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EXECUTIVE SUMMARY
OF
FINAL REPORT
BAIROIL WATER SUPPLY PROJECT
LEVEL II
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FINAL REPORT
BAIROIL WATER SUPPLY PROJECT
LEVEL II

Prepared for:
State of Wyoming
Water Development Commission

Prepared by:
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760 Whalers Way, Suite B200
Fort Collins, CO 80526

May 19, 2000
1.0 INTRODUCTION

1.1 General

The Town of Bairoil (Town) is located 40 miles north of Rawlins on Highway 73 in Sweetwater County, Wyoming. The purpose of this project was to evaluate the existing system and to make recommendations for the development of an additional long-term, reliable water supply source.

The Bairoil water system is classified as a community water supply (EPA, 1998) and provides water for an average daily resident population of 160 through 65 active service connections. It also supplies water to the Bairoil School and several commercial establishments. The Town presently receives its water supply from two sources:

- Abel Springs: Primary Source
- Battle Springs Wellfield: Supplemental Source

The Town has concerns about both the quality and the quantity of water provided by Abel Springs. The main supply from Abel Springs does not provide sufficient water to supply the Town during the peak demand periods. During these periods, the Abel Springs source is supplemented by water from deep Battle Springs wells in the Battle Springs wellfield, owned and operated by Merit Energy, Inc. (previously by BP-Amoco). The Merit Energy wells and transmission line into the Town are expensive to operate because of the pumping depths and long transmission distance. Use of these wells and transmission line are further compounded by operational issues associated with the transmission line. The Town does not currently pay for water from these wells and is concerned that they may not be able to use water from this source indefinitely. Therefore, the Town would like to be independent of the Battle Springs wellfield.

1.2 Existing Water System

The Abel Springs source was developed in the 1950’s. The springs are located approximately three miles northwest of the Town and provides an estimated flow of 35 to 100 gallons per minute (gpm) from an infiltration gallery. The springs provide a good quality water supply; however, they are susceptible to drought and reportedly fail to provide a satisfactory water supply during dry times.

The Battle Springs wellfield comprises six deep wells screened in the Battle Springs Aquifer with individual reported yields of 347 to 589 gpm and a combined yield for all wells of approximately 2,650 gpm. These wells provide a backup source and additional fire capacity (source redundancy) for the Town. These wells are 1,000 to 1,300 feet deep and are located 13 to 18 miles
west of the Town. The primary purpose of these wells is to supply water Merit Energy production facilities through a Merit Energy owned and maintained pipeline. In 1984 the Town constructed a 2,500-foot, 4-inch PVC pipeline to connect the Merit Energy transmission line to the Town’s storage tank.

The Town’s potable water is disinfected with chlorine gas injection prior to going into the storage tank. No other treatment is applied to the water. Storage for the water system is in a 350,000 gallon covered steel tank built in 1985. The tank is structurally sound, well maintained and in good condition. Treated water from the storage tank to the distribution system is gravity conveyed by a single, 4,100 feet long, 10-inch PVC pipeline to the entrance of the distribution system. The distribution system is also gravity-based.

1.3 Purpose and Scope of Project

The WWDC (Wyoming Water Development Commission) and the Town of Bairoil sponsored this Level II investigation to locate a suitable alternative water source for the Town. Project funding stipulated that the proposed source should provide the minimum anticipated quantity and quality to meet the Town’s needs for the minimum life of the project loan or an estimated 30 years. In conjunction with identifying the location and yield of the proposed water source, LA was directed to prepare conceptual designs and cost estimates for a transmission line to convey water from the source to the existing distribution system. This Level II investigation identified and investigated the following alternative water supply options:

- Upgrade the existing infiltration gallery.
- Develop a ground water source from the Battle Springs Formation.
- Develop a ground water source from the Fort Union Formation.
- Construct an infiltration gallery in Camp Creek.
- Purchase the deep Battle Springs Formation wells which currently provide a backup water supply.

Based on the evaluation of the data and determination of each source’s potential for success, LA completed a well in the Battle Springs Formation. The Battle Springs Formation is widely mineralized with uranium in the Bairoil vicinity. On previous projects, LA has found that radionuclide concentrations are closely related to the proximity of uranium ore deposits and that radionuclide concentrations in ground water decrease sharply away from ore bodies. Therefore, the exploration program included an evaluation of uranium mining records and exploration data to help define the location of mineralized zones in proximity to the Town of Bairoil. Following the evaluation of historical data, three new boreholes, one well, and three soil pits were logged and tested. The water quality from the completed well was tested and its sustainable yield was determined by a series of aquifer tests. Preliminary design work and cost estimates were prepared to develop a water supply from the Battle Springs Formation and to upgrade the Abel Springs infiltration gallery.
2.0 WATER DEMAND

Few detailed records of water consumption exist for the Town of Bairoil. A flow meter was installed in the transmission line exiting the water storage tank in January 1997. Unfortunately, the meter ceased to work after one year and metered records are only available for 1997. The records indicate that the daily water usage varied from a low average of 30,000 gallons to a maximum daily usage of approximately 150,000 gallons. Over the entire year of 1997, water usage averaged 56,260 gallons per day. Assuming that 160 people are provided with water, this translates to a daily usage ranging from 187.5 gallons per day (gpd) to 937.5 gpd per person. Using the metered records, the following demand estimates were determined.

<table>
<thead>
<tr>
<th>Water Demand Estimates for the Town of Bairoil (Current and Future)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Average Daily</td>
</tr>
<tr>
<td>Maximum Daily</td>
</tr>
<tr>
<td>Peak Hourly</td>
</tr>
</tbody>
</table>

The maximum daily demand was used to establish the design capacity of the system. Since the existing maximum daily demand for the Town of Bairoil is 150,000 gpd (105 gpm), the supply source should provide water at a rate equal to or greater than 105 gpm.

The storage requirements of the Town were also evaluated and it was determined that the Town has sufficient storage with the existing 350,000 gallon storage tank.

3.0 POTENTIAL WATER SUPPLY ALTERNATIVES

Four alternatives were identified and evaluated in the development of a long-term, reliable supply for the Town of Bairoil. All four alternatives are ground water sources – two alternatives would use the Quaternary alluvial or colluvial aquifer and two alternatives would utilize a deep Tertiary ground water source. These alternatives are described below.

Alternative 1. Complete a new well in the Battle Springs Formation or the Fort Union Formation and run a connecting pipeline to the existing Abel Springs pipeline or directly into the Town.

This was the preferred alternative because: (1) the Battle Springs Formation is an established ground water source which generally provides a relatively safe, low maintenance water supply of consistent quality; (2) a potential source of good quality ground water in the Battle Springs Formation could be located relatively close to Abel Springs; therefore, the construction cost to provide a transmission line from the well to a connection with the Abel Springs transmission line would be relatively low; and (3) a ground water source is likely to meet future regulatory requirements, whereas surface water may be subject to additional treatment requirements in the near future.
future. A field program was undertaken to find, test and develop a new ground water supply for this alternative.

**Alternative 2. Redevelop the existing Abel Springs infiltration gallery.**

This alternative was also recommended because Abel Springs is a moderately-yielding, high quality well water supply for the Town. It is known to provide good quality drinking water with negligible concentrations of radionuclides. Further, construction costs to expand the infiltration gallery would be relatively low.

**Alternative 3. Develop a new infiltration gallery in the adjacent Little Camp Creek Drainage.**

This alternative was not recommended because the Little Camp Creek drainage did not appear to have much potential for a suitable infiltration gallery, and the water transmission and pumping costs would be high.

**Alternative 4. Purchase a portion of the Battle Springs wellfield and pipeline from Merit Energy.**

This alternative was not considered viable because only one of the wells in the wellfield meets WDEQ/WQD drinking water quality standards for radionuclides. In addition, the system has exceeded its design life and would require systematic replacement. The operational costs and the maintenance requirements of the pipeline to serve only as a supplemental water supply could be prohibitive to the Town.

**4.0 GROUND WATER EXPLORATION AND DEVELOPMENT**

A ground water exploration and development program was undertaken to find a ground water supply. The geology of the area was reviewed to find areas which had the potential to provide an abundant source of good quality ground water. The hydrogeology of the area was investigated and the principal aquifer of interest was the Battle Springs Aquifer. Secondary investigations were completed in the Fort Union Formation and the alluvium.

Exploration boreholes were sited and drilled at three locations: two in the Battle Springs Formation and the third in the Fort Union Formation. Each of the boreholes was geologically and geophysically logged. A test well was installed at the borehole site with the best developed sands and lowest gamma counts. This test well, Bairoil 2A, was completed to a depth of 580 feet in the Battle Springs Formation. A multiple screen completion was used to maximize water yield from separate sand layers. After the well had been completed, it was developed and pump tested. These pump tests indicated that the well should be able to sustain pumping at 75 gpm. Water quality samples indicated the well will supply a calcium-bicarbonate type water which meets the WDEQ/WQD Chapter VIII Class I water quality standards and the National Primary Drinking Water Standards for drinking water. Radium levels were acceptable and meet EPA standards.
5.0 CONCEPTUAL DESIGNS AND COST ESTIMATES

Conceptual designs and cost estimates were prepared for the two most viable alternatives and for additional recommended work to the distribution system. These designs and cost estimates are discussed in the following sections.

5.1 Alternative 1: New Well and Transmission Line

This alternative includes the design effort and costs to integrate Bairoil 2A well, constructed in this Level II Investigation, into the Bairoil water system. The cost estimate for this work is $654,000. These costs include the design and construction of a transmission line with the associated valves and fittings from the new source well to the existing system at Abel Springs; single phase power extended from the well to the nearest existing transformer; a pump, controls and telemetry; and the Town’s purchase of the previously completed well.

5.2 Alternative 2: Abel Springs Redevelopment and Expansion

This alternative presents an approach to expand the Abel Springs infiltration gallery, to reduce water losses between the infiltration gallery and the Bairoil storage tank, and to reduce any losses from the collection boxes. The investigation and design of the infiltration gallery would include: (1) mapping the existing infiltration gallery; (2) evaluation of the infiltration gallery using native material as backfill; (3) evaluation of the infiltration gallery using various sand and gravel filter materials as backfill; (4) development of specifications for the screen (slot size and open area); (5) evaluation of conveyance within the transmission line; and (6) assessment of the potential clogging of the infiltration gallery. In addition, losses from the infiltration gallery and the transmission line would be evaluated and plans would be prepared to reduce system losses. The cost estimate for the investigation, rehabilitation and expansion of the infiltration gallery is $190,000.

5.3 Distribution System Improvements and Miscellaneous Work

Distribution modifications would result in a more efficient and easily maintained system with more balanced water pressures throughout. The cost estimate for these improvements is $237,000. This cost estimate includes the addition of a new distribution line; the removal of dead-end mains; the closure of some loops in the system; the addition of some valves and fire hydrants; a leak detection survey; a survey of easements; and the abandonment of old alluvial wells and old storage tanks.
6.0 PERMITTING AND ENVIRONMENTAL ISSUES

For this project to proceed with construction, the Town of Bairoil will be required to obtain certain permits, rights-of-way, and easements. State, county, and federal agencies must be contacted as part of the Level III process. In some instances, the initial contacts have already been made. The following issues for each alternative must be addressed during final design.

Alternative 1: New Well and Transmission Line

- Easements: Bureau of Land Management (BLM) and the Sun Ranch.
  The BLM permit will require clearance for the proposed activities from the State Historic Preservation Office (SHPO) and the US Fish and Wildlife Service (USFWS).
- USACE §404 Permit
- WDEQ/WQD Permit to Construct
- Water Rights Permit
- Power Company Coordination

Alternative 2: Abel Springs Redevelopment and Expansion

- Easements: BLM, Sun Ranch
- USACE §404 Permit
- WDEQ/WDQ Permit to Construct
- Water Rights Permit

Distribution System Improvements

- WDEQ/WQD Permit to Construct

7.0 ECONOMIC ANALYSIS AND ABILITY TO PAY

Economic analyses were prepared for the following three tasks.

- Battle Springs ground water supply development
- Abel Springs redevelopment and expansion
- Distribution system improvements

Several potential sources for funding this project were evaluated. These include the following: (1) Private financing through the Town of Bairoil; (2) Wyoming Water Development Commission; (3) Rural Utilities Service (RUS) Loan; (4) Wyoming State Revolving Fund (SRF); (5) Wyoming Mineral Fund Loan; and (6) Wyoming State Lands and Investments Loan. The Town of Bairoil determined that they would not apply for RUS or SRF funding. Therefore, LA has only presented the WWDC funding option for the WWDC-eligible projects.
### Financing for Battle Springs Ground Water Supply Development

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction cost WWDC eligible</td>
<td>$654,450.00</td>
</tr>
<tr>
<td>WWDC 60-percent Grant</td>
<td>$392,670.00</td>
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<tr>
<td>Loan Amount</td>
<td>$261,780.00</td>
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<tr>
<td>WWDC Loan @ 7.25% - 30 yr.</td>
<td>($1,775.08)</td>
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#### Additional Monthly Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorination</td>
<td>$100.00</td>
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<tr>
<td>Easements</td>
<td>$2.50</td>
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<tr>
<td>Pumping Cost</td>
<td>$161.10</td>
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<tr>
<td>Labor</td>
<td>$520.00</td>
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#### Long-term Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Pump replacements</td>
<td>$22.22</td>
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#### Totals

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Monthly Cost</td>
<td>($2,580.90)</td>
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<tr>
<td>Total Monthly Tap cost @ 65 taps</td>
<td>($39.71)</td>
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</tbody>
</table>

### Financing for Abel Springs Redevelopment and Expansion

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Cost</td>
<td>$190,000.00</td>
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<tr>
<td>WWDC 60-percent Grant</td>
<td>$114,000.00</td>
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<tr>
<td>Loan Amount</td>
<td>$76,000.00</td>
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<tr>
<td>WWDC Loan @ 7.25% - 30 yr.</td>
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#### Total

<table>
<thead>
<tr>
<th>Item</th>
<th>Financing Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Tap Cost w/ 65 taps</td>
<td>($7.93)</td>
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</table>
## Financing Alternatives for Distribution System Improvements

<table>
<thead>
<tr>
<th>Item</th>
<th>Option 1 SLIB</th>
<th>Option 2 SRF</th>
<th>Option 3 RUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Community Cost</td>
<td>$118,690.44</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Loan Amount</td>
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<td>$237,380.00</td>
<td>$237,380.00</td>
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<tr>
<td>State Loan and Investment Board (SLIB)</td>
<td>($804.81)</td>
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<td>-----</td>
</tr>
<tr>
<td>Monthly Payment @ 7.25% for 30 yrs.</td>
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<td></td>
</tr>
<tr>
<td>State Revolving Fund Loan (SRF)</td>
<td>-----</td>
<td>($1,433.70)</td>
<td>-----</td>
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<tr>
<td>Monthly Payment @ 4% for 20 yrs.</td>
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<tr>
<td>Rural Utilities Service Loan (RUS)</td>
<td>-----</td>
<td>-----</td>
<td>($1,341.67)</td>
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<tr>
<td>Monthly Payment @ 5.5% for 30 yrs.</td>
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<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Tap Cost w/ 65 taps</td>
<td>($12.38)</td>
<td>($22.06)</td>
<td>($20.64)</td>
</tr>
</tbody>
</table>
8.0 RECOMMENDATIONS

Based on this investigation, LA recommends the following work:

1. **Utilize the new Battle Springs well.** This well, Bairoil 2A, was installed during the Level II investigation and should be tied in to the water system.

2. **Rehabilitate and expand the Abel Springs infiltration gallery.** This alternative is considered a viable means of increasing the quantity of high quality Abel Springs water in the system, with an estimated increase in yield of approximately 20 to 30 percent. Even if the infiltration gallery is not rehabilitated, it should be kept online.

3. **Make improvements to the distribution system.** Improvements will increase water pressures throughout the system and maintain system pressures during fire flow. They should also improve the water quality.

4. **Remove old water system components.** The old storage tanks and water system components should be removed. Since they are still partially connected to the existing system, they are a source of contamination. Isolating and removing these abandoned components will improve overall water quality.

5. **Perform miscellaneous work.** As defined below:
   - Conduct a leak detection survey of the distribution system.
   - Replace the broken transmission line meter.
   - Add water meters at the points of service.
   - Repair broken seals and welds at the Abel Springs collection boxes.
   - Fence off the collection area from livestock.
   - Repair the altitude valve on the Battle Springs line.
   - Install a backflow preventer at the junction between the ¾-inch service line to the corrals and the distribution line, if one is not already in place.

6. **Clarify or obtain all easements.**

7. **The Merit Energy’s Battle Springs wellfield should be kept on line to meet high demand flows as long as there is no cost to the Town.**

8. **Drill a second Battle Springs well for redundant supply.**

8.1 Operations and Maintenance Consideration

If the above recommendations are implemented and using the chlorination system already in place, the Town should be able to meet anticipated future EPA ground water treatment rules without any change in the personnel requirements to operate the system.