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Executive Summary

for the

Sheridan Raw Water Supply Project
(Cemetery Irrigation)
Level II

Prepared for:
Wyoming Water Development Commission
Herschler Building, 4th Floor-West
122 W. 25th Street
Cheyenne, WY 82002

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Sheridan, WY 82801

October, 1998
Executive Summary

WITHDRAWN

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(Cemetery Irrigation)
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INTRODUCTION

PURPOSE OF STUDY

This Executive Summary of the Final Report for the Sheridan Raw Water Supply Study provides background information, recommendations and cost estimates pertinent to the proposed plan. These recommendations include a new raw water irrigation source on Big Goose Creek, a transmission main to the cemetery, and a new sprinkler system throughout the cemetery. This system will be an automated, programmable system to simplify irrigation practices and allow the application of more water than does the currently restricted supply through the city treated water system.

This study was funded by the Wyoming Water Development Commission. With the completion of the Final Report, the project is proposed to move into Level III for the 1999 funding program.

The irrigation system proposed for construction by this study will achieve the following benefits:

• Improved Use of Water Resources

By converting the water source for the irrigation of the cemetery from Sheridan’s treated water system to this untreated source, improved utilization of water resources will be achieved. Part of the Corps of Engineers 404 Permit process for Twin Lakes Dam, which was constructed as part of the WWDC funded Sheridan Area Water Project and provides stored water for the City of Sheridan, required the development of a water conservation plan. This plan requires the per capita water usage for the Sheridan Area Water System be reduced. Converting the irrigation of the cemetery to an alternative source is one means of complying with this order.

• Improved Water Supply Pressures Within the City

The Sheridan Area Water System consists of multiple pressure zones and distribution systems. The cemetery is within a distribution system called the South Hill Area. This area was recently studied to evaluate options for improving pressures during peak demand times, which occur during the summer when irrigation is the heaviest. The cemetery is the largest water user within this distribution system. Converting the cemetery to this alternate irrigation source would reduce the peak demand requirements for this area, thus providing some improvement in pressures for the residents of the area. This study was partially funded by the WWDC through the Sheridan Area Water Supply Joint Powers Board.

• Water Rights

In August 1996 the State Board of Control completed a hearing process involving the existing water rights for the City of Sheridan. That process was initiated by a ranch which filed an abandonment petition against a portion of the City’s water rights, which are proposed for reactivation through this project. The order established by the Board of Control at the conclusion of this matter stated that the majority of the City’s direct flow water rights would continue to be located at a diversion point approximately 12 miles west of Sheridan. It further ordered that 3.0 cubic feet per second (cfs) be allowed to be diverted at three points closer to the City of Sheridan for purposes which include irrigation of the cemetery.
• Improved Operation and Maintenance

The current system which irrigates the cemetery is generally in poor condition. Also, irrigating of the cemetery is restricted due to the pressure problems discussed above. Part of this project would involve the reconstruction of the irrigation facilities for the cemetery. These improved facilities would reduce the maintenance requirements associated with the current system. By establishing a separate source of water for the cemetery, the operators would be able to irrigate the cemetery much more efficiently, without usage restrictions currently associated with irrigation practices through the City’s treated water system. Thus, a savings in limited operation and maintenance resources for this facility would be achieved.

PROJECT LOCATION

The project is located in the west central part of the City of Sheridan. Both the cemetery and the proposed diversion point are within the Sheridan city limits (see Figure 1). This location is in the NW 1/4 S34 T56N R84W. Figure 1 also shows the South Hill Area distribution system. The diversion point on Big Goose Creek is located on NB Avenue approximately one-half mile northwest of the cemetery.

CONSULTANT TEAM

The study team for this Level II project includes the prime consultant MSE-HKM, Inc. of Sheridan, Wyoming. Subconsultants include Pilch Engineering (geotechnical aspects and assessment of an infiltration gallery water source), Carl Thuesen (landscape architecture, planning and cost estimates for the irrigation distribution system), and Prestfeldt Surveying (project surveying).

CURRENT IRRIGATION OF THE CEMETERY

Water mains from the city water system serving the cemetery are primarily 6-inch in size. Throughout the cemetery water lines are typically 3- to 6-inch. The metallic mains in the cemetery are in poor condition due to corrosion, and repairs must frequently be made. Water enters the cemetery in three locations. Meters and upstream pressure sustaining valves are located at each of these points. Watering of the cemetery is frequently restricted to maintain more water for domestic use within the South Hill Area.

Ownership of the property in the cemetery is shown in Figure 1. The city owns the majority of the area, however the Elks, Eagles, Masons, and Odd Fellows lodges own certain areas throughout the cemetery. The lodges perform irrigation, mowing and other maintenance for their areas. They contract with caretakers to perform this maintenance. The city staff maintains the city areas as well as the small Eagles and Masons areas adjacent to the maintenance building, and performs burials in all areas.

WATER DEMAND PROJECTIONS

Water enters the cemetery through three water lines. These locations have been metered since 1996. During the past three years an average of approximately 86,000 gallons was supplied to the cemetery each day. The daily readings varied considerably however. Frequent meter readings were taken during August 1998 to gather additional data. These show a peak day of 335,000 gallons with several days running close to 200,000 gallons. Historical usage is not a
good indicator of projected needs. While meter readings show the mid-July to mid-September 1998 period had some of the highest water usage since meter readings began in 1996, the operators of the various systems contacted regarding this study still commented about the lack of water supply at critical times this past summer.

Information was gathered on the weather, soil and grass at the cemetery. This information in conjunction with the Wyoming Water Resource Center publication "Consumptive Use and Consumptive Irrigation Requirements in Wyoming" was used to determine the design evapotranspiration (ET) rates for the new system. The maximum evapotranspiration rate was determined to be 0.29 inches per day. This amount of water will be used to design the system. This level of irrigation will not be needed at all times or even during all years. It might be considered a worst case, and therefore will be available for application during drier years. The water right available at this location allows this level of withdrawal from Big Goose Creek.

A total of approximately 57 acres are proposed for initial irrigation. Additionally approximately 20 acres are available for future irrigation. Approximately 11 acres of the lodge and city areas within the 57 acres proposed for initial irrigation have sprinkler systems that have been described as adequate. Therefore, the initial system will be to irrigate 57 acres, with 46 acres of new sprinkler systems. With the design ET rate and this area, the design daily application rate will be approximately 440,000 gallons.

**POTABLE WATER**

With the conversion of the irrigation of the cemetery to raw water, potable water will need to be maintained to the maintenance building area. A main will be provided from the South Hill Area system to the maintenance building with a fire hydrant installed on the end of this line for flushing and fire protection. Potable water will then be available to the maintenance building, a drinking fountain outside of the maintenance building for public use, and possibly for a future public restroom should one be built at this site. Hose bibs located in the cemetery will be off the irrigation system for watering specific areas. These will be labeled as "NON-POTABLE WATER - DO NOT DRINK".

**WATER RIGHTS**

Water rights are a significant issue with the development of this raw water supply. As presented on page 1, putting an existing City of Sheridan water right to beneficial use is one of the primary goals of this project. A February 1997 Board of Control order relating to city water rights resolved a dispute with a neighboring rancher. It established three diversion points with a total diversion of 3.0 cubic feet per second (cfs) downstream of the city intake. These diversion points are for use during the summer irrigation season.

The amount established for the cemetery diversion was 1.33 cfs. Following an analysis of the possible development of the other two diversion points, discussions with Mike Whitaker of the State Board of Control and considerations on how best to utilize these water rights for Sheridan for the long term, it was determined to proceed with the transfer of the other two water rights to the cemetery location. This would establish 3.0 cfs (1,346 gallons per minute) for the cemetery. All of the water rights at the alternate diversion points would then be developed for use by the cemetery irrigation system.
DIVERSION POINT

LOCATION

The proposed diversion point in Big Goose Creek for the cemetery irrigation supply is located
within the NB Avenue right-of-way, approximately 2,500 feet from the maintenance building at
the cemetery. This location is shown in Figure 2. The creek channel at this point appears to
be well suited for the proposed diversion and pumping station. This location is also
advantageous because it is within a public right-of-way and has a fairly direct route up the hill
to the cemetery. Easy access is also available from NB Avenue. The south creek bank where
the pumping station is proposed appears to be very stable. Aerial photographs back to 1954
indicate the channel has not changed. The location of the proposed pumping station is
approximately 1.5 feet below the elevation of the projected 100-year flood. The pump station
will be raised approximately 3.5 feet to place it above the flood plain.

METHOD OF DIVERSION

Various options for the diversion were considered. Soil borings were also conducted. The
recommended option is to install a perforated pipe (similar to a well screen) approximately 2.5
feet below the bed of Big Goose Creek. This will allow infiltration of the creek waters into the
diversion, however filtration will be provided by the gravel in the creek bed, eliminating most of
the sand, sediment and organic material. Cleaner water will be very beneficial to the system of
piping and sprinkler heads. A concrete wet well is proposed adjacent to the creek with a vertical
turbine pump station mounted on it.

Stream monitoring took place during the summer of 1998. From these readings, historical
information and water rights, is appears this location should be a reliable source of water for this
irrigation system.

IRRIGATION FACILITIES

DESIGN APPLICATION RATE

As previously mentioned, it is proposed to transfer the other two intermediate water rights on Big
Goose Creek to the cemetery for a total 3 cfs or 1,346 gpm. It is recommended this system be
designed so all water may be applied within an 8-hour period at night. Night application is more
efficient since evaporation is lower and winds are typically not as strong. This results in more
of the water entering the soil. Night application also eliminates conflict with public use of the
cemetery and allows the daytime hours for maintenance activities without restrictions related to
irrigation. The proposed irrigation system will be automated to allow this nighttime application
without personnel needing to be on-site.

With the design application rate of 440,000 gallons per day (gpd) (initial 57-acres), the water
right of 1,346 gpm allows the application to occur within the 8-hour window both for this initial
acreage as well as the future expansion of approximately 20 additional acres.

PUMPING STATION

A triplex (3-pump) pumping station would be mounted on top of the concrete wet well adjacent
to Big Goose Creek. Three pumps would be used to allow variations in the flow rate, should the
maximum application rate not always be required. In addition, a small "jockey" pump would be
used to maintain the pressure on the distribution system at all times. This will allow hose bibs located in the cemetery to be under pressure for periodic use during the day when the irrigation system is not operating. The design pressure of approximately 60 pounds per square inch (psi) would be maintained at the sprinkler heads. This results in a pressure at the pumps of approximately 140 psi.

The pump station would be designed with automatic controls to maintain a constant pressure at the discharge point of the station despite varying demands. The sprinkler system would be designed with a controller operated to adjust water application to the various zones to match the pump capabilities. An electrically operated valve would be used to maintain the constant pressure throughout the 8-hour irrigation period as the various zones are watered. Pumps will start and stop automatically based on the pressure downstream of the booster station.

TRANSMISSION MAIN

The primary transmission main will extend approximately 2,500 feet from the pumping station at the creek to the point near the maintenance building where it will branch into smaller transmission mains to bring the water throughout the cemetery. A 12-inch PVC main is proposed. PVC material is recommended because of corrosion concerns and a cost advantage when compared to ductile iron. Smaller mains throughout the cemetery will also be PVC.

Two routes were investigated between the creek and the cemetery. One route is available which follows the platted NB Avenue and an easement. A better route crosses private property. The possibility of obtaining an easement for this route was discussed with this property owner. While an agreement has not yet been reached, this will be pursued further during the design phase. One of the advantages of the route requiring the easement is that it is shorter, therefore there will be an economic advantage which can be used when negotiating with the property owner.

The slope below the cemetery has many areas which are saturated or are unstable. The proposed route ascends a stable section. The ground at this location appears to be a clayey gravel. If the easement discussed above (see Figure 2) is obtained, the transmission main should be able to be successfully installed up to the cemetery. A 4-foot depth of bury is proposed over this transmission main, since it is seasonal and will be drained in the winter. This shallower bury will result in a construction cost savings, especially through any difficult location such as areas of higher ground water.

SPRINKLER AND CONTROL SYSTEM

A series of 8-inch transmission mains will be installed throughout the cemetery to serve the various pressure zones. Smaller lines will branch from these mains. Any existing sprinkler systems for the lodge areas which are to remain, will also be connected to these mains.

Cemeteries are very difficult to fit with underground irrigation systems due to the fixed dimensional requirements imposed by the grave plot size, roads, block sizes and alley and walkway locations. Often large trees and monuments interrupt the spray patterns, resulting in less than optimal coverage uniformity. For these reasons we recommend closer head spacing intervals and higher precipitation rates to assure more even precipitation application. Sprinkler heads will be set at a spacing of approximately the spray radius. This head to head coverage will result in a more thorough application of water.

A system of drains will be designed into the distribution system to dewater the piping prior to winter. With the cemetery located on a hilltop, it is believed daylight drains to the sidehill are
more appropriate than using air pressure to dewater the system. Sprinkler heads will be optimally grouped 10 to a zone or controller station. They will have a typical delivery rate of 10 gpm for a total of 100 gpm per station. Electrically operated solenoid valves will open and close based on direction from the main controller to irrigate the approximately 163 zones. Each zone utilizing full circle heads will cover approximately ½-acre. With the design application rate of 0.29 inches per day and the delivery rate from the sprinkler heads, each zone will be watered in about 25-minutes. The control system will be able to apply this amount of water in several doses during the application period to enhance the percolation and eliminate runoff.

Satellite controllers operating multiple watering zones are recommended with a master control unit. The master controller will adjust the operation of the satellite controllers to match the pump output and apply the water within the design period. The master control unit will allow the program to make adjustments for weather conditions, operation and maintenance of the cemetery requirements, and for other reasons. It also will sense higher than normal applications to certain zones warning of a possible leak.

Flow sensors will be incorporated into the satellite controllers to measure the quantity of water delivered through each controller. This information and the acreages of the lodge areas will allow calculation of the amount of water delivered to all areas of the cemetery owned by the city or the various lodges. These water quantities can then be used to bill the property owners for this water use as determined appropriate.

GEOTECHNICAL ISSUES

The geotechnical (soils) issues were investigated and considered as part of this study. Soil borings at the intake site helped determine the type of diversion proposed. The stability of the slope for the transmission main leading to the cemetery was investigated for the routing of this main. Soil borings were conducted in approximately six locations in the cemetery to identify the type of soils for water application and pipe installation considerations.

PERMITTING

The following agencies have been contacted regarding permitting associated with this project.

- State Board of Control (water rights issues)
- U.S. Army Corps of Engineers (permitting for work in Big Goose Creek)
- State Department of Environmental Quality (permitting for work in Big Goose Creek)
- State Department of Game and Fish (permitting for work in Big Goose Creek)
- State Historical and Preservation Office (all excavation activities)

A petition for change of point of diversion and place of use will be required to move the other two alternate diversion points to the cemetery. This will be accomplished through the State Board of Control (State Engineer's Office).

Work within Big Goose Creek will require permitting by the Army Corps of Engineers through their Nationwide Permit which dictates several requirements regarding work in the creek. The Wyoming Department of Environmental Quality Rules will also need to be considered regarding construction in the creek.

The State Historical and Preservation Office indicated mammoth bones have been encountered at the cemetery, therefore they will probably require an archeologist be on-site at all times when excavation is occurring. This cost will need to be added to the project budget.
EASEMENTS

The only permanent easements involved with this project are those associated with the preferred route for the transmission main up to the cemetery. This easement has not been finalized but is proposed for further negotiation during the design phase.

ECONOMIC ANALYSIS

COST ESTIMATE AND FUNDING PLAN

Table 1 summarizes the cost estimate for the project.

| TABLE 1 |
| COST ESTIMATE SUMMARY |

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This project is proposed to be funded by the City of Sheridan and the WWDC. The City of Sheridan will fund their share equally from two sources. These are the Water and Sewer Fund (an enterprise fund) and the Engineering Department. The Engineering Department’s share will be provided by the 1% Optional Sales Tax, if that continues following the upcoming election.

The WWDC typically funds new construction project at 60% grant. This level of grant funding is proposed for this project since it addresses the water conservation plan requirements of the Corps of Engineers Permit for the Twin Lakes project (see page 1). With this breakout, the WWDC will fund $685,980 of the proposed project cost with the city funding the remaining $457,320 (40%). No debt is proposed. Because the budget for the annual operation and maintenance of the cemetery must currently be subsidized by the Engineering Department budget, there is no means for paying back additional debt or increasing the annual costs associated with the cemetery.
The lodges have been receiving water at no cost. It is recommended the city begin charging for irrigation water used at the cemetery. The recommended charge is the current charge for treated water ($0.80 per thousand gallons). These payments will help offset the cost for the operation and maintenance of the water supply system. Even if no debt is incurred for the construction of this project and charges for water used are commenced, the annual cemetery budget will continue to run at a deficit requiring supplement funding through the Engineering Department.

RECOMMENDATIONS

Summarized below are the primary recommendations associated with this Level II Study.

- Transfer both the 1.17 cfs originally designated for the golf course and the 0.5 cfs Beckton diversion to this location. Prepare a petition for this change and present it to the State Engineer.
- Install the creek diversion on NB Avenue utilizing an infiltration gallery located below the bed of Big Goose Creek. Connect this gallery to a concrete wet well adjacent to the creek. Provide a means of backflushing the infiltration gallery from the city water system.
- Utilize a triplex vertical turbine pump station with a small pressure maintenance pump to deliver water. This pump station will automatically adjust to maintain a constant downstream pressure.
- Utilize a 12-inch PVC transmission main from the intake to the cemetery maintenance building. Continue negotiations with the property owner to utilize Alternative Route No. 2. At this time Alternative Route No. 1 is anticipated, however Alternative Route No. 2 is the preferred route.
- Utilize a master satellite control system with a central computer communicating to satellite controllers for programming and water management.
- Design the sprinkler system to cover approximately 10 control zones operated by satellite controllers. These controllers as well as the pump station will be adjustable and operate automatically.
- Design the application of irrigation water to occur during the 8-hour nighttime period.
- Provide approximately 46-acres of new sprinkler system and attempt to incorporate the existing distribution system, where possible.
- Contact the lodges to verify their desire to upgrade any portions of their distribution systems at this time. Encourage their participation in the project.
- Provide potable water system improvements to the maintenance building area as presented in Section 3.07 of the Final Report.
- Finalize budgeting, planning, funding and design so construction can commence in late 1999 with system operation to occur in the summer of 2000.