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EXECUTIVE SUMMARY
LEVEL II FEASIBILITY STUDY

SHOSHONI WATER SUPPLY SYSTEM REHABILITATION PROJECT

PREPARED FOR WYOMING WATER DEVELOPMENT COMMISSION

JANUARY, 1991

CIVIL ENGINEERING PROFESSIONALS, INC. CEPI
IN ASSOCIATION WITH JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.
EXECUTIVE SUMMARY

SHOSHONI WATER SUPPLY REHABILITATION PROJECT

INTRODUCTION:

The Town of Shoshoni, a community of approximately 500 residents, is located just east of Boysen Reservoir in Fremont County, Wyoming (See Figure 1). The Town owns and operates a public water supply and distribution system. The system provides potable water to the Town, as well as to a small number of rural customers. Water is obtained from four wells located west of Town, and is delivered to the Town's distribution system through approximately 5.4 miles of water transmission pipelines (See Figure 2). A one-half million gallon ground storage tank is utilized to provide peak day and fire flows. Portions of the operational water supply system are over 60 years old.

In the past, water customers have complained to the Water Department that low water pressures were being noted at their services. These low pressures generally coincided with hot summer days when widespread lawn watering was being performed. Although water metering has not been performed in the past to discourage excessive water usage, Shoshoni is presently pursuing a meter installation program.

In 1989 the Town of Shoshoni applied to the Wyoming Water Development Commission (WWDC) for assistance with an investigation of the rehabilitation needs for their water system, citing among other considerations the complaints received about low water pressures. The Town's application for assistance was approved at the 1990 State Legislative Session and a Level II Feasibility Study was authorized. Since guidelines specify that only water supply system concerns may be funded with WWDC monies, Shoshoni's water distribution network was specifically excluded.
FIGURE 1
PROJECT LOCATION MAP
SHOSHONI
WATER SUPPLY SYSTEM
REHABILITATION PROJECT

Civil Engineering Professionals, Inc.
PROJECT STUDY AREA

LEGEND

- Line A
- Line B
- Line C
- Line D
- Existing Well
- Existing Water Tank
- Existing Valve

FIGURE 2
SELECTED IMPROVEMENTS
SHOSHONEI WATER SUPPLY SYSTEM REHABILITATION PROJECT

Civil Engineering Professionals, Inc.
The purpose of the Level II study was to conduct an inventory of the Town's water supply wells, conveyance pipelines, and storage tank (Phase I), and prepare conceptual designs and cost estimates for the appropriate repairs/improvements (Phase II).

**PHASE I STUDY**

The Phase I portion of the Study consisted of a field inventory and analytical investigations of the components of Shoshoni's water supply system. The field inventory was conducted through visual inspections, field surveys, excavation of key system components, well performance testing, and water quality evaluations.

In order to establish the required performance criteria of the water supply system to meet the particular needs of the Town of Shoshoni, basic data such as population projections, water usage rates, and operational procedures were investigated. A 40 year study period from 1990 to 2030 was used as the planning period for the Study.

For the purpose of the Study, the population of Shoshoni was projected to increase beyond its present 500 people at an annual rate of approximately 2.2 percent, equating to a population in the year 2030 of 1200. Water usage was estimated assuming that a metering system will have been instituted, and that the system will experience water usages typical of similar Wyoming towns with metered water systems. Average day water usage for the metered system was projected to be 300 gallons per capita per day (gpcd), with peak day flows of 650 gpcd - significantly less than presently experienced pre-metered flows of 725 gpcd and 1350
gpcd, respectively. From a present system operational perspective, the most significant item noted was that the Town operates its wellfield totally on a manual basis.

**Wellfield:**

Each of the four water supply wells, locally known as Wells No. 1 through No. 4 (See Figure 2), were investigated through review of the available historic records, field testing, and analytical evaluations. In addition, production and potential characteristics of the Wind River aquifer, the source of Shoshoni's well water, were evaluated. Well No. 1, although performing satisfactorily with regards to productivity and sand production, was noted to have several defects. The relative inaccessibility of the well location within the utilities superintendent's residence, the presence of environmental liabilities, inefficient pump operation, and a poor location with respect to possible future disinfection requirements were noted as Well No. 1 defects. Well No. 2 was noted to be one of the best producing wells in the system, although a need was identified for larger, more efficient pumping equipment. Well No. 3 was noted to have several critical flaws, among which were significant gas production, worn pumping equipment, and construction that precludes deepening the pump setting. Well No. 4, the newest well in the field, was noted to be a good producing well. However, the well construction product was noted to be deficient in that encrustation, corrosion, and microbial growth may result from improperly constructed torch slotted casing intervals. As a result of the well investigations, it was determined that Wells No. 1 and No. 3 should be upgraded or replaced, Well No. 2 should be provided with upgraded pumping equipment, and Well No. 4 should be relegated to a backup source for the water supply.

Aquifer evaluations performed for the Study indicate trans-
missivites consistent with those determined in previous investigations made in 1966. Historical data indicate that the static water level in the wellfield has declined approximately 100 feet since the advent of the wellfield. Theoretical analyses of aquifer conditions indicate that the Wind River aquifer is capable of yielding water to the wellfield for the foreseeable future. Well yield, however, is primarily dictated by well design and construction, particularly constraints imposed by limited pump setting depths.

**Water Quality:**

Water quality investigations performed for the Study indicate that groundwater developed by the Shoshoni wellfield is characteristically high in the analytes of sodium, sulfates, fluoride, and Total Dissolved Solids (TDS). Although each of the four analytes were found in concentrations less than those mandated by EPA Primary Drinking Water Standards, all but sodium exceeded EPA Recommended Secondary Standards. All other EPA mandated limits for volatile organic compounds, trihalomethanes, and herbicides and pesticides were met. The Town of Shoshoni presently does not perform any water treatment - raw well water is provided to the customers. Since each of the elevated analytes identified in the water quality evaluation are within Primary Drinking Water Standards, EPA personnel suggest that no provisions for water treatment other than for disinfection be made at this time.

As a matter of facilities planning performed for the Study, the expected implementation of EPA mandated disinfection requirements for groundwater source water systems was evaluated for possible impact to the Town of Shoshoni. Suggested water supply facilities rehabilitation measures proposed in the Study were evaluated for future integration into a chlorine dosing system to
Transmission Pipelines:

Approximately 5.4 miles of water transmission pipelines are utilized in the Shoshoni water supply system. In an effort to determine the condition of these facilities, segments of the pipelines were excavated for inspection, for a corrosion evaluation, and for mapping purposes. In addition, select segments were cut into and inspected for interior conditions. For the purpose of this Study the pipeline system was divided into segments denoted as "Lines A, B, C, and D" (See Figure 2). Line "A", an 8-inch diameter cast iron pipeline approximately 60 years old, delivers water from Wells No. 2 and No. 3 to the vicinity of the water storage tank. This pipeline was found to be in good condition with the exception that the entire length is provided with inadequate soil cover depths. There is concern that upon meter installation and implementation of a consumption based billing program that segments of the water supply pipeline system will be prone to freezing. Whereas customers have become accustomed to flowing water in their sinks, and the water department has routinely allowed storage tank overflows, it is feared that the elimination of these practices during cold weather periods will cause acute freezing problems. For this reason, it was recommended that Line "A" be mounded with additional soil cover to a total depth of 5 feet - a standard construction practice in this region.

Line "B", a 10-inch diameter ductile iron pipeline approximately 26 years old, delivers water between the water storage tank and the Town's distribution system. This pipeline was found to be in excellent condition.

Line "C", a 6-inch diameter cast iron pipeline approximately
60 years old, roughly parallels Line "B", and also picks up discharge production from Well No. 1. This pipeline was found to have numerous deficiencies. Long segments were noted to have inadequate soil cover, and in some cases the pipeline is completely exposed. Segments were noted to exhibit advanced corrosion, both on the interior and exterior of the pipe. For this reason, major leakage problems are suspected, and the hydraulic capacity of the pipeline has been significantly reduced. The recommendation of the Study was to abandon this pipeline.

Line "D", a 10-inch diameter ductile iron pipeline 12 years old, delivers water from Well No. 4 to the Town's distribution system. This pipeline was found to be in excellent condition.

Water supply system hydraulic conditions were evaluated for the Study. Hydraulic evaluations indicate that the existing pipeline facilities should be able to convey adequate flows to Shoshoni's distribution system for domestic use and fire protection throughout the study period, even with considering the abandonment of Line "C". However, in order to adequately operate the pipeline facilities, evaluations noted the need for air relief and surge arresting equipment. These items were recommended in the Study.

Water Storage Facility:

The Town's water storage facility consists of a one-half million gallon welded steel ground storage tank, completed in 1978. The tank should be of adequate size to provide the storage requirements for Shoshoni throughout the Study period.

Visual inspection of the storage tank indicate that the tank interior is in immediate need of painting. Advanced corrosion threatens the structural integrity of the roof support system if
not checked soon. The tank exterior is in relatively good condition. Only spot touch-ups are deemed necessary there.

System Controls:

As mentioned previously, Shoshoni presently operates its wellfield manually. Manual operation of the wellfield poses safety concerns, demands inordinately excessive manhour attention, and promotes wasted power and water resources. Modern automated wellfield systems provide a possible solution to the problems associated with manual operation. Properly designed automated systems can provide efficient means of performing such tasks as well pump start-up or shut-down, storage tank level sensing, and around-the-clock system emergency monitoring. The present most popular mode of system message transmissions is by radio telemetry systems. Automated systems should be designed to match the technical skills of those expected to operate the system.

Results of the Phase I portion of the Study included recommendations as previously discussed for storage tank rehabilitation, transmission pipeline upgrades, and automated system control implementation. In addition, Phase I recommendations included options for wellfield rehabilitation measures ranging from further inspection and possible subsequent rehabilitation for Wells No. 1 and No. 3, to outright abandonment and replacement of these two wells. The total cost of all the identified repairs and improvements was estimated to be $266,000 if no well replacements were performed, and $516,000 if both wells were replaced. Shoshoni presently charges residential customers a flat $15 per month charge for water service. It was projected that the Town would need to increase these monthly charges by $2.10 per month for the least expensive option, or by $4.05 if the most expensive option was accepted, assuming WWDC loan and
grant funding assistance is made available.

**PHASE II**

The results of the Phase I Inventory Report were presented to the Town of Shoshoni at a public meeting on October 10, 1990. The Town chose to pursue all recommended improvements, including abandonment and replacement of two wells. The selected improvements chosen for conceptual design in Phase II (See Figure 2) are summarized below:

1. **Well Replacements**  
   Wells No. 1 and No. 3 would be abandoned and new replacement wells located in close proximity to Line "A". The estimated cost of abandoning and replacing the two wells is $413,398.

2. **Upgrade Well No. 2**  
   A larger pump would be installed to increase efficiency and to produce more, better quality water. The estimated cost for upgrading this well is $18,975.

3. **Water Tank Painting**  
   The tank interior would be blasted and painted with an AWWA approved paint system. Exterior surface defects would be brush-off blasted and spot painted. The estimated cost for painting the tank is $52,440.

4. **Pipeline Upgrades**  
   Pipeline upgrades would include realignment of a segment of Line "A", providing additional soil cover over Line "A", proving air relief valves, and abandoning Line "C". The estimated cost for these items is $88,621.
5. **Automated Wellfield Systems**
   The automated system would include a radio telemetry system relaying system control information between wellfield components and a master receiver unit. The master unit would be located in a central location such as at the Town Hall or at the Fire Station. The estimated cost for this system is $71,760.

6. **Water Supply Disinfection System**
   As requested by the EPA and Wyoming Department of Environmental Quality, a disinfection plan was proposed in the Study. The plan included two chlorinators and appurtenances located at strategic points in the supply system, as well as necessary pipeline additions. The estimated cost for the chlorination system is $108,882.

The total cost to construct the selected improvements is estimated to be $771,826.

Land ownership, easement, and permitting requirements investigated for the Study indicate the need to obtain agreements and/or permits from the Bureau of Land Management, Bureau of Reclamation, the Wyoming State Engineer's Office, and the Bureau of Indian Affairs. Possible easement conflicts on the Wind River Indian Reservation may pose special problems for construction in that segment of the project.

Typical residential customer water bills were projected to increase $6.04 in order to implement the selected improvements identified in Phase II. Customer rate increases were projected assuming a 50 percent loan, 50 percent grant funding scenario to be obtained from the WWDC. Loan terms were assumed to include a 40 year term at a 4 percent interest rate.