engineering gathered all available information from the Greybull Town Hall concerning population, billing records, production records, as built construction drawings, maintenance records, and water rights. A survey of the major components allowed for the evaluation of the hydraulic capability of the transmission line. Past and present population data was examined and a future population projected. Water consumption and production data was tabulated, evaluated and projected for future water demand.

Current supply sources were evaluated for quality, stability, and quantity. Supply alternatives, including modifying existing sources and locating new sources, were examined for regulatory compliance, construction cost, and operation, maintenance, and repair costs. These sources include treating surface water through conventional means as well as new technologies and the addition of new ground water sources.

Operation of the transmission line, recorded pressures, and flow rates were examined to determine efficiency. Deficiencies in physical equipment, operating procedures, and policy were listed for presentation to the Town of Greybull and WWDC.
CONCEPTUAL DESIGN

The scope of work calls for conceptual design of project components previously selected from the Development Plan by the Town of Greybull and WWDC staff. Alternative delivery options and other elements of the development plan were reviewed with the Town and WWDC staff at a progress meeting on August 16, 1995. At that meeting, the Town requested the following items be selected for further study during Conceptual Design:

1) Water Delivery System - A new surface water treatment plant in combination with continued use of Shell Valley Well No's. 1 and 2.

2) Determine cost for leak detection survey of transmission pipeline.

3) Replace the Smith Valve with an appropriate control valve.

4) Replace the Whaley Valve with an appropriate control valve.

5) Inspect the air relief valves, vacuum breaker valves, and blowoff valves and identify ones needing replacement.

6) Design a new flowmeter installation at the chlorination vault east of Shell.

7) Design an aboveground flow meter vault prior to the inlet to the 1.0 MG water tank.

8) Design a telemetering system to collect and transmit operating data from along the transmission pipeline to the Town shop.

In addition, Nelson Engineering completed a refined cost estimate for another groundwater well because that option appeared the most cost effective, if not most desirable.

The reasons for pursuing a surface water treatment plant include the Town's desire to use Shell Creek water due to perceived better taste, the Town's desire to maintain water rights on Shell Creek water, and the fact that the transmission line is already in place from that location. WWDC noted during the August meeting that if the Town, after reviewing the conceptual design for a treatment plant, no longer felt that alternative was a viable option, they could apply for a groundwater exploration program.
REGULATORY CONSTRAINTS

According to the EPA's letter to the Town, dated December 9, 1993, the infiltration gallery collecting water near Shell Creek is under the direct influence of surface water in direct violation of SWTR. Thus, the Town has three options: 1) filter the water from Shell Creek; 2) meet the filtration avoidance criteria to remain unfiltered; or, 3) convert to another water supply source that is not under the direct influence of surface water. However, in any case, the water system would still be required to meet WDEQ regulations on capacity, storage, and redundancy as stated in WDEQ-WQD regulations, Chapter XII.

WATER SUPPLY

In twenty years, the projected maximum and average daily demands for the service area are 1165 gpm and 465 gpm. The current wells have production capacities of 225 gpm (Shell Well No. 1) and 960 gpm (Shell Well No. 2). The two wells combined have enough capacity to meet future demand. However, WDEQ regulations require redundant sources so that demand can be met with the largest source inoperative. The regulations differ for surface water treatment plants and groundwater wells. If treatment plants are involved, the maximum daily demand must be supplied with the largest source inoperative (Shell Well No. 2). Thus a treatment plant must be designed for 950 gpm. If only groundwater is involved, the average daily demand must be supplied with the largest unit inoperative (Shell Well No. 2). Therefore, an additional well would only need to produce 250 gpm.

PROPOSED IMPROVEMENTS

During this study, Nelson Engineering determined that the following items need to be repaired or replaced in order for the transmission line to operate more efficiently.

<table>
<thead>
<tr>
<th>Station</th>
<th>Item</th>
<th>Work</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>56+18</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>63+10</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>156+66</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>187+56</td>
<td>Smith Valve</td>
<td>Replace w/PRV</td>
<td>11,625</td>
</tr>
<tr>
<td>272+43</td>
<td>Blowoff</td>
<td>Repair</td>
<td>700</td>
</tr>
<tr>
<td>298+94</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>318+42</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>Station</td>
<td>Item</td>
<td>Work</td>
<td>Cost</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>355+57</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>404+66</td>
<td>Whaley Valve</td>
<td>Replace w/PRV</td>
<td>11,625</td>
</tr>
<tr>
<td>538+02</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>541+33</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>563+77</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>610+02</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td>609+49</td>
<td>Lucas Valve</td>
<td>Install Low Flow PRV</td>
<td>7,000</td>
</tr>
<tr>
<td>778+75</td>
<td>Air Valve</td>
<td>New Valve</td>
<td>250</td>
</tr>
<tr>
<td>795+40</td>
<td>Air Valve</td>
<td>New Valve</td>
<td>250</td>
</tr>
<tr>
<td>865+20</td>
<td>Flow Meter @1.0 MG Tank</td>
<td>Replace</td>
<td>30,000</td>
</tr>
<tr>
<td>866+50</td>
<td>Air Valve</td>
<td>Replace</td>
<td>3,250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>97,200</td>
</tr>
</tbody>
</table>

Also, due to the 17 mile distance between Town and the water sources, a telemetry system would aid in the operation of the system. The following is a list of locations that need to be monitored or automated, along with construction costs.

<table>
<thead>
<tr>
<th>Location</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greybull Town Shop</td>
<td>$20,500</td>
</tr>
<tr>
<td>Greybull Tank</td>
<td>17,700</td>
</tr>
<tr>
<td>Lucas PRV</td>
<td>18,100</td>
</tr>
<tr>
<td>Whaley PRV</td>
<td>26,000</td>
</tr>
<tr>
<td>Smith PRV</td>
<td>18,100</td>
</tr>
<tr>
<td>Shell Wells</td>
<td>25,400</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$125,800</strong></td>
</tr>
</tbody>
</table>

During this study, discrepancies in usage versus production records, and hydraulic evaluation indicated possible leaks in the transmission line. A leak detection survey was attempted, however, the sound detection equipment was ineffective. A survey using more advanced technology, involving aerial photography, infrared and thermal enhancement photography is necessary. This survey is estimated to cost $27,000. The benefits are to isolate and fix leaks to conserve water and minimize operating costs.

**ECONOMIC ANALYSIS/ABILITY TO PAY**

Several Federal and State agencies are available to assist Greybull in the funding of this project.
Wyoming Water Development Commission - The Commission provides funding for design and construction of qualified types of water supply projects. Funding levels are as follows:

Transmission Line Rehabilitation 50% grant - 50% loan up to 30 years @ 4%
Surface Water Treatment Plant not eligible
Groundwater Exploration Wells 75% up to $200,000 - 25% Community Match
Groundwater Well, Control Tank, Transmission Pipeline, Power Supply (via Level III program) 67% grant - 33% loan

Wyoming State Farm Loan Board (FLB) - Farm Loan Board's present policy is to offer 50% Grant-50% Loan at 7 1/4%. Grant funds are in high demand and shrinking supply, and desirable funding for this water treatment plant could take some time in materializing.

Rural Economic and Community Development (RE&CD) - RE&CD, formerly the Farmers Home Administration, presently offers grant and loan programs for water supply projects. The State funded programs are less costly for the Town of Greybull.

PROJECT COSTS

Estimated Level II and Level III project costs for the alternative projects as presently defined are illustrated below:

Final Cost Estimates - Surface Water Treatment Plant - Level III

Preparation of Final Designs and Specifications $ 125,000
Permitting and Mitigation 1,000
Legal Fees 20,000
Acquisition of Access and ROW 10,000

Cost of Project Components:
Leak Detection Survey $ 27,000
Transmission Line Rehab 97,200
Telemetry System 125,800
Water Treatment Plant 1,457,300

Construction Cost Subtotal #1 $1,707,300
Engineering Costs (CCS#1x10%) 170,730

CCS#2 $1,878,030
Contingency (CC#2x15%) 281,700

Construction Cost Total $2,159,730
Project Cost Total $2,316,000(Rnd)

EXECUTIVE SUMMARY - 6
Cost Estimate Aquifer Test Well - Level II

1. Meetings & results presentation $ 9,500
2. Geology, engineering, and permitting 24,000
3. Consultant services during drilling 50,000
4. Well construction sub-contract 310,000
5. Aquifer flow testing 14,000
6. Water quality testing 4,500
7. Conceptual Design 2,000

Estimated Level II Budget $ 414,000

Final Cost Estimates - Groundwater Project - Level III

Preparation of Final Designs and Specifications $ 49,000
Permitting and Mitigation 4,000
Legal Fees 1,000
Acquisition of Access and ROW 5,000

Cost of Project Components:
- Well (Completed in Level II) $ ----
- Control Tank 35,000
- Wellhouse and Valving 42,000
- Power Extension 30,000
- Assume 1 Mile Pipeline 184,800
- Leak Detection Survey 27,000
- Transmission Line Rehab 97,200
- Telemetry System 125,800

Construction Cost Subtotal #1 $541,800
Engineering Costs (CCS#1x10%) 54,180
CCS#2 $595,980
Contingency (CC#2x15%) 89,400

Construction Cost Total $ 685,380
Project Cost Total $ 744,400(Rnd)

Total Cost Estimate - Groundwater Option

Level II - Aquifer Test Well $ 414,000
Level III - Groundwater Project 744,400

Total Project Cost $1,158,400

EXECUTIVE SUMMARY - 7
Repayment Analysis

Surface Water Treatment Plant

Project Cost: $2,316,000

Components:
  Transmission Line $ 351,390  50% - 50% WWDC
  SWTP 1,964,610  50% - 50% FLB

Greybull's Portion:
  Transmission Line $ 175,695  Annual Cost = $10,160
  SWTP 982,305  Annual Cost = 81,158

Annual Debt Retirement $91,318

Groundwater Wells

Project Cost: $1,158,400

Components:
  Transmission Line $ 351,390  50% - 50% WWDC
  Level II 414,000  33% Drilling cost only
  Level III 393,010  67% - 33% WWDC

Greybull's Portion:
  Transmission Line $ 175,695  Annual Cost = $10,160
  Level II 102,300  Annual Cost = 5,916
  Level III 129,690  Annual Cost = 7,500

Annual Debt Retirement $23,576

An Annual Cost Analysis of both projects is illustrated as follows:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Project Cost</th>
<th>Debt Retire.</th>
<th>OM&amp;R</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWTP</td>
<td>$2,316,000</td>
<td>$91,318</td>
<td>$88,840</td>
<td>$180,158</td>
</tr>
<tr>
<td>Groundwater Well</td>
<td>1,158,000</td>
<td>23,576</td>
<td>11,540</td>
<td>35,116</td>
</tr>
</tbody>
</table>

The Annual Costs translate to an estimated monthly cost for the 1185 users of $12.70/month and $2.47/month respectively.

As illustrated, the groundwater alternative is less initial cost and less annual cost.

EXECUTIVE SUMMARY - 8
CONCLUSIONS

As a result of the water system study, several conclusions can be drawn. They are:

1) Population of the service area is expected to experience limited growth.
2) Pre-determined pressure settings for transmission line control valves would optimize water conveyance.
3) Production records indicate excessive production of water.
4) Treated water is spilled from the 1.0 mg tank unnecessarily.
5) Mainline water meters are not in operating condition.
6) Hydraulic grade line evaluation indicates a leak(s) in the transmission line east of Shell.
7) Air valve vaults do not meet current WDEQ regulations.
8) Air Valves on the transmission line would benefit from a preventative maintenance program.
9) The transmission line can convey up to 1200 gpm at acceptable pressures.
10) The Smith and Whaley gate valves are inappropriately utilized.
11) The Shell Valley Well No's. 1 and 2 can sustain production of 225 gpm and 960 gpm for the next 30+ years.
12) Some services are poorly designed, forcing the Town to operate the water system inefficiently.
13) The Shell Tank is under utilized.
14) A 950 gpm Shell Creek water treatment plant is the most cost-effective alternative meeting local desires and State/Federal regulations.
15) An additional artesian supply well developed in close proximity is the more cost-effective means of increasing the water supply and mitigating the EPA-NOV.
16) The favored funding for this project is via State agencies.
RECOMMENDATIONS

1) The Town needs to progress the water supply improvements in effort to mitigate the EPA Notice of Violation.
2) Greybull should apply to WWDC for a Level II project - aquifer test well at an estimated cost of $414,000.
3) Request a WWDC Level III project for funding of a leak detection survey, a telemetry system, recommended pipeline improvements, and new well appurtenances.
4) Adjust the controls on the 1.0 MG water tank to minimize spillage.
5) The Town should clarify with EPA their full responsibilities for potable water delivery to the rural services.
6) As operators of the water system, the Town should institute several policies regarding consumer hookups to the transmission system.
   A. The system will furnish water at pressure no less than 20 psi at the tap site, west of Sta. 110+00.
   B. East of Sta. 110+00, water shall be furnished, at pressure from 0 to 20 psi.
   C. All services shall include backflow prevention devices at the tap location.
   D. All service taps shall be inspected and approved by Town of Greybull personnel prior to service.
7) The services south of Shell dependent on a full Shell Tank should be replumbed to allow full use of the tank.
8) Review closely the proposed list of improvements in this report and carefully select and prioritize with input from your maintenance staff.
9) Accept the findings in this report and move forward with the supply project while improving on an active preventative maintenance program.