

*Executive Summary*  
*for the*  
*City of Buffalo –*  
*Sheridan Area Water*  
*System – Lake DeSmet*

*Level I Study*

*June 2008*

*Prepared for:*

*Wyoming Water Development Commission*  
*Cheyenne, Wyoming*

*Prepared by:*

*HKM Engineering*  
*Sheridan, Wyoming*

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## 1.0 INTRODUCTION

### Background

The Buffalo/Sheridan Area Water Supply/Lake DeSmet Level I Study evaluates complex water supply issues in Sheridan and Johnson Counties. This project has three local sponsors – the City of Buffalo, Sheridan Area Water Supply Joint Powers Board (SAWS) and the Lake DeSmet Counties Coalition Joint Powers Board (LDCC). There are several study tasks unique to each entity. There are also several topics that intertwine.

There are many reasons for the recent growth around Buffalo and Sheridan. It is expected this growth will continue and possibly even increase. Reasons include:

- Energy development in northeast Wyoming (primarily coal bed methane and coal).
- Growth in the world-wide demand for energy, thus increasing the price for these sources of energy and allowing new technologies to emerge, leading to new methods of extraction and production.
- The discovery of Sheridan and Buffalo and the attractive nature of these communities and their location. Both communities have received nationwide recognition in recent years as good places to live.
- The non-energy natural resources of the area, including Lake DeSmet. Lake DeSmet is one of the few water bodies around with water available for development.

In recent years there have been rumors of significant energy development around Lake DeSmet, which will not only impact the area but could consume a significant portion of the water available from the lake. This has also led to some development taking place immediately around Lake DeSmet, with the potential for more. Development is occurring concurrently in the areas north and northeast of Buffalo, and closer to Sheridan.

Therefore, the timing is good for this particular study and the involvement of these three entities with a major presence in this area. A common theme among the many challenges facing these entities, particularly as a result of growth, is water. While energy development is spurring this study and has raised the level of concern for water supply, Sheridan and Buffalo will continue to grow even if the projected energy development does not occur or does not occur in a time frame that might currently be suggested.

### Purpose of Study

This study has several purposes. The primary purpose is to examine water supply issues. This includes water supply required to serve the long-term needs of a growing SAWS service area, the City of Buffalo and the area surrounding it, and how the water available in Lake DeSmet factors into the above issues as well as other potential uses. Purposes specific to the three sponsors included:

- **City of Buffalo.**
  - Estimate the growth and future water demand needed for both the City and the surrounding rural area.
  - Analyze Buffalo's water system capacities to serve this growth, and prepare preliminary plans on improvements required.

- Evaluate Buffalo's current water rights and the potential for additional rights from these existing sources.
  - Evaluate and prioritize other additional long-term water supply options.
  - Develop plans for a conceptual regional system in the rural areas around Buffalo.
- **Sheridan Area Water System**
    - Analyze historical growth and water usage, and project future growth and water requirements.
    - Evaluate the existing water service boundary and consider the need for any changes in this boundary.
    - Consider the local growth management plans as additional water needs and changes in the water service boundary are evaluated.
    - Prepare a master plan for expanding the SAWS system to serve projected growth.
    - Identify improvements required to existing SAWS facilities.
    - Evaluate options for additional long-term water supply. Make recommendations on which option(s) should be pursued.
    - Consider SAWS rates, fees and policies in regards to the above improvements.
- **Lake DeSmet**
    - Conduct a detailed baseline water quality study of Lake DeSmet.
    - Consider how this water quality affects or impacts the many areas of interest.
    - Evaluate water marketing alternatives for LDCC.
    - Evaluate management issues for Lake DeSmet, including coordination with the other major holder of water and associated assets (PacifiCorp).
    - Evaluate the feasibility of Lake DeSmet being the source of water for a regional water system.

Figure 1 at the back of this report illustrates the study area and some of its key features.

### Consultant Team

HKM Engineering was the prime consultant for this project and conducted the majority of the engineering evaluations and recommendations relating to the SAWS water system. Subconsultants with other important roles on this project team included:

- States West Water Resources Corporation of Cheyenne, Wyoming.
- EnTech, Inc. of Sheridan, Wyoming.
- Petersen Planning Consultants (PPC) of Saratoga, Wyoming.
- Richard P. Arber Associates, Inc. of Denver, Colorado.
- Hydrosphere Resource Consultants of Boulder, Colorado.

### Previous Studies

There is an extensive list of previous studies that pertain to the Buffalo and Sheridan water systems and Lake DeSmet. Studies that were used in the development of this report are listed under the bibliography at the end of the Final Report. All three of these entities have previous Level I or Level II planning studies that are particularly pertinent to the work under this project.

## **2.0 POPULATION AND POPULATION PROJECTIONS**

Population and land use trends in the vicinity of Buffalo and northern Johnson County, as well as the City of Sheridan, the SAWS service area, and the unincorporated area of Story were conducted under this study. These trends were examined to provide a basis for anticipated potable water demands in areas presently served by Buffalo and SAWS, as well as nearby areas that may generate additional water demands. Anticipated demands were subsequently developed and applied to the hydraulic models of the Buffalo and SAWS water systems.

Populations in the study area are expected to increase considerably over the next 10 to 20 years. New job opportunities associated with power plant development in Campbell County, potential for a coal gasification facility near Lake DeSmet, and continued coal bed methane (CBM) development, among other factors, is expected to drive this growth. This growth is expected take place in the cities of Buffalo and Sheridan and the SAWS area (where central water systems already exist), but also in the rural areas between Buffalo and SAWS, thus the need to consider a regional water system.

Actual population estimates and projections of growth are not presented in this Summary. Refer to Chapter 2 of the Final Report for those tables and discussions.

Of the many entities analyzed in this study, SAWS appears to have the greatest need of additional long-term water supply, requiring additional supply within about 10 years. Therefore its growth rate, per capita usage rates and commitments to serve users that are not yet connected to the system, are of particular note. As of December 2007, SAWS had 1653 accounts. About 85 of these are paying the minimum and do not have meters. They have also committed to serve about 648 additional taps. With their current water supplies, they can serve an estimated 450 additional users beyond these commitments. Estimates depend heavily on per capita usage during the irrigation season. In most cases SAWS requires the new users to have other sources for outside watering. This reduces water needs per user during the critical summer irrigation season which controls the capability of existing supplies to serve additional users. The SAWS system has been growing at an annual rate of at least 3% since the core system was completed in 1996.

## **3.0 BUFFALO AREA WATER MASTER PLAN**

### **City of Buffalo Water Supply**

The City of Buffalo obtains its raw water supply for the water treatment plant (WTP) from Clear Creek and stores water in Tie Hack Reservoir. The water passes through the hydropower unit before being routed to the WTP. The City has four direct flow water rights from Clear Creek, totaling 7.95 ac-ft. During very dry years such as 2006, the most junior water right above is regulated during the summer, leaving an available flow of 3.95 cfs. Regulation can start as early as mid-June and last through September.

The hydropower unit requires 6.25 cfs to operate, and this flow is delivered year around to maximize income to the City. This flow supplies the WTP. When WTP demands exceed 6.25 cfs (4.0 mgd), additional flow can be routed through the existing pipeline and

discharged prior to entry to the WTP. The total capacity of the pipeline is approximately 10 cfs (6.5 mgd). The 10 cfs pipeline capacity is sufficient to supply the new 6 mgd WTP.

The treated water demands for the City have averaged approximately 210 gallons per capita per day since 2000. The domestic demands for stored water from Tie Hack Reservoir occur during the summer months when demands are highest. The peak day demand has averaged approximately 550 gallons per capita per day since 2000. Based upon these averages, the diversion, pipeline, and WTP can serve a population of approximately 11,000 people.

The active storage of Tie Hack Reservoir is 1640 ac-ft. During very dry years such as 2006, the senior direct flow rights totaling 3.95 cfs will not fully supply the hydropower unit and the WTP during high demand periods. At a minimum, 2.3 cfs must be released from Tie Hack to supply the hydropower unit. With increased population, treated water demand will exceed hydropower demand during peak periods.

The conclusion of this analysis is that the stored water in Tie Hack Reservoir is sufficient to supply a population of approximately 13,000. The diversion, existing pipeline, and soon-to-be expanded WTP can supply an estimated population of 11,000. This analysis assumes that storage releases are made to support hydropower production on a year-round basis. In an extreme dry year such as 2006, this hydropower demand is approximately 60% of the total demand. If Tie Hack Reservoir were used only to meet domestic demands, the reservoir could serve a population of approximately 19,000.

#### Potential Expansion of Service Area

The development of alternatives and recommendations to expand this water system and potential service to areas outside of the City were based on the above in-city peak usage rates, however, fire flows were not incorporated into the design in rural areas.

The potential service areas that would logically be annexed to the City and served with City water were identified. Several improvements to this water system were also identified to serve these areas, and summarized in the Final Report. These components were preliminarily designed for the build-out of these areas. The improvements presented will serve approximately 4400 additional people. The estimated cost of these improvements is approximately \$7.7 million.

The potential service areas surrounding the City of Buffalo were identified and shown in the Final Report. Alternatives for serving these areas from the Buffalo water system were investigated and analyzed. Both water system expansions and needed additional water supply quantities were considered. Cost estimates were prepared for the alternatives.

Two alternatives were analyzed for the additional long-term water supply, transmission and treatment once the existing system serves its maximum population. These were expansion of the Clear Creek system and a new system with a Lake DeSmet source. It was determined that the future water supply for the City of Buffalo could be most economically supplied from Lake DeSmet. The large cost of storage in the Upper Clear Creek Basin is the primary cost difference. Water is already available in Lake DeSmet.

Several alternatives for serving the areas outside of Buffalo were developed. The cost for capital improvements were estimated, along with monthly user's fees per residence. A key issue to be further assessed as the Buffalo system is expanded or a rural system created is the entity that will manage this system. The City is reluctant to expand its commitment for service beyond its current and future in-city users, so a new entity appears to be required. Exactly what type of entity and the extent of the area it serves requires further analysis, in conjunction with other interests in the area such as the SAWS system, the Story community and Sheridan and Johnson Counties. The Final Report lays the groundwork for such a possible system.

## **4.0 SHERIDAN AREA WATER SYSTEM**

### **Overview of SAWS**

Sheridan Area Water System (SAWS) is a major rural water system which was constructed to serve residents in the rural areas outside of Sheridan, primarily to the south and west (Big Goose and Little Goose Valleys). SAWS is governed by a Joint Powers Board. This entity was formed by the City of Sheridan and Sheridan County in 1988 to resolve the many water issues that existed both within the City water system and in the rural areas adjacent to Sheridan.

The SAWS system and the City of Sheridan system were designed and operate as one water system. The same operators provide operation and maintenance, and it has only one public water supply number. Therefore SAWS' relationship with the City is very close, but also complex because these are two entities. Ownership of the individual facilities within the SAWS water system can also be complex. Figure 4.2 in the Final Report summarizes the ownership of components that are shared with the City.

### **Overview of Water System**

The source water for this water system is Big Goose Creek. The diversion point is located about 13 miles southwest of Sheridan at the edge of the Big Horn Mountains. SAWS' sources of water include:

- The natural flow of Big Goose Creek (SAWS' junior direct flow right is 7.14 cfs).
- Water stored in mountain reservoirs that is released into Big Goose Creek and diverted at this location (SAWS holds permits for 628 ac-ft in Twin Lakes, Park and Dome Lake Reservoirs, 565 ac-ft when the 10% conveyance loss is applied).

Both of these sources are very important to SAWS and also the City. Their water rights for direct flow diversions and storage vary considerably, however. The City has significant and very senior direct flow rights, while SAWS' direct flow rights are junior, being among the first lost when the creek is regulated during the irrigation season. Therefore stored water is relied on during the irrigation season, which typically lasts 75 to 100 days. For the many reasons discussed in the Final Report, SAWS should anticipate all of its water coming from storage during that period. As noted above, additional water supply for use during the irrigation season is needed within about 10 years. Direct diversions from Big Goose Creek should satisfy the demands during all other times for many years to come.

The Big Goose WTP is the primary source of treated water for SAWS. They own 71.3% of this plant. The other plant on the system primarily serves the City, but also serves some SAWS users. The Big Goose WTP and the transmission facilities that form the core of the SAWS system are generally in good condition and have adequate capacity. While the design of the system optimizes gravity flow, several pump stations, storage tanks and pressure zones are needed due to the significant elevation differences served. Expansions to the system are needed as the area grows, as outlined in the Final Report.

SAWS' existing water rights are summarized above. SAWS may also utilize unused portions for the City's water rights, however this is difficult to count on for the long-term because the City is also growing and will need their rights. Another complicating factor is that during the irrigation season, all SAWS water must come from storage and the water must be released from that storage to match the peak withdrawal rate at the point of diversion. This makes proper management of not only the stored water but the entire water system very important.

### Additional Long-term Water Supply

Based on the Design Criteria established to assess water supply needs, SAWS currently requires 376 ac-ft for the irrigation season. This quantity allows for an estimated 40 ac-ft for that is released from storage but cannot be diverted. SAWS has 565 ac-ft in storage. Several alternative long-term water supply options were investigated under this study. Long-term supplies in the Big Goose Creek drainage are preferred because that is where the existing system infrastructure is located to divert, treat and transmit the water to users. While SAWS' needs in the shorter term are more critical than the City's, SAWS should work together with the City in this planning to maximize efficiencies.

While ultimately additional water supply will probably come from Lake DeSmet, this is believed to be many years away. This could change if others (such as the City of Buffalo, the area north of Buffalo or the Story community) spur the need for a regional water system. At that point, SAWS should work together so such a regional system is constructed with the most benefit to all.

In the mean time, the additional long-term water supply sources that could be pursued by SAWS are listed below. These options (and others) are covered in more detail in the Final Report. Also discussed are shorter term temporary sources that can be used if needed, prior to a long-term source being available. It is important to have alternatives, as they not only allow comparison and selection based on criteria that others may determine to be more important than is presented in this study, but it provides competition so hopefully costs are based on true market values. The funding source for the development of the alternative may also affect the ultimate selection.

SAWS should proceed on the acquisition of additional long-term supply soon. Some of these should be pursued in conjunction with the City. Options in their order of priority are:

1. Obtain Sawmill Reservoir.
2. Obtain additional water storage in Park Reservoir (second to Park Reservoir is Dome Lake, although Park is definitely preferred).
3. Construct a new strategically located off-channel reservoir such as Gillispie Draw.

4. Pursue exchanges with water in the Piney Creek watershed such that additional water can be diverted out of Park Reservoir into Big Goose Creek.
5. Develop the Lake DeSmet source.
6. Acquire senior direct flow rights. (This option would move up in priority if the scenario of a direct flow right closer to Sheridan could be secured for diversion to Kendrick Golf Course or City parks for a raw water system.)
7. Other options include leasing agreements.

The quantity to be obtained within the next few years is somewhat dependent on the alternatives selected. If Sawmill Reservoir is purchased (for example), the 1,000+ ac-ft, it would yield is a very appropriate amount. If a reservoir is to be constructed, this should be done in conjunction with the City and the reservoir should be larger than 1000 ac-ft based on the efficiencies of construction. If water supply is obtained from say Park, quantities in the range of 500 to 1000 ac-ft should be pursued, to provide a supply sufficient to serve the growing population well into the future.

### Water Service Boundary

A water service boundary was established for the Sheridan water system (SAWS and the City) in 1988. This service area represents the area for which the water system master plan was originally developed. This was based on where potential users which originally signed up and could be effectively served. The system does not serve this entire area, but may be expanded within this area as to accommodate the need. This is also the area of usage designated for the City's and SAWS' water rights. Not all of the area within this boundary is necessarily developable, and approvals must be granted to the SAWS JPB and County planning processes for expansion of the current service area.

This study recommends the service boundary for the Sheridan water system be extended to the northeast around the City (see Figure 4.5 of the Final Report). This change must be filed with and approved by the State Engineer's Office in regards to water rights.

### Policy Issues

Policies are important to proper water system management. SAWS has been addressing policies and several issues are discussed in the Final Report. Some of these include the City, and how the Ownership and Operating Agreements with the City covers them.

Policy considerations include (others are discussed in the Final Report):

1. Have water rates and connection fees which cover the true cost of not only operating and administrative costs, and debt repayment while setting aside reserves for both future system upgrades and emergencies, but for securing adequate long-term water supplies.
2. Have a rate structure that encourages conservation to the extent desired based on the availability of water and SAWS' capacity to pursue additional water.
3. Have requirements for land being developed that has agricultural water rights, for those rights to be maintained for outside watering of the subdivision once it is developed. Include requirements in the water service agreement for such developments that they not use SAWS water for outside use.

4. Provide incentives and a means for a developer with valuable water rights to bring those to SAWS in exchange for considerations such as connection fees (PIFs).
5. Having a policy to address the unusual year of significant drought.
6. Updating agreements with the City (as needed) to address policy issues relating to acquisition of additional water rights issues and other areas of common interest (such as when the City annexes areas served by SAWS).

### Improvements to the SAWS System

Since the SAWS water system is relatively new, limited improvements to the existing system are presented in the Final Report. Expansions to this system were analyzed and preliminarily designed. Preliminary cost estimates are also provided. These include the following (for some of these, it is more appropriate for the City to take the lead):

- the Woodland Park area, and on up the Southeast service area (east of I-90),
- the Upper Road area,
- the area northwest of City and cross-valley line to the airport (currently underway),
- the McCormick Road area, the area around Big Horn and Little Goose Valley, and
- the Big Goose Valley.

## **5.0 LAKE DESMET**

Lake DeSmet is the largest body of water in Sheridan and Johnson Counties. It also is unique in that it potentially has water available for development. The majority of this water is controlled by these two counties. Lake DeSmet has received considerable attention in northeastern Wyoming and throughout the state recently due to the acquisition of the lake by these two counties from the long-time holder of these assets (Texaco), and the rumors of major energy development adjacent to the lake.

During the development of the 2003 Master Plan, the Lake DeSmet Counties Coalition Joint Powers Board (LDCC JPB) developed the following five goals it considered being in the best interest for future management of available water from Lake DeSmet:

1. Maintain the recreational benefits of Lake DeSmet.
2. Generate revenue to offset O&M expenses.
3. Provide reservations for future municipal uses.
4. Provide water for irrigators in times of need.
5. Maximize water sales while maintaining multiple uses.

The reservoir and facilities acquired by LDCC JPB include:

1. Lake DeSmet Reservoir and the following pertinent impounding structures:
  - a. North and South dams, with their outlet works and associated land.
  - b. East dikes and spillways and associated land.
  - c. Land encompassing the lake up to the high water level of 4620.
2. Piney Creek diversion dam and associated land.
3. Piney Creek diversion tunnel (8316 feet long, 8.58 feet in diameter).
4. An easement to the land up to 4630, and other access easements.
5. Reservoir supply permits from Rock Creek, Shell Creek and Piney Creek and storage permits totaling 159,113 ac-ft of storage capacity. Of this quantity, 54,830 ac-ft are in the dead pool or is committed to others.

The second primary holder of storage rights in Lake DeSmet is PacifiCorp Energy. They have permits for 62,199 ac-ft. All of these quantities are based on the full capacity of the lake at 234,987 ac-ft (elevation 4620). The lake has not been operated at this level.

Lake DeSmet's water rights are complex due to the multiple enlargements of this reservoir, multiple ownership of the storage and supply permits, the many water sources, and other water rights within this watershed that compete for the same supplies and may have earlier priority dates. Table 5.1 in the Final Report summarizes storage and supply permits for Lake DeSmet. While Piney Creek is the primary supply for Lake DeSmet (via a tunnel), water can also enter this reservoir from Clear Creek (must be pumped), Shell Creek and tributary lands (flowing directly into the lake), and Rock Creek (via ditches).

### Reservoir Yield

*Yield* is the amount of water which can be dependably supplied from the reservoir in a specified interval of time, typically on an annual basis. The *firm yield* is the maximum quantity of water which can be provided during a critical dry period.

The analysis of the yield of Lake DeSmet was performed by a study that simulated the reservoir operation over a period of time in accordance with an adopted set of rules. A model of the Clear Creek River basin, concentrating on Lake DeSmet, was prepared by HKM using MODSIM. MODSIM is a river basin management decision support system originally conceived at Colorado State University. MODSIM is designed as a computer-aided tool for developing improved basin wide and regional strategies for short-term management, long-term operational planning, drought contingency planning, water rights analysis and resolving conflicts between urban, agricultural, and environmental concerns. MODSIM has many capabilities important for Lake DeSmet including analysis of water rights and storage contracts. It may also be used to run a multitude of "what if" scenarios.

The firm yield for each individual storage "account" is determined by applying an assumed pattern of delivery to the storage volume for the permit and operating the model. The volume of storage delivery was lowered iteratively until the storage reached approximately zero during the critical dry period. The annual delivery volume at this point represents the firm yield for that "account" or storage permit. The total firm yield of Lake DeSmet is the sum of the firm yields for each of the individual "accounts". Many other assumptions were made for the modeling, including that no reservoir storage will take place in July though September because of senior downstream direct flow rights, and that a 10 cfs instream flow be maintained.

Table 5.3 in the Final Report provides the firm yield as calculated for each of the individual reservoir "accounts". In all "accounts", the firm yield is less than the volume of the storage permit. The total firm yield for Lake DeSmet is estimated at 74,200 ac-ft.

### Management

The LDCC JPB is comprised of representatives of Johnson and Sheridan County Commissioners plus four at large members. The JPB has used a part-time manager since it acquired these facilities in 2001. The workload by the manager continues to increase and will increase significantly should the anticipated energy development

proceed or Lake DeSmet water be marketed for other types of consumptive uses. As future management options are considered, it should be anticipated that the LDCC will need to expand this position, and increase the amount budgeted for management.

Ideally, the manager for the LDCC would have both engineering and management expertise. If such a person can be found, the present practice of employing a part-time person may make good sense. Specific engineering and permitting tasks, and even construction-related tasks, could then be contracted for with firms providing such expertise. Although this part-time person would not actually perform much of the work, he or she would have enough experience in the water supply field so as to know what is required in the management of their facilities, on behalf of the LDCC. Other options include contracting management responsibilities or reaching an agreement with PacifiCorp on a management arrangement (refer to the Final Report for more detail).

### Water Uses

Currently the primary use of Lake DeSmet is recreation. Fishing, boating, camping, swimming and picnicking comprise the majority of the use. These recreational activities result in a significant economic boost to Sheridan and Johnson Counties.

The second current primary use of Lake DeSmet water is irrigation. The two primary irrigation interests are the 11,800 ac-ft of storage capacity controlled by the Lower Creek Clear Creek Irrigation District and the contractual obligation to provide 10,870 ac-ft to contract irrigators. LDCC also has water available for seasonal lease to downstream irrigators that may wish to supplement their existing supply. Interest in leasing has been limited due to sufficient supplies from the normal sources used by these irrigators.

Another potential use is municipal use. The LDCC has committed 2500 ac-ft to both Sheridan and Johnson Counties for future municipal use. This is a very valuable asset and both counties must take care to maintain this water for their long-term future use. Both the Sheridan and Buffalo water systems should consider the findings and recommendations in this report and within the next few years, consider whether they believe they will put a greater quantity to use in the long-term. If they do, they should negotiate with the LDCC to secure this additional water supply.

It is believed at this time that Lake DeSmet will not be an immediate source of water for Buffalo, the SAWS system, or a regional system, but will eventually be the water supply for a rural system in northern Johnson County, and extending into the southern part of Sheridan County. Eventually it is expected to supplement water supply to both the Buffalo and Sheridan water systems. The value of having access to such a source of water should not be discounted simply because it is long-term. If additional supply is needed, it should be secured for long-term municipal use while it is still available.

At this time, the most likely potential industrial use for Lake DeSmet water appears to be for a coal-fired power plant or coal gasification plant. This potential use is believed to be the reason PacifiCorp and MidAmerican Energy have purchased assets in and around Lake DeSmet. It is not known at this time whether or when they may move forward on a major construction project; however, it is believed this is sufficiently likely, particularly in considering that PacifiCorp is the second largest holder of water and other assets in Lake

DeSmet. Therefore the LDCC should continue to work closely with PacifiCorp (and possibly others) for the proper and efficient potential development of this finite resource.

While eventually more of Lake DeSmet's water may be put to consumptive use and the water level in the lake will fluctuate more dramatically, LDCC would like to balance recreational opportunities with these other uses. They understand the economic value of recreation to the local economy and will take this into consideration. On the other hand, the LDCC is a storage entity and is responsible for the storing and use of water for these two counties in an efficient and economically sound manner.

A section in the Final Report discusses marketing ideas of Lake DeSmet water by the LDCC. It is a goal of this board to market more water to help cover the costs associated with the facility's operation and maintenance. As the effort to market water from this reservoir is expanded, it is recommended that several steps be taken, such as:

- The allocation of the estimated firm yield into the 13 storage permits while considering supply permits and priority dates, and reaching agreement on these amounts by all involved. With this done, marketing can be from specific storage permits to more accurately set the value of water and manage the reservoir.
- Contact PacifiCorp (and others that may have indicated an interest in additional water to date), to more fully understand their interest in leasing LDCC's water.
- Let local irrigators and other potential users in the area know of the desire to market more water, so they can approach the Board.
- Carefully weigh long-term commitments from the more senior storage rights.
- Decide between leasing and sales. Leasing may be generally preferred, however if someone desires to obtain a dependable long-term supply, they may need to own it.
- The Wyoming Game and Fish Department is very interested in Lake DeSmet as a recreational resource. Contact them to better substantiate their interests.

One apparent certainty on the front range of the Big Horn Mountains: water is increasing in value and the quantity of water available from these mountains is not increasing. Sheridan and Johnson Counties have a valuable asset in Lake DeSmet. These counties and the LDCC JPB have been taking measures to invest in and protect this asset and will continue to follow this approach.

### Water Quality

A baseline water quality sampling of Lake DeSmet was planned and conducted under this project. Given the array of possible uses of Lake DeSmet, its water quality is of great concern and interest. A primary goal was to develop an understanding of the lake's current water quality and to allow future comparisons. Three seasonal samplings were conducted in 2007. The sampling and analysis plan was prepared based on interest for:

- a drinking water supply,
- a fishery and for other aquatic life,
- recreational and scenic values,
- considerations due to development within this watershed, and,
- considerations relating to the possible introduction of CBM produced water,

Overall, the quality of Lake DeSmet is good. There are a few constituents with higher concentrations (e.g., sulfate, calcium, total dissolved solids) likely due to the geological setting. In most cases, there was little variation between the three sampling events and the sampling sites. The water quality has not declined based on comparison to samples taken in the 1970s and 1980s. Water quality data indicate Lake DeSmet is relatively well mixed longitudinally. It appears wind mixing plays a much more prominent role in the reservoir's hydrodynamics than inflows. This is because of the long water retention time in the reservoir – over 13 years.

Inflow water quality varied considerably by source. Concentrations of most constituents in Shell Creek were significantly greater than those in Piney Creek. Piney Creek and Shell Creek also differ in their flow contribution to the lake, with Piney Creek by far making the larger contribution to the lake. The quality of Piney Creek is in many cases, better than that in Lake DeSmet.

With respect to recreation and aquatic life, reservoir water quality is currently supporting these uses. Temperature, dissolved oxygen, and water clarity are not limiting to trout production or recreation. Metal and trace element concentrations are not at levels that would restrict or be detrimental to fish and other aquatic life. Total sulfide concentrations are high but not to the point of being detrimental.

There are elevated concentrations of some constituents that make Lake DeSmet less than ideal as a drinking water supply. Trihalomethane formation potential and total organic carbon concentrations were high, which can be of concern. Concentrations of total dissolved solids and sulfate are close to the secondary contaminant limits for drinking water. This water is also very hard.

Changes in the operation of the reservoir could result in changes in quality in regards to a drinking water supply, including those due to: 1) increased changes in surface-water elevations (may result in increases in turbidity and suspended sediments due to wave action and erosion, and can affect aquatic life), 2) changes in timing and water quality of the inflows (can improve or deteriorate in-reservoir water quality, depending on the dominant sources of water and their quality), 3) changes in the flushing rate of the reservoir (increases in the reservoir flushing rate can serve to improve water quality, especially if the inflows are from Piney Creek, which has better water quality).

Use of the reservoir as a recipient of CBM produced water could result in increases in total dissolved solids, SAR, major ions such as sulfate, metals, and radionuclides. These increases could impact aquatic life and drinking water uses. The impacts would depend on the flow, location, and quality of the produced water. There may be portions of the reservoir that are mixed less than others and thus may result in more localized impacts.

Increases in development around the reservoir could result in increases in sediment, nutrients, bacteria, and toxic metals and organics. The magnitude of the impact will depend on the density of the development and any best management practices used throughout the watershed to minimize the effects to the reservoir.

Recommendations for on-going monitoring of the lake, as well as potentially developing a water quality model of Lake DeSmet, are included in the Final Report.

## **6.0 REGIONAL WATER SYSTEM**

The feasibility of a regional water system with a Lake DeSmet source was assessed at a preliminary level under this study. Such a water system could take two directions. One is a system in the area north of Buffalo and west of Lake DeSmet (see Chapter 3). The other concept is a system that could also deliver water north to the SAWS system, including service to Story. It appears many people living in Story are interested in a central water system, and a conceptual system was developed under this study. Such a system appears more feasible for the community if it is part of a regional system.

As part of the regional water system concept, Lake DeSmet was considered as the water supply. The water treatment facility would generally include a raw water intake and delivery system, pretreatment, filtration (probably utilizing a membrane filtration process), chemical feed facilities, disinfection, storage, facilities to deliver treated water into the distribution system, and solids handling facilities. Softening treatment is also recommended due to the relative hardness of this water (which is much harder than the water supplies for Sheridan and Buffalo). This conceptual design is presented in the Final Report. At the appropriate time for planning such a facility and regional system, a more detailed preliminary engineering study is needed (Level II).

### **Interest in a Regional System**

Several public meetings were held in Buffalo and Sheridan, and one in Story, during this study. They give an indication of the potential interest in a regional water system. Some developers of subdivisions in this area and other landowners were also contacted. Generally, it appeared interest in a regional water system was limited at this time.

The Johnson County Commissioners and Johnson County Planning Commission would rather see a central water system in the growing area north of Buffalo than the proliferation of the individual wells. They therefore support the regional system concept.

While it appears individual wells for the developments north of Buffalo and west of Lake DeSmet are currently meeting needs, there are also concerns. Reports were received from individual landowners about the need to drill multiple wells. There were also reports of less than desirable water quality and concerns that at some point the aquifer will be stressed to where wells will impact each other. The state DEQ was contacted regarding their review and approval process for subdivisions in this area. While they have been generally receiving engineers' reports for projects with individual wells that they can approve, they have long-term concerns, especially as the number of wells continues to increase.

At this time it appears existing developments have limited interest in a regional system because of their existing investment. It is anticipated future developers may be more interested, because of the benefits a central water system will bring the area, given the above concerns with individual wells. The next step may be to hold a public meeting particularly targeting landowners north of Buffalo and west of Lake DeSmet to discuss this study and a potential regional water system. If such a meeting is well attended, it may provide direction for a potentially more detailed study of such a water system.

## Entities

Based upon the experiences of other regional entities in Wyoming, options for the entity to own and operate the regional system were presented. These include:

- A joint powers board (JPB) to provide wholesale water service to the City of Buffalo and one or more outlying districts that are created to serve the rural areas.
- A regional utility services JPB. As opposed to having a separate JPB responsible for merely wholesale water service, an overarching JPB could conceivably provide water, sanitary sewer and even solid waste collection and disposal services.
- The City provide outside-City water (and possibly sewer) service on a regional basis.
- The City provide outside-City water (and possibly sewer) service to a separate district.

Further discussion is required to better define the type of water system that may be developed in the area north of Buffalo and based on that plan, determine the best entity to govern such a system. Input is especially needed from residents of this area. Since the City of Buffalo desires to continue to emphasize using their resources to serve users within the city limits, at least at this time, a water district may be the preferred entity for areas outside the City. However, further analysis and input are needed for final decisions.

## **7.0 ECONOMICS AND FUNDING**

A section that presents an overview of funding sources for projects that could result from this Level I study or subsequent Level II studies was presented in the Final Report. The cost estimates for several projects was also presented. Some of these estimates (such as for a new storage reservoir or a water treatment plant on Lake DeSmet, require additional study). While there are several factors that enter in as to which funding sources are best for a specific project, the WWDC remains a primary source for most projects. Funding sources discussed include:

- The three programs operated by the Wyoming Water Development Commission
- The Abandoned Mined Lands (AML) program
- Rural Development/Rural Utility Service (RD/RUS)
- Mineral Royalty Grant Program (under the State Loan and Investment Board (SLIB))
- State Revolving Fund (SRF)

Other programs include: Joint Powers Act Loans (JPA), the Wyoming Business Council (WBC), Community Development Block Grants (CDBG), Business Ready Community Grant and Loan Program, Capital Facilities Tax, reserves and Plant Investment Fees.

## **8.0 SUMMARY OF RECOMMENDATIONS**

This section summarizes recommendations made in the Final Report. Many of the topics covered in this study are complex, and may need to be addressed over several years. Others require additional study and input from stakeholders. For additional information on topics listed below, refer to the appropriate section of the Final Report.

### Buffalo

1. Construct the transmission and storage improvements within the City water system as summarized in Section 3.5. These are needed to serve the growing service area.

2. Continue to maximize the water supply capabilities of the Clear Creek source (raw water supply, transmission, treatment). Expand these facilities to the extent possible as growth occurs and the need arises (see Section 3.7). Maintain the municipal use water rights in Lake DeSmet, because eventually it appears to be the water source of choice for Buffalo when the Clear Creek supply approaches its capacity.
3. It is recommended that a rural water system be created to serve the area north and northeast of Buffalo. Several issues regarding the entity, water source, size of service area, the potential connection to the Buffalo water system, and estimated costs need to be studied in more detail.

### Sheridan Area Water System

1. Water Service Boundary:
  - a. Expand this boundary in the area north and east of the City (see Figure 4.7).
  - b. File the new boundary with the State Engineer's Office, to document the approved usage area for Sheridan's water rights.
2. Additional long-term water supply:
  - a. Continue to pursue additional long-term water supply, with the goal of having needed additional supply in place within the next 10 years.
  - b. Pursue the purchase of Sawmill Reservoir. Negotiate with the owner over the next couple years to see if an acceptable price and terms can be reached.
  - c. Continue to pursue the purchase of shares in Park Reservoir in the interim.
  - d. Coordinate with the City on the additional long-term supplies being pursued. The appropriate percentage of additional acquisitions should possibly be more than or less than the one-third share contained in the Ownership Agreement.
  - e. In conjunction with Sheridan County and the City, maintain the 2500 ac-ft that has been set aside in Lake DeSmet for future municipal use.
  - f. For a new reservoir, conduct a Level II study to more thoroughly investigate this option and prepare a more detailed cost estimate and funding plan.
3. Infrastructure:
  - a. With the City, proceed with the storage project at the Big Goose WTP.
  - b. Upgrade the existing booster stations and automatic valve stations.
  - c. Proceed with the larger projects as summarized in Sections 4.18 and 10.3 when needed due to growth and determined by SAWS JPB. Pursue funding for these projects at the appropriate time. Adjust cost estimates at the time of the application due to revisions to the plan (if any) or general cost increases.
  - d. Consider the improvements recommended for the water treatment plants.
4. Policies:
  - a. Continue with the process of revising SAWS Rules and Regulations.
    - i. Consider different PIFs whether or not acceptable storage rights are provided as water service agreements are finalized with developers.
    - ii. There is a significant difference in the cost of PIFs for ¾-inch tap and 1-inch taps. The smaller taps should continue to be encouraged for residential users. Maybe hold the cost where it is if SAWS water is not used for outside purposes, but increase it if it is used outside.
  - b. Negotiate with the City to modify the Ownership Agreement so water purchased for SAWS can be out of their portion of the reserve account. Possibly make this retroactive to the 2007 purchases.
  - c. Proceed with the plan to attempt to exchange a portion of Lake DeSmet water so SAWS can eventually hold additional shares in Park, so this water can be

diverted down Big Goose Creek. This exercise will help verify some of the concerns with the exchange process outlined in this report.

- d. Since the recent water rate changes were more significant than any time previous, review these after one year to verify they are providing the revenue required and as estimated in this study. Also, verify the additional funding of improvements discussed can be funded from these rates.
  - e. Review and adjust the rates annually in conjunction with budgeting.
  - f. Maintain polices that encourage conservation of water and plans to be implemented should water resources be short in a given year.
  - g. Provide opportunities for developers to bring acceptable water rights to SAWS in conjunction with their request for service.
  - h. Whenever possible, as lands with agricultural water rights develop, require that those rights be maintained as a secondary irrigation system so SAWS water does not have to be used for watering yards.
  - i. Continue to work with the City on the details for handling the annexation of areas that contain SAWS users or facilities (see Section 4.14).
  - j. Clarify the process for assuring the proper sizing and funding of extensions that are initially built for one development, but may eventually serve others.
5. Other items:
- a. Develop a GIS of the SAWS service area beginning with the layer of the new base mapping (with aerial photography). Add lot lines, water lines, active taps, pre-1989 commitments, others committed but not yet served, City areas, etc.
  - b. Develop a model of the Big Goose drainage, complete with all reservoirs, streams, diversions, and water rights, for use to better manage this watershed.
  - c. Maintain the hydraulic water model of this system.
  - d. Conduct hydrant flushing where flows and pressures readings are taken as presented in this study, and compare there results to the model.

#### Lake DeSmet Counties Coalition

1. Continue to manage the lake for recreational benefits while exploring options for the further development of the resource. Since the LDCC would like to market some of their water, and if a more concerted effort in this regard is to begin, discuss this with PacifiCorp (and possibly other interested parties) so hopefully there can be a better understanding of all future plans and water needs. If PacifiCorp is interested, there are many tasks that can be worked on together to mutual benefit. If they are not interested or are not seeking additional water, other options can be pursued.
2. Considering the many issues of mutual interest with PacifiCorp (and potentially others) it appears these entities will benefit from a stronger and closer relationship. If PacifiCorp proceeds with a coal gasification of other major facility near Lake DeSmet, it will impact this area significantly. Items to discuss with PacifiCorp prior to that time:
  - a. The firm yield of Lake DeSmet and the individual storage accounts.
  - b. The proportioning of storage when the lake does not fill.
  - c. The allocation of O&M Expenses.
  - d. The use of the Piney Creek Diversion to fill all storage accounts.
  - e. Updating the current Agreement (which has expired).
  - f. Access to and management of facilities of joint interest at the South Dam.
  - g. The development of a capital improvements plan and its funding.
  - h. The marketing of a portion of LDCC's water.
  - i. A plan for the management of the lake into the more complex future.

3. Johnson and Sheridan County should continue to invest in this valuable facility and its water. This may mean an increase in the funding of LDCC by these two counties.
4. Continue to work with municipal interests on the long-term reservation and eventual use of Lake DeSmet water. Interested entities should continue to analyze their water requirements and participate with the LDCC in this lake to protect their interests.
5. Develop a plan for temporarily operating the lake at a level between 4616 and 4620 to better assess its capability to operate at that level. More fully assess the lake under those conditions and develop a plan for improvements required.
6. Review the results of the modeling effort and calculation of firm yield under this project. Consider how this work can be used by the LDCC and what additional modeling scenarios would be beneficial. Involve PacifiCorp (and others as appropriate) in these discussions to help assure agreement with the procedures followed. Maintain this model and conduct runs periodically to build a familiarity.
7. Associated with the above item is the comparison of the results of the modeling to the actual filling (such as the increased usage of the Piney Creek source as allowed by the recently issued supply permit), and releases from the reservoir.
8. Continue the water quality monitoring that was commenced under this study.
9. Prepare a plan for the allocation of stored water when Lake DeSmet does not fill completely (need to consider the many supply and storage permits, their priority dates, various possible operating levels, and competing water rights).
10. Even if additional consumptive uses develop, LDCC should always withhold a certain amount of senior storage rights for future use by these two counties.
11. Continue to review, revise and follow the goals previously established for the management of Lake DeSmet as summarized in the Final Report.
12. As the area around Lake DeSmet develops, remain involved in the oversight of the lake and the land around it. Participate in the planning process in Johnson County, to help assure these land and water assets are protected for the long run to the extent practical from the impacts of different types of development.

### Regional Issues

1. Continue planning on a possible rural water system to serve the area north of Buffalo. Additional public information and feedback is needed to better understand the level of interest in this area. It may be helpful if a small group of interested people was formed representing this area, which could assist with coordination issues as planning progresses. The water supply also needs further analysis. Eventually it appears Lake DeSmet will be the water source, but this may be many years out. The City of Buffalo should finalize a policy on their willingness to possibly serve this area as a consecutive user, where they are not responsible for the system operation or maintenance after a master meter.
2. Residents of Story should continue to assess their interest in a central water system. They may pursue a planning study to consider the issues introduced here. This may have to be a Level I study, since Story is not an acceptable entity for Level II. It will take a more detailed study with significant public involvement to establish an appropriate boundary and form a water district. A steering group of interested people should be formed to further coordinate this matter.
3. If a regional system is developed, it will be advantageous if its water source is similar in quality to Buffalo's and Sheridan's, as it may easily connect into those systems.





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