Manderson Water Supply Project
(Basin Area Water Supply Project)

Level II Study

EXECUTIVE SUMMARY

For

WYOMING WATER DEVELOPMENT COMMISSION & SPONSOR

By:

Graham, Dietz & Associates
Consulting Engineers
Cody & Powell, Wyoming

Wester-Wetstein & Associates Inc.
Consultants in Engineers and Hydrogeology
Laramie, Wyoming

November 1994
SUMMARY

Manderson Water Supply Project
(Basin Area Water Supply Project)

Objective

The original scope of the Manderson Water Supply Project was to perform a Level II Feasibility Study of possible water supply sources for the town of Manderson and users in its immediate vicinity. The project was let to Graham, Dietz and Associates, Consulting Engineers; teamed with James M. Montgomery, Consulting Engineers, Inc. in June, 1992. The town of Manderson is the sponsor of the Level II Study being conducted for the Wyoming Water Development Commission (WWDC). JMM subsequently closed their Wyoming office at the end of 1992 and Wester-Wetsstein & Associates, Inc., which was formed by two former JMM employees, was chosen to replace JMM in providing engineering and hydrogeology services.

Discussion

The first phase of the project was completed in October of 1992 and included: meetings, system inventory, area water demand, and proposed alternatives for supplying quality water to this area. The alternatives covered sources from ground water to surface water and existing supplies to newly developed supplies. All in all there were six alternatives and several sub combinations presented before the WWDC, the town of Manderson and other concerned parties.

The option selected was ground water from a new well penetrating target aquifers of Paleozoic age. This alternative would serve Manderson and most likely a large portion of the surrounding area up to and including the people of the Basin area. Other ground water well sources evaluated had less desirable characteristics when viewed over the long term. Surface water in the area proved even less desirable due to the mounting regulations, testing, and because the local streams are extremely silty having traveled through flood irrigated agricultural land.

Of initial interest was the Worland wells (owned by the City of Worland) with their apparent large excess quantity of good water. An early meeting with the Mayor and staff indicated a reluctance to sell water for "domestic" consumption. However they wished to limit new industrial usage outside the Worland area by controlling large taps off any proposed system which used their source. With a minimum of 11 to 12 miles of piping required to bring the water to Manderson, a new well 7 miles away appeared to be as cost effective as 4 to 5 miles of additional piping. Wells drilled as exploratory oil wells which produced water instead, did not have the desired quantity or quality.
and were risky prospects to finish as potable water sources. The existing water wells used by Manderson were rejected due to their quality and redevelopment would not likely improve this situation cost effectively.

Surface water development of either the Big Horn River or the Nowood River was rejected. The increasing regulation and testing would drive up operational expenses in both treatment and testing cost. Basin currently uses a treatment plant which obtains water from the Big Horn River that is a collecting point for chemical laden irrigation runoff. As these chemicals are identified changes in treatment equipment and methods would be required. Basin’s treatment plant would need up-grades soon and the townspeople continue to complain about the taste. For the reasons stated the Basin treatment plant was considered than rejected. Another consideration was that funding for treatment plants is not an eligible WWDC item.

Well Discussion

As all other alternatives were rejected the only remaining suggested alternative was to drill a deep madison formation water well. The Level II Study contained a budget item to construct a deep water exploratory well. Well drilling design was accomplished with the aid of a newly formed hydrogeology consulting firm (Wester-Wetstein & Associates, Inc., Consultants in Engineering & Hydrogeology) made up of the individuals that had been working on the project from James M. Montgomery before JMM pulled out of the state of Wyoming. This shift in subconsultants allowed for continuity to be maintained with little disruption to the project. Wester-Wetstein & Associates, Inc., also oversaw construction and testing operations.

The plans and specifications were developed for a well in the madison formation with testing to also take place in one of the other identified water bearing formations, the Tensleep. The construction of the well was bid March, 1993 with all bids exceeding the proposed budget, so all bids were rejected. After discussion with WWDC, minor changes in the budget were made and the specifications for the construction, were re-bid in April, 1993. The successful bidder was Cyclone Drilling Inc. of Gillette, Wyoming.

The construction was begun in late June 1994 and the bottom hole depth of 5430 feet was reached on July 14th, 1993. The original plan depth was exceeded by over 1000 feet and actually entered another water bearing formation, the big horn. Testing followed of the quantity and quality of water. The tests on quality showed that it would meet Environmental Protection Agency EPA drinking water standards. All elements and compounds checked were below the limits set by the EPA. The well which is referred to as Wild Horse #1 is located about 7 miles from Manderson in Section 17, Township 50 North, Range 91 West in the Southwest Corner. A safe-yield analysis using parameters obtained from aquifer performance tests of the well
indicated that the well would be capable of producing 270 gpm assuming continuous use over a 40 year period.

These results were presented at a joint meeting involving the WWDC, Manderson, and surrounding area. At this fall meeting several things became apparent. (1) There were more people desirous of good quality water in the immediately surrounding area than were covered by the scope of the project. (2) There was not sufficient water to meet the needs of the greater area which included the town of Basin. After some discussion and evaluation of possible options, a course of action was developed. The representatives to the WWDC would request expansion of the scope to include the town of Basin, a rural district which would cover from the Greybull River South to the Washakie County line, and fracture enhancement of the well in hopes of increasing the flow.

During the winter months and early spring of 1994 the scope of the project was increased to formally include Basin and the rural residents of South Big Horn County. The rural residents formed an improvement district in which a vote indicated 95% were in favor of district formation. With the inclusion of these public entities into the project, the number of people to be served increased dramatically since Basin alone has a population of 1180 vs. Manderson with 83.

The hydraulic fracture of Wild Horse #1 took place during June, 1994 and was performed by Dowell Schlumberger. A workover rig was then contracted to clean the well of frac sand left behind by the fracture operation. Post-frac testing of the well indicated an improvement in the production and the specific capacity of the well even though the effective transmissivity was not greatly affected. The increased production is thought to be a result of a decrease in non-linear head loss as water enters the well from the aquifer. Thus, although the effective transmissivity was not enhanced, the fracture did stimulate well production.

Even though production was increased, the Wild Horse #1 well is still not able to meet the long-term demands of the enlarged service area. Therefore it is the recommendation of this study to drill another well about a mile away from the present well into the Paleozoic madison and possibly the big horn formations. From the information gained, the risk in hitting a dry hole is slim and the likelihood of a well as productive or more than the present well, is great. The cost of such a well would be no more than the additional storage that would be required if it was not drilled. The DEQ requires an additional day's worth of storage if a backup source is not available. Other benefits of a second well would be servicing. Should one well need to be worked on the other could meet most of the demand for short periods of time. It is proposed that the second well be drilled during 1995 along with the final design work on the transmission main from the wells to Manderson, Basin, and South Big Horn County Hospital.
The routing proposed to serve the communities and rural residents follows existing public easements were possible. This is due to the lay of the land and development of the river bottom ground for agriculture. The majority of the population resides along these routes. The transmission line would then be along the routes of greatest population density. This would allow direct service to many of the rural residents as well as serving the population centers.

The rural district began its efforts with a mailing to the rural population toward the end of 1993. In this mailing, a monetary commitment of $200.00 was requested for each tap. The cost range for the new taps were estimated to be in the range of $40.00 to $60.00 for the rural district.

The directors, working closely with the engineer wished to develop a system that would have a cost of about $45.00 per month, per tap. With these guidelines in place it was determined that a density of 5 taps per mile would need to be maintained to keep the costs in this range. There are several areas that would not be able to be served under this criteria, however piping was sized to accommodate moderate growth in the system into these areas in the future.

Five identifiable regions were established and costs were developed, which were: South Greybull, Basin Gardens Road, Orchard Bench, Rairden, and Nowood; serving 31, 14, 66, 47, and 10 taps respectively. (See table 1 for cost summary). These areas and costs are identified in addition to the main line from the wells to the South Big Horn County Hospital.

Construction

Conditions present in the Wild Horse No. 1 well affect the pipeline directly. The well temperature is over 90 degrees F. at the well head and has a shut in pressure over 260 psi. Due to the high temperature of the water, the pressure class of the pipe must be down-rated. For example, Class 150 pipe must be down-rated to a working pressure of approximately 120 psi for a water temperature of 90 degrees. The well head pressure is sufficient to fill two proposed storage tanks located on a ridge west of the well without the assistance of a pump.

The relatively high pressures at the well head will require steel piping between the wells and the two 62,000 gallon storage tanks (Figure IV-1). From the tanks to Manderson, 12" AWWA C-900 Class 150 PVC pipe is proposed. Outside Manderson to the Rairden takeoff due to the increased pressure class 200 will be used and then is reduced to Class 150 from that point to Basin. Eight inch AWWA C-900 Class 150 PVC pipe is proposed from Basin to the South Big Horn County Hospital. It is important to note that the relatively high temperature of the water requires an increased pressure class for the pipe. The entire pipeline system will adequately supply water to the communities and outlying rural area with no pumps or booster
stations along the route. Most areas can be served with 50 to 60 psi or more except the Highway 433 area in the Rairden segment which will have lower pressure because the pipeline is going against grade.

The pipeline will supply water at Manderson directly into their distribution system after going through a pressure reducing station. The storage up line and at the well will be sufficient to eliminate their storage tank but it can be used if Manderson so desires. At Basin the pipeline will go directly into the existing storage tanks for distribution to Basin, South Greybull, South Big Horn County Hospital, and Basin Gardens Road. The storage at the wells and at Basin will make up the storage for the entire system.

At Basin there will be a control and rechlorination facility. This facility will be able to control and check functions back at the well through telemetry. Located near the Basin storage tanks there is almost a direct line of sight to the wells, allowing ideal conditions for telemetry controls. Should rechlorination be necessary it can be added at this facility to retain the level of residual chlorine required at the ends of the system.

The proposed system has included loops when practical and hookup/metering vaults at the ends of the system where future connections with either Worland’s or Greybull’s systems may occur. These were included to increase the efficiency of the system and allow for an emergency supply at some point down the road if these systems were connected.

System Controls

With three public entities working in close cooperation on this project, it seems only natural that they would form a Joint Powers Board to oversee the new water supply and system. Manderson, Basin, and the South Big Horn County Water District are in the process of forming a Joint Powers Board that should be established in late 1994 or early 1995 to oversee the entire project. Through the course of the project, costs have been reviewed very closely, particularly the distribution of cost among the different users.

A brief breakdown of costs as they apply to each entity is contained below.

All (Manderson, Basin, South Big Horn County Water District)

<table>
<thead>
<tr>
<th>Entities</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Second Well</td>
<td>$341,600.00</td>
</tr>
<tr>
<td>Transmission Main</td>
<td>$3,993,400.00</td>
</tr>
</tbody>
</table>
- Purchase Existing Well $340,000.00
- Final Design and Specifications $345,000.00
- Permitting and Mitigation $25,000.00
- Legal Fees & Administration $15,000.00
- Acquisition of Access and Right-of-Way $49,000.00

Subtotal $5,104,000.00

**Manderson**
- Manderson Pressure Reducing Station $50,100.00

Subtotal $50,100.00

**Basin**
- Basin Metering & Rechlorination Facility $84,800.00

Subtotal $84,800.00

**South Big Horn County Water District**
- Rural Transmission Main $3,852,200.00
- Final Design and Specifications $250,000.00
- Permitting and Mitigation $15,000.00
- Legal Fees & Administration $15,000.00
- Acquisition of Access and Right-of-Way $10,000.00

Subtotal $4,142,200.00

Grand Total $9,381,100.00

These costs and the proposed year in which the expenditure is expected are shown in the appendix, pages 1-3.

An expenditure schedule was developed to aid the funding agency’s budget for the upcoming 3 years. The proposed funding for the project will come from 4 identified sources at this time. They are: State of Wyoming; Wyoming Water Development Commission (Grant); U.S. Department of Agriculture; Farmers Home Administration/Rural Development Administration (Grant and Loan); State of Wyoming; Farm Loan Board (Grant); and South Big Horn County Water District (Tap Fee). The estimated proposed breakdown is as follows:
1. Wyoming Water Development Commission (Grant) $6,060,100.00
2. Rural Development Administration (Grant) $1,542,325.00
3. Rural Development Administration (Loan 5.25%, 30 years) $1,542,325.00
4. Wyoming Farm Loan Board (Grant) $168,250.00
5. South Big Horn County Water District $68,100.00

TOTAL $9,381,100.00

The proposed grants to this quality project would reach near 84% of the total costs, allowing the people of South Big Horn County quality water at an affordable price. With an inclusion of an estimated $140,000 to cover annual costs, such as operation, maintenance, and capital depreciation reserve, the cost will be on an average with other parts of the state.

The town of Manderson will share in the cost of the transmission main, wells, their pressure reducing facility and should have an individual home tap fee less than $25.00 per month. The town of Basin will share in the transmission main, wells, their rechlorination and control facility, and with their existing water debt have tap fees less than $30.00 per month. South Big Horn County Water District will share in the transmission main, wells, secondary transmission main, and will be able to charge less than $45.00 per month for an individual tap.

The costs outlined are based on a projected 820 individual taps in the system. It does not include commercial or industrial fees which will be left up to the Joint Powers Board to establish as these taps are likely to be larger than the 3/4 inch typical household tap existing and proposed in the system.

Final Recommendation

The project has had an incredible level of cooperation and support from the local people, which is due to their desire to improve their existing water quality that is not acceptable today. The additional benefits of the proposed system would include higher property values, better fire protection, and improved convenience of supply. If completed, the project will lead to a better quality of life for the residents of South Big Horn County. While the cost to individuals is somewhat higher than at present, it is still an affordable project due to the high level of grant participation. The agencies identified have applications in hand and are supportive of the project as outlined and are budgeting for the project.
**BASIN AREA WATER SUPPLY PROJECT**  
MANDERSON WATER SUPPLY PROJECT LEVEL II STUDY  

**1995 EXPENDITURES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Preparation of Final Design and Specifications for Main</td>
<td>$345,000</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td>$25,000</td>
</tr>
<tr>
<td>Legal Fees</td>
<td>$15,000</td>
</tr>
<tr>
<td>Acquisition of Access and Rights-of-Way</td>
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**Cost of Project Components**

<table>
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<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill second Manderson well</td>
<td>$270,000</td>
</tr>
</tbody>
</table>

**Construction Cost Subtotal #1**  
$270,000

**Engineering Costs = CCS #1 X 10%**  
$27,000

**Subtotal #2**  
$297,000

**Contingency = Subtotal #2 X 15%**  
$44,600

**Construction Cost Total**  
$341,600

**Project Cost Total**  
$770,600

GRAHAM, DIETZ & ASSOCIATES  
WESTER-WETSTEIN & ASSOCIATES INC.

PAGE 1
BASIN AREA WATER SUPPLY PROJECT
MANDERSON WATER SUPPLY PROJECT LEVEL II STUDY

1996 EXPENDITURES

Preparation of Final Design For Rural Systems $250,000
Permitting and Mitigation $15,000
Legal Fees $15,000
Acquisition of Access and Rights-of-Way $10,000

Cost of Project Components
Construction of main from wells to county hospital $3,156,800
Manderson pressure reducing station $39,600
Basin metering & rechlorination facility $67,000

Construction Cost Subtotal #1 $3,263,400
Engineering Costs = CCS #1 X 10% $326,300
Subtotal #2 $3,589,700
Contingency = Subtotal #2 X 15% $538,500

Construction Cost Total $4,128,200

Project Cost Total $4,418,200

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PAGE 2
BASIN AREA WATER SUPPLY PROJECT
MANDERSON WATER SUPPLY PROJECT LEVEL II STUDY

1996-1997 EXPENDITURES

Preparation of Final Design For Rural Systems $0
Permitting and Mitigation $0
Legal Fees $0
Acquisition of Access and Rights-of-Way $0

Cost of Project Components

Construct rural water system $3,045,200

Construction Cost Subtotal #1 $3,045,200

Engineering Costs = CCS #1 X 10% $304,500

Subtotal #2 $3,349,700

Contingency = Subtotal #2 X 15% $502,500

Construction Cost Total $3,852,200

Purchase Wildhorse #1 Well $340,000

Project Cost Total $4,192,200

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PAGE 3
MANDERSON WATER SUPPLY PROJECT
PROPOSED TRANSMISSION AND DISTRIBUTION SYSTEMS

FIGURE IV-1