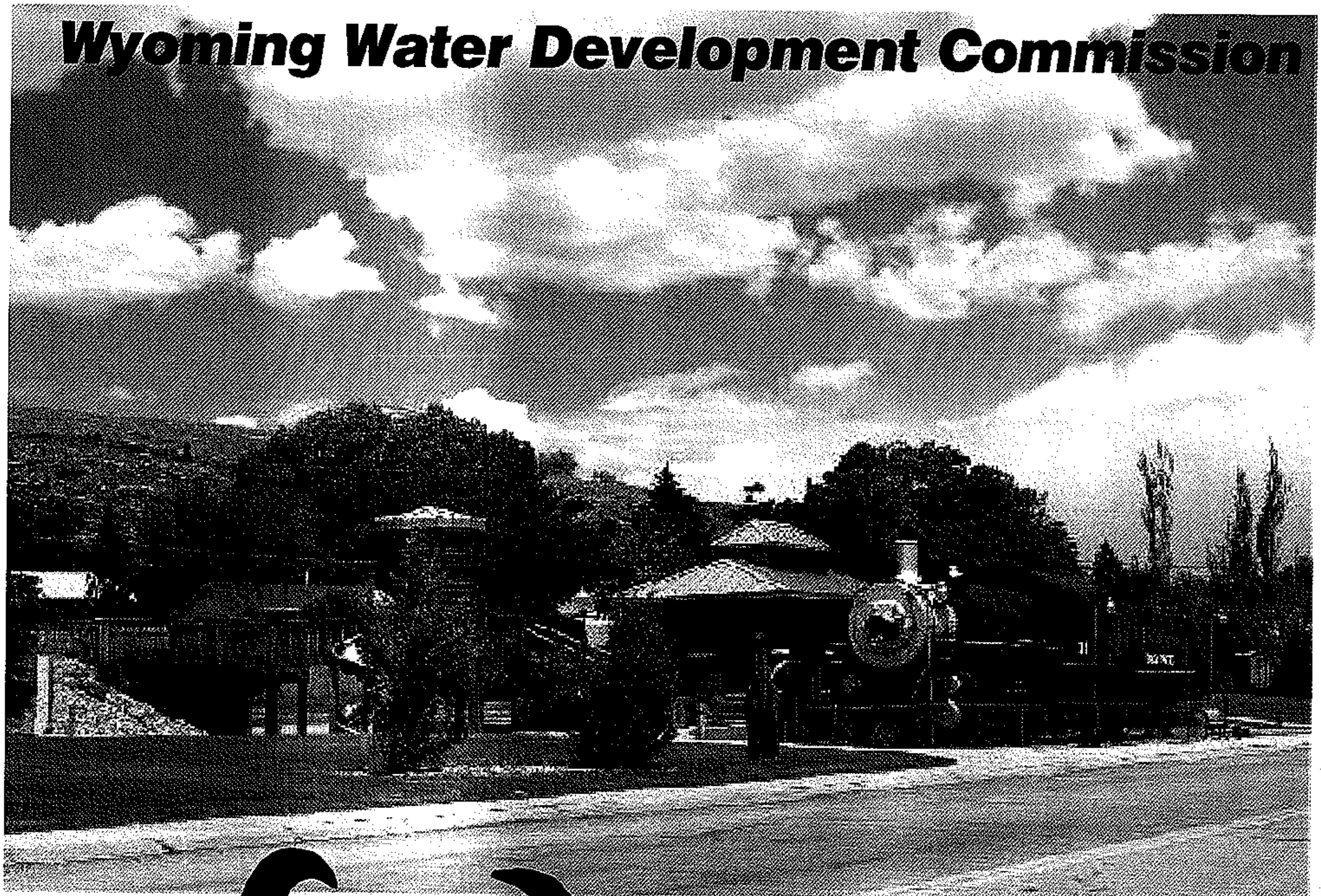

PRIDE IN SERVICE
RAWLINS WYOMING

Executive Summary

CITY OF RAWLINS WATER MASTER PLAN - LEVEL I

MAY 2010

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

CONJUNCTION WITH

James Gores & Associates

OLSSON ASSOCIATES

RAWLINS MASTER PLAN
LEVEL I STUDY
- Executive Summary -

Submitted To:

STATE OF WYOMING
WATER DEVELOPMENT COMMISSION
6920 YELLOWTAIL ROAD
CHEYENNE, WYOMING 82002

THE CITY OF RAWLINS
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MAY 2010

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Executive Summary

1 GENERAL

This document briefly summarizes information and recommendations presented in subsequent chapters of the Rawlins Master Plan – Level I Study.

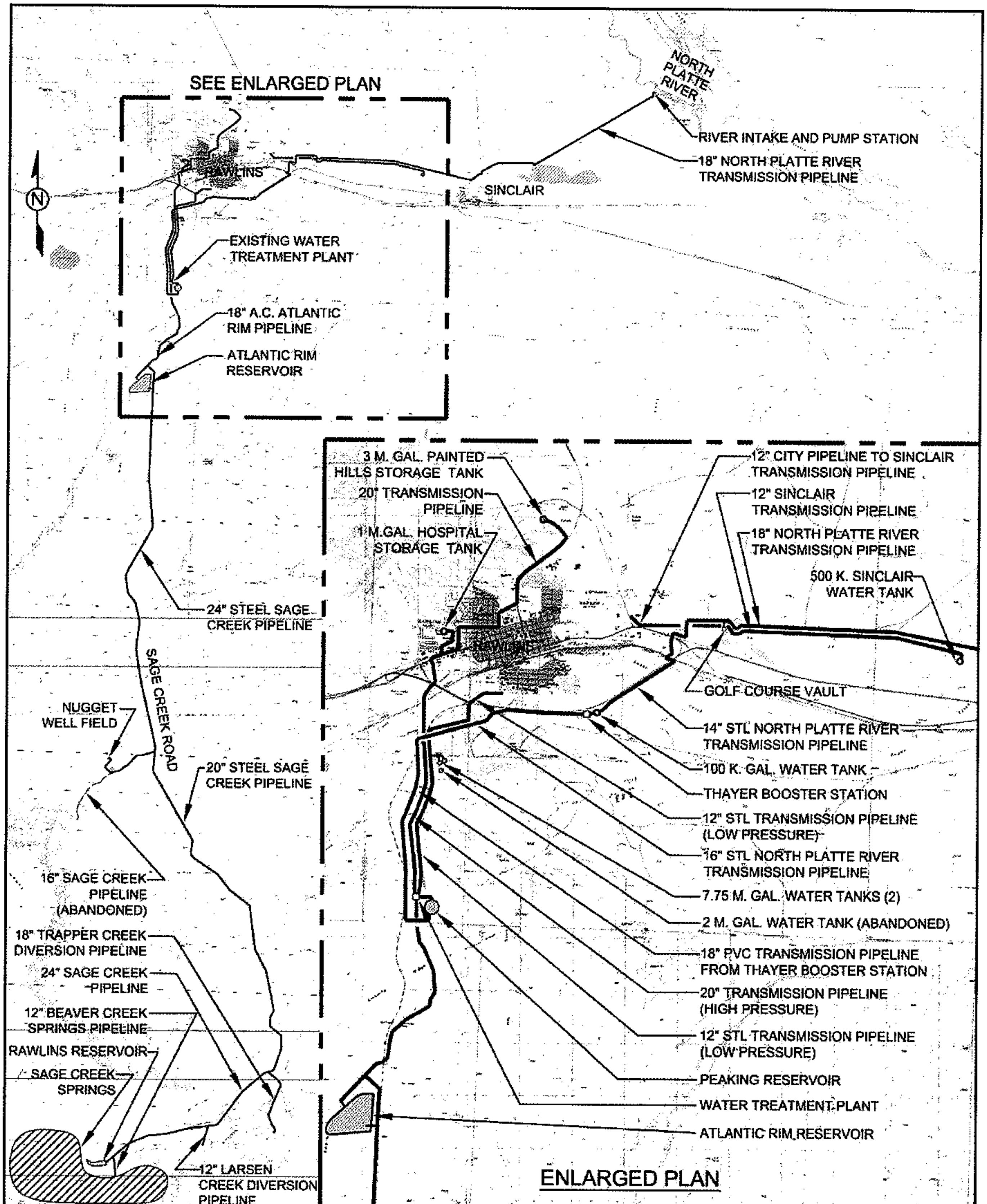
2 EXISTING SYSTEM

The City of Rawlins obtains water for municipal use from three sources which is stored in three large reservoirs upstream of the water treatment plant. The water treatment plant filters and treats the water to compliance with EPA primary and secondary water quality standards. Upon leaving the water treatment plant, finished water is collected in four storage tanks which feed the City's two pressure zones.

The City of Rawlins three water supply sources are 14 springs located in the upper Sage Creek Basin, three Nugget Formation wells located approximately 14 miles south of the City, and the North Platte River from its diversion facility near the Town of Sinclair. The water from all three sources is treated at the City's Water treatment plant which utilizes diatomaceous earth filters as a means of mechanical filtration and chlorine gas for disinfection. Incorporated in and critical to the operation of the City's water supply system are a series of three earthen reservoirs – Rawlins Reservoir, Atlantic Rim Reservoir, and Peaking Reservoir. Figure 1-1 illustrates the major components of the Rawlins Water System.

The Sage Creek Basin springs have been in use since 1924. Water from the springs is collected in a series of collection pipelines located approximately 23 miles south of the Water treatment plant. The Sage Creek Pipeline runs between the Rawlins Reservoir and the Water treatment plant and consists of 20-inch and 24-inch steel pipeline. This pipeline conveys up to 6.92 CFS (3,100 GPM) of water from the 14 springs in the Sage Creek Basin and up to 2.0 CFS (900 GPM) from three Nugget Formation Wells. The Nugget wells (Nos. 1, 2 and 3) are artesian wells that were completed in the mid-1980's and had initial flows ranging from 350 GPM to 900 GPM (after stimulation).

The City of Rawlins currently has water rights on the North Platte River for 2.01 cubic feet per second (CFS) which was acquired from the Union Pacific Water Company. The Union Pacific Water Company originally had water rights for 2.32 CFS, but opted to retain 0.31 CFS for railroad and domestic use. In 2002, the Town of Sinclair transferred 1.0 CFS of territorial water rights on the North Platte River to the City of Rawlins and bestowed to the City of Rawlins an additional 1.21 CFS of their water rights on the North Platte River. In exchange, the City of Rawlins agreed to deliver up to 1.21 CFS of potable water to the Town of Sinclair as well as construct and maintain any pipelines and facilities associated with the delivery of water to the Town of Sinclair. The North Platte River Pipeline conveys water from the North Platte River Pump Station to Peaking Reservoir. Midway in the pipeline is a diversion to the Rochelle Ranch Golf Course to provide raw water for irrigation. Water must be boosted at Thayer Booster Station in order to reach Peaking Reservoir. Water from the North Platte River is subject to unpredictable turbidity from seasonal or climatic changes and is used only to supplement water from the Sage Creek Springs Pipeline.



DATE: MAY 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology	605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE
JOB NO.: 7.009			RAWLINS WATER MASTER PLAN	1-1
SCALE: NONE			SYSTEM PLAN	

In order to fully utilize the water from the Sage Creek Basin springs, a series of reservoirs were constructed and incorporated into the system. The first of these was the Rawlins Reservoir which was permitted in 1955 for 624 acre feet of water. Rawlins Reservoir is located about 4 miles upstream on Sage Creek from Highway 71 approximately 25 miles south of the city. Water can be conveyed from Rawlins Reservoir to the Water treatment plant through the Sage Creek Pipeline. The second reservoir constructed was the Peaking Reservoir which is located approximately 0.25 miles southeast of the water treatment plant. Peaking Reservoir was permitted in 1966 and is appropriated for 346.66 acre feet of water. The reservoir is primarily filled via the Sage Creek Pipeline, but can also accept water from the North Platte River. The last reservoir, and the most problematic, is the Atlantic Rim Reservoir. Atlantic Rim Reservoir was permitted in 1978 for 644.5 acre feet of water. The reservoir is located along Highway 71 approximately 2.25 miles south of the water treatment plant. The reservoir is filled via the Sage Creek Pipeline. The reliability, usability, and sustainability of the Atlantic Rim Reservoir have been in question for many years because it has leaked since its construction.

3 SERVICE AREA, POPULATION PROJECTIONS, AND DEMAND

As part of this study the City of Rawlins service area was identified, population projections were developed, and current and future demand for the City of Rawlins and the Town of Sinclair were identified and/or calculated. The service area for this study includes the incorporated and unincorporated areas of Rawlins currently served by the water supply and distribution system. Additionally, the incorporated and unincorporated areas of the Town of Sinclair are also included in this study since they have an agreement with the City of Rawlins for finished water from Rawlins' treatment facilities in exchange for the use of the Town of Sinclair's water rights to the North Platte River.

The City of Rawlins, Town of Sinclair, and Carbon County population forecasts from: 1) the Economic Analysis Division of the Wyoming Department of Administration and Information (WDAI), and 2) past water master plan reports. The developed population growth rates were then used to estimate the future water demands for the service area.

There are a number of external factors that may influence the future population of the City of Rawlins and thus it was decided to pursue a model that shows a moderate growth rate for the City of Rawlins. The population model was developed using the historical population data (Census, City and County records) and the information from the WDAI while taking into account the known external factors that will have a significant impact on the City of Rawlins' population. These external factors include nearby construction and energy development projects in the area as well as adjustments to the U.S. Census data to better correspond to the utilities use by residents as monitored by the City of Rawlins.

The baseline model uses data from the U.S. Census Bureau for the population of Rawlins in 1970, 1980, 1990, and 2000. Between 2001 and 2007, the populations are as estimated by the WDAI for the City of Rawlins and the Town of Sinclair. Current projections from the WDAI show the population declining which is unlikely to occur with the potential development from the energy industry. For the purpose of forecasting, the WDAI's forecast for the state of Wyoming was utilized to forecast the population of Rawlins, which averages to 0.8% population increase per year between 2009 and 2020. The forecast data between 2009 and 2020 was extrapolated out to the year 2038.

The projections for the City of Rawlins and Town of Sinclair are summarized in Table 3-5 and are shown graphically in Figure 3-3.

TABLE 3-5 CITY OF RAWLINS & TOWN OF SINCLAIR PROJECTION SUMMARY 2008 - 2038				
	City of Rawlins	Town of Sinclair	Total	
Year	Population	Population	Population	% Annual Change
2008	10,922	426	11,349	–
2009	12,091	475	12,565	10.7%
2010	13,476	532	14,009	11.5%
2011	13,075	516	13,591	-3.0%
2012	13,386	529	13,915	2.4%
2013	13,066	516	13,582	-2.4%
2014	13,052	515	13,568	-0.1%
2015	13,039	515	13,554	-0.1%
2020	12,985	513	13,498	-0.4%
2025	12,932	511	13,443	-0.4%
2030	13,058	516	13,574	1.0%
2035	13,464	532	13,996	3.1%
2038	13,870	548	14,418	3.0%

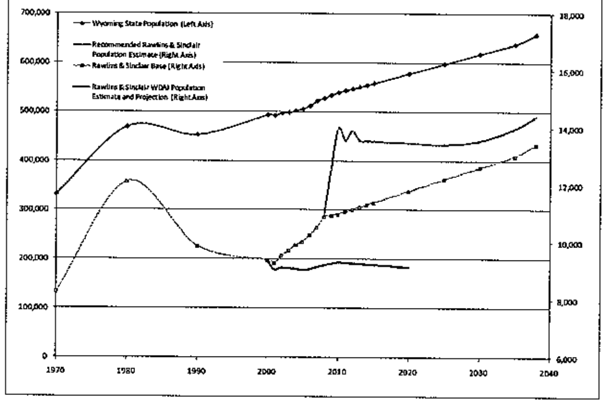


FIGURE 3-3
HISTORICAL AND ESTIMATED CITY OF RAWLINS & TOWN OF SINCLAIR POPULATIONS
1970 - 2038

Finished water production provided by the City was used in conjunction with population estimates to determine the average daily water usage per person. Between 2003 and 2008, usage has averaged 201 gallons per capita per day (GPCD). Rawlins' water usage typically peaks in July due to increased residential and municipal irrigation. The peak monthly usage to average day ratio is 1.91 between the years of 2003 and 2008. This figure also corresponds well to the previous ratio calculated by JMM at 1.88 (JMM, 1983). WWC did not calculate this figure, but recalling their peak month usage of 391 GPCD and average day usage of 206 GPCD would result in a ratio of 1.90. The average peak day usage to average day usage ratio is approximately 2.16.

Future demands for the Rawlins water were estimated using the future population projections and average usage figures. Average daily demand on the water system is projected to increase from 2.2 million gallons per day (MGD) to 2.9 MGD. Peak month usage is expected to increase from 4.2 MGD to 5.5 MGD and peak day usage will increase from 5.7 MGD to 7.5 MGD. The latter two figures were calculated from peak month ratio and peak day ratios described previously. The estimates are summarized in Table 3-9 and shown graphically in Figure 3-4.

Table 3-9 Future Demand Projection 2008 - 2038				
Year	Population	Avg. Day Demand (MGD) @ 200.8 GPCD	Peak Month Usage (MGD) @ 1.91 Ratio	Peak Day Usage (MGD) @ 2.16 Ratio
2008	10,922	2.2	4.2	4.7
2009	12,565	2.5	4.8	5.5
2010	14,009	2.8	5.4	6.1
2011	13,591	2.7	5.2	5.9
2012	13,915	2.8	5.3	6.0
2013	13,582	2.7	5.2	5.9
2014	13,568	2.7	5.2	5.9
2015	13,554	2.7	5.2	5.9
2020	13,498	2.7	5.2	5.9
2025	13,443	2.7	5.2	5.8
2030	13,574	2.7	5.2	5.9
2035	13,996	2.8	5.4	6.1
2038	14,418	2.9	5.5	6.3

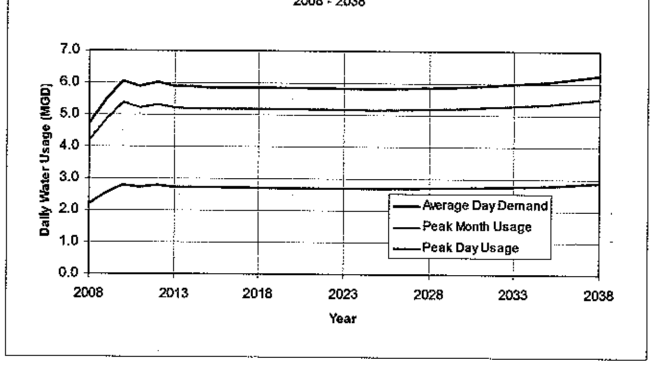


Figure 3-4
Future Demand Projection
2008 - 2038

4 WATER SUPPLY

This study reviewed the use, availability, reliability, and operations of the water sources currently in use by the City of Rawlins and identified and discussed the system deficiencies and presented recommended remedial actions for deficiencies. The deficiencies identified were:

1) *Atlantic Rim Reservoir Leak* - The Atlantic Rim Reservoir has leaked since it was first constructed in the early 1980s. Several studies have been conducted to evaluate the seepage from the reservoir. Some of the early studies suggested lining the reservoir with a synthetic liner, but this was never done due to cost.

2) *Adequate Raw Water Storage* - From previous studies it was demonstrated that the City could meet their water demand by solely pumping from the North Platte River. Unfortunately, the water treatment plant is designed to treat the water from Sage Creek Basin which is very low in turbidity and total dissolved solid. A mass balance study was conducted on Peaking Reservoir identified that additional storage beyond just the Peaking Reservoir is required in the system. The excess flows from Sage Creek Basin can either be stored in Atlantic Rim Reservoir or a new reservoir constructed to replace Atlantic Rim Reservoir.

3) Atlantic *Rim Reservoir to Water Treatment Plant Pipeline* - The 18-inch A.C. (asbestos cement) pipeline spans nearly 13,000-feet between Atlantic Rim Reservoir and the water treatment plant, and has seen an increased number of operational and maintenance issues over the last several years. The pipeline has consistently proven unable to withstand the high pressure as there is a failure of the pipeline almost every time the pipeline is valved off at the water treatment plant. The City avoids closing the valve on this pipeline in anticipation of a failure. The pipeline is also a bottleneck in the system as it is undersized for the rating of the Sage Creek Pipeline.

4) *Nugget Wells Declining Yield* - The actual capacity of the well field is dependent upon backpressure applied to the wells and how aggressively they are utilized. At the time of construction, production of the wells was projected to decline due to interference between the wells, turbulent losses associated with the flow from each well, and back pressure imposed on the wells from the transmission pipeline. In 1997, the shut-in pressure on the wells was tested at 100 PSI, a 40 PSI reduction since construction.

5) *Use of Raw Water for Irrigation* - The City of Rawlins currently utilizes a great deal of finished water to irrigate the City's parks and cemetery. Under current operation, the City irrigates a total of 50 acres at these two facilities, and at this rate, the City of Rawlins likely distributes 1.35 MG of finished water every week to these two facilities alone. This could increase to 1.90 MG each week if the cemetery is expanded to full capacity.

6) *Water Treatment* - A very cursory evaluation was made of the treatment plant to determine if the facility used to house the Actiflo system could be adapted for pre-treatment of the water prior to going to the diatomaceous earth filters in the water treatment plant. An immediate solution was not obvious. But simply installing screens to remove the daphnae and shrimp from Peaking Reservoir would be a great help.

7) *Optimal Use Raw Water Sources* - The City currently utilizes water from the springs in the Sage Creek Basin, the Nugget Wells, and the North Platte River. Additionally, this report identifies a fourth source, resurrecting the cemetery and penitentiary wells for raw-water irrigation of City-owned facilities. All of these sources are constrained by issues with water quality, yield, seasonal influences, pumping and treatment costs, filtration, and potability. The City also uses earthen reservoirs for storage of raw water for use during peaking periods. The reservoirs also offer the potential for detention and settling as well as blending of various sources. An operational study should be completed to ensure that the City utilizes existing water sources effectively and in compliance with future regulation of the North Platte River.

5 DISTRIBUTION AND GIS

After the water is treated at the Rawlins water treatment plant, it is conveyed to the City via two pipelines. The City has a low pressure zone and a high pressure zone, and there is a 12-inch pipeline that feeds the low pressure zone and a 20-inch pipeline that services the high pressure zone. Tied onto the pipeline feeding the low pressure zone, are two 7.5 million gallon reservoirs known as the Tank Farm. There are two storage tanks that service the high pressure zone. The first of these tanks is the hospital tank situated on the east side of City with a capacity of 1 million gallons and the second, the Painted Hills tank, is situated on the north side of City and has a capacity of 3 million gallons.

The water system was modeled using the H2ONet modeling program. The computer modeling showed the operational capacity of the distribution system to be in fairly good shape. A few deficiencies were identified. It was noted when looking at the diurnal cycle in the development of the model that the tank levels at the Tank Farm varied very little during the course of the day. Part of this is due to the fact that the tanks float on the system and if sufficient water is coming from the water treatment plant there is no need to take water from storage. Also, the tanks run in parallel so that water is added and removed from each tank simultaneously. The piping to the tanks needs to be modified so that they can operate in series or independently from each other so that the water goes through one tank and then into the second tank. The distribution system modeling also showed the need for a third pressure reducing station to allow the flow of water from the high pressure zone to the low pressure zone at Spruce and Pine Streets.

In addition to the development of the computer hydraulic model, the scope of the project called for the compilation and integration of a complete Geographic Information System (GIS). At the beginning of the project, spatial data relevant to the City's water system was collected. Data collection was performed using Magellan Professional Mobile Mapper CE GPS units rated to submeter accuracy. Approximately 200 data points across the City, including several fire hydrants, as well as major water system facilities (wells, springs, diversion structures, water treatment plants, storage tanks, pump stations, etc.) were collected. Digital photographs were taken at these major system components and were linked to their relevant GPS locations.

6 ECONOMIC ANALYSIS AND WATER SYSTEM FINANCING

The City of Rawlins' finances as they pertain to their water system were examined and revealed that for fiscal year 2008-09 there was a budget forecast shortfall of $239,743.00 between revenues and expenses (revenues of $1,692,650 and expenses of $1,932,393). Actual revenues and expenses turned out to yield a $178,082.23 surplus (revenues of $1,698,811.68 and expenses of $1,522,729.31). The practice of understating revenues and overstating expenses when assembling the water department budget appears to have occurred for many years and is ongoing. This is not a recommended practice. In addition to the financial status review, recommendations for water rates adjustments and financing structures were made.

The City of Rawlins currently categorizes their 3950 water customers into twelve types. Even though the City classifies users into twelve categories, the basic rate structure is simple. The City has two components to its water charge. The first is an availability fee which is flat rate of $14.00 per month. The second is a $2.00 per thousand "commodity charge" for water used. The same flat monthly fee is charged to all water customers, with two exceptions. Users "Outside Corporate Limits" pay $2.70 per thousand gallons. Construction water users in town pay $5.00 per thousand and out of town pan $10.00 per thousand. The Town of Sinclair, which is a consecutive public system, is not required to pay the standard base $14.00 per month. Based on a negotiated agreement between the two towns, Sinclair is billed at 62.5% of the standard rate, or $1.25 per thousand gallons, for water consumption. The other exception to the standard rate structure is the Glenn Addition, otherwise known as the "corrals." This city-owned area on the south side of Rawlins provides an area for people to keep horses in town. Corral pens are not metered. Each account is simply charged a flat monthly rate of $10.00. One master meter measures the total water usage to the corrals so the City can account for the amount of water used.

As of December 2009 the city does not have a tiered rate for the commodity portion of its water use fees. In April 2009, Rawlins raised their base water rate to $14.00, which previously was $10.00 per month. This was done in anticipation of the need to begin making payments on their WWDC loan for the Sage Creek Project. With just under 4,000 accounts, not including City-owned accounts, the base fee now raises approximately $190,000 per year of additional revenues over the previous rate.

The City of Rawlins' water accounting system was also reviewed. Water accounting is similar to financial accounting in that it simply means tracking amounts of water as it moves through the collection, treatment, and sale cycle. During the most recent year for which we have data there was an inordinately high percentage of finished or treated water lost from the system. According to metering information, the City's treatment facility produced over 805 million gallons of potable water during FY2008. However, during that same period point-of-use meter readings totaled only 552 million gallons billed to customers. This means that 253 million gallons, 31% of the potable water produced at the Rawlins treatment plant, was lost as non-revenue water. Part of the disparity can be explained by incidents for which the losses are known or can be estimated. Still, losses exceeding 10% in a municipal system are considered excessive.

In addition to the finished water, Rawlins also experiences a significant loss from their raw water sources. The City is only able to compare the total raw water produced against the total water treated at the plant. Data kept since 2003 indicates that only approximately 80% of the raw water collected annually makes it into the system as finished water.

7 SYSTEM IMPROVEMENTS

The major component of this study is to identify areas of improvement that are beneficial for all aspects of the water system. These include system improvements, operational improvements, and managerial improvements. The improvements identified are summarized below. The projects are summarized here in the order of precedence.

1) *Replace the Pipeline Between Atlantic Rim Reservoir and the Water Treatment Plant Pipeline and Construct a Booster Station to Deliver Water from the North Platte River to Atlantic Rim Reservoir* - Based on WWDC's recommended scope, the replacement of the main pipeline was estimated at $3,024,484 and the construction of the booster station was estimated at $858,521 for a total of $3,883,005. The WWDC has requested money from the legislature in the amount of $3,900,000 for the project. Of this, $2,613,000 will be in grant form and the remaining $1,287,000, or 33% of the total funding package, will be a loan at 4% interest over 30 years.

2) *Atlantic Rim Reservoir Rehabilitation* - As a cost-effective alternative, this report proposes to install an impermeable liner in the reservoir which would mitigate all leakage. This improvement is also considered a top priority and the WWDC has also commenced the process of appropriating funds for the rehabilitation of Atlantic Rim Reservoir. The WWDC has requested money from the legislature in the amount of $4,000,000 for the project. Of this, $2,680,000 will be in grant form and the remaining $1,320,000, or 33% of the total funding package, will be a

loan at 4% interest over 30 years. The funds include appropriations for the main pipeline replacement and the booster station as well as replacement/remediation of the existing line to be used as a transmission line from the booster station to Atlantic Rim Reservoir. This project comes as a substantial savings compared to decommissioning Atlantic Rim Reservoir and constructing a new reservoir, which was estimated at $16,500,000.

3) *Investigate the Cemetery and Prison Wells for Irrigation Use and Develop a Water Source and Raw Water Storage Reservoir Operational Plan* - The addition of a raw water irrigation system sourced by two non-potable wells located within City limits would reduce the demand and associated costs of the water treatment plant. Costs were developed for the investigation of the wells, the preparation of a Water Source and Raw Water Storage Operational Plan, and for connecting the wells to the cemetery and nearby parks. The budget for the investigation of the wells and the development of an Operational Plan is $115,000 and the total cost to connect the wells for irrigating said facilities is $712,524. The investigation of the wells and development of the operational plan should be completed by the year 2011.

4) *Paint the Tank Farm Tanks* - The interior and exterior coatings of the Tank Farm Tanks are due for replacement. The hospital tank and the Painted Hills Tank have been recently completed. The coating will protect the tanks from corrosion both on the interior and from weathering on the exterior. The cost to repaint both of the tanks is estimated at $2,059,401. The tanks should be painted by the year 2013.

5) *Install Second Looping Line to North East Rawlins Distribution Area* - The northeastern section of Rawlins is currently fed from a 16-inch main that runs east from the Painted Hills Tank. The only additional connection to the area is a single 6-inch main. In the event of a failure in the primary connection, the area would suffer significantly. The improvement consists of installing an additional 12-inch main that connects the area along Inverness Boulevard. The cost of the project is estimated at $366,757. This cost assumes that a portion of the project cost can be borne by the developer of the proposed subdivision between Higley Boulevard, and Harshman Street. The cost will be higher if the City must install the entire pipeline without cooperation from a developer. This line should be completed by the year 2013.

6) *Install Interconnect and PRV Across Pressure Zones at Intersection of 15th Street and Spruce Street* - The system modeling effort identified a low pressure condition that can occur during certain parts of the day in the eastern part of town. This improvement essentially constructs a 12-inch pipeline that serves as an interconnection between the high and low pressure zones. The estimated cost of the improvement is $386,205. This improvement should be implemented by the year 2015.

7) *Install Booster Pumps at Miller Hill Vault* - The Nugget wells have decreased in production over time. By installing a booster station downstream of the three wells, the back pressure imposed on the wells will be reduced and will increase production. The estimated cost for adding booster pumps to the Miller Hill Vault is estimated at $475,848. This improvement should be completed by the year 2018.

8) *Install Raw Water Lines to Cemetery and Prison Wells* - This improvement is a follow-up to the investigation of the cemetery and penitentiary wells described previously. If the wells prove sufficient and are economic to bring into production, then it is recommended to construct the necessary infrastructure to provide raw water to the cemetery and nearby parks. This improvement consists of the construction of two small well houses, the installation of well pumps, pipelines connecting to the facilities to be irrigated, and raw water isolation equipment.

The estimated cost to install the required infrastructure is $712,524. This improvement should be implemented by the year 2018.

9) *Install Screens on the Inlet of the Water Treatment Plant* - The water treatment plant must backwash their diatomaceous earth (DE) filters periodically to maintain filter efficiency. It is recommended to install screens on the inlet works of the Plant to increase the DE filter cycle times. The cost to conduct the study and install the screens will be approximately $100,000. This improvement should be implemented by the year 2020.

10) *Construct Raw Water Pipeline and Booster Station From the North Platte River Pipeline For Irrigation* - An alternative to utilizing the cemetery and penitentiary wells for irrigation purposes would be to utilize water from the North Platte River Pipeline. This improvement consists of installing a small booster station near the proposed connection to the North Platte River Pipeline and approximately 2.5 miles of pipeline. This improvement should be considered as an alternative or supplement to the use of the cemetery and penitentiary wells. At this time, it appears that the use of the cemetery and penitentiary wells is a more cost-effective option and therefore this improvement is not recommended at this time. The estimated cost to install the required infrastructure to irrigate the parks and cemetery with water from the North Platte River is $858,521.

8 OPERATIONAL IMPROVEMENTS

Overall the City of Rawlins does an excellent job running their system. Their priority is to use the water from Sage Creek Basin which has the highest quality and lowest cost to use. The City is using raw water from the North Platte River to irrigate the new golf course which is the cheapest means of providing irrigation water to that facility. There are only a few small recommended modifications.

1) *Increase use of the Nugget Wells* - In view of the benchmarks established during the development of the Platte River Recovery Implementation Program, a program for use of the wells should be developed in conjunction with the State Engineer's Office to make the best use of the wells. It may mean using the wells in the non-irrigation season to avoid exceeding the benchmarks established for the non-irrigations season to get the credit for the groundwater accretions to the North Platte River. The depletions and benchmarks are complicated and development of a program of usage with the State Engineer's Office would be the best way to approach this issue

2) *Develop Reservoir Operation Plan* - A reservoir operation plan should be developed to keep the water in Rawlins Reservoir as fresh as possible. Also, aside from the North Platte River depletions and benchmarks, it was determined that if Peaking Reservoir is kept full at May 1 of each year, even with the record low flow from the Sage Creek Basin, the City can meet the future demand through pumping of the North Platte River. The City should try to make sure that the combined storage of Peaking and Atlantic Rim Reservoirs meets or exceeds the storage capacity of Peaking Reservoir on May 1 of each year.

3) *Reconfigure Tank Farm Inlet and Outlet Piping* - The inlet and outlet piping at the Tank Farm tanks should be reconfigured so they do not function in parallel. The piping needs to be re-arranged so that water will flow into one tank, then into the next tank prior to going into town. This will require very little piping and help assure a good turnover in the two tanks.

4) *SCADA System Training* - The water treatment plant personnel should receive additional training on their SCADA system so the can better access the data being collected.

5) *Activate In-Town* Wells - Consideration should be given to re-activating the penitentiary and cemetery wells in the future. This will alleviate some of the demand from the water treatment plant during the summer months and help keep the City below the benchmarks established in the Platte River Recovery Implementation Program.

9 MANAGERIAL IMPROVEMENTS

The economics and management practices of the water system were reviewed to identify practices that can be improved. The goals are to ensure that the Water Department provides fair water rates to the City subscribers while generating the revenues to operate the system in a fiscally sustainable manner including funding for preventative maintenance and future improvements. While the Rawlins system is in sound financial condition, there are improvements that can be made in the approach Rawlins uses in water accounting and budgeting for the system. Those are discussed in the following sections.

1) *Water Accounting* - Rawlins currently produces an unacceptably high amount of nonrevenue water, water that is filtered and treated by the water plant but does not go through a meter for billing or other accounted-for use such as watering of city parks. Currently the city is accounting for only 69% of its produced water, 552 million gallons of the 805 million produced. Rawlins needs to improve its water accounting practices. An acceptable system loss percentage is generally considered to be 10% or less. Rawlins is at 31%.

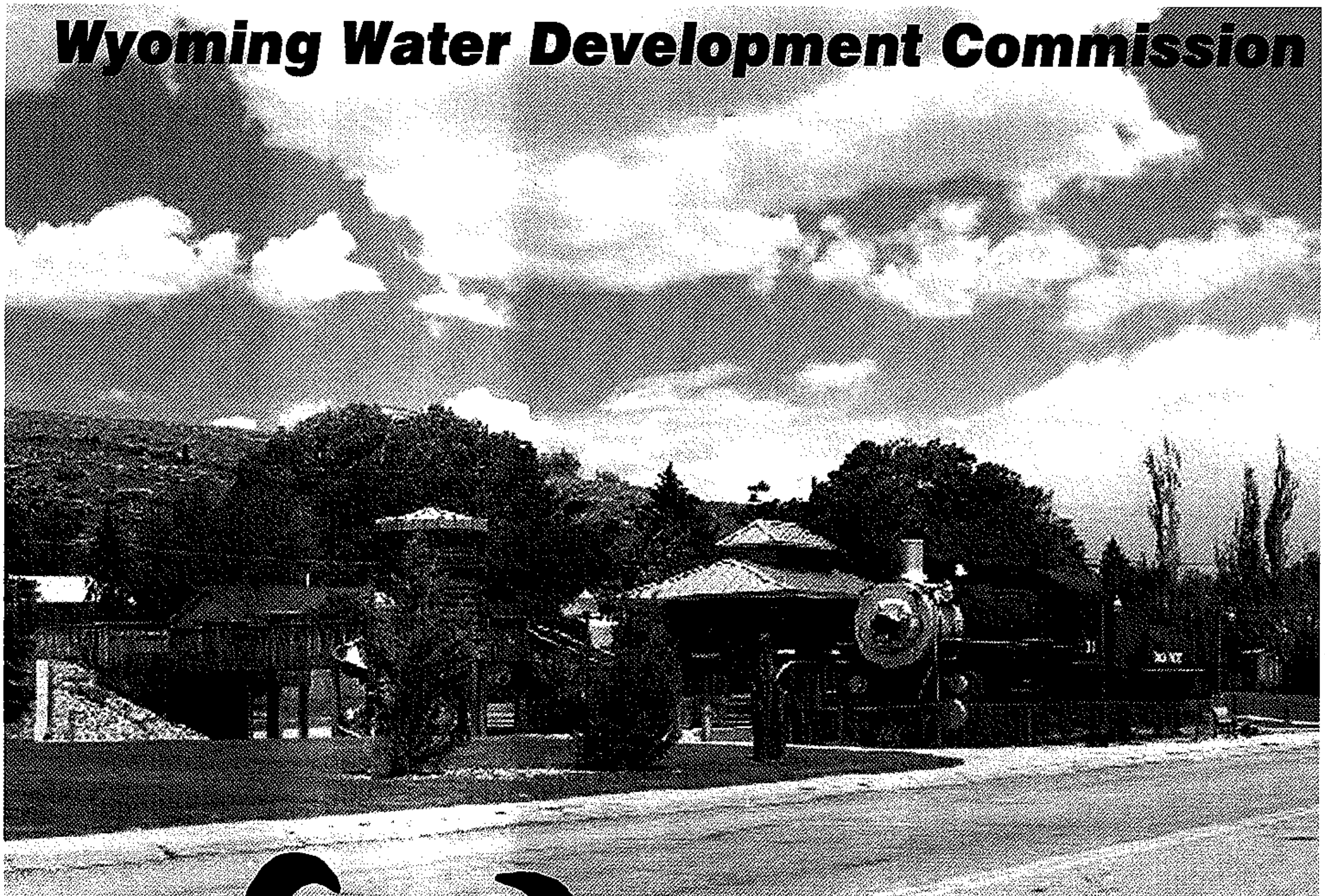
Raw water losses are of less concern than is produced water because its cost to the city is significantly lower and there is less the City can do that will cost effectively reduce those losses. Leakage from the reservoirs and evaporation losses are normal. Measures are being planned to cost effectively reduce some of those losses.

2) *Water Rates* - Rawlins present system of charging for water service is generating sufficient revenues to meet present needs. Out-of town users are charged a slightly higher water use rate than are in-town users. The cost of produced water is $2.50 per thousand gallons based on City cost data. This should be the rate charged for any usage. Base rates will have to increase several-fold for Rawlins to meet financial obligations if the recommended system improvements are to be made. If the City is to make the identified improvements and the system is to remain fully self-supporting, base water rates are forecast that need to be approximately $190 per month plus the $2.50 per thousand gallon water use charge in just nine years, 2018.

If the City makes the identified improvements and the present funding assistance programs are used to their fullest, base water rates are forecast that need to be $75.40 plus the $2.50 per thousand gallon water use charge by 2018.

3) *Budgeting* - Rawlins' historical practices in budgeting for the water system can be characterized as overstating forecast revenues and understating forecast expenses. It is recommended that each upcoming year's budget be based on the year-to-date expenses and revenues rather than on the last year's budget as is now being done. This will result in a tighter, but more realistic water department budget. Also, during the budgeting process, the draft budget needs to show actual reserves in the water account. Present practice is to show as "Beginning Balance" a significantly smaller number that is sufficient to force a balanced budget.

Wyoming Water Development Commission



Final Report

CITY OF RAWLINS WATER MASTER PLAN - Level I

MAY 2010

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

CONJUNCTION WITH

James Gores & Associates

OLSSON ASSOCIATES

FINAL REPORT

RAWLINS MASTER PLAN
LEVEL I STUDY

Submitted to:

STATE OF WYOMING
WATER DEVELOPMENT COMMISSION
6920 YELLOWTAIL ROAD
CHEYENNE, WYOMING 82002

THE CITY OF RAWLINS
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SECTION 1 - INTRODUCTION

SECTION 1

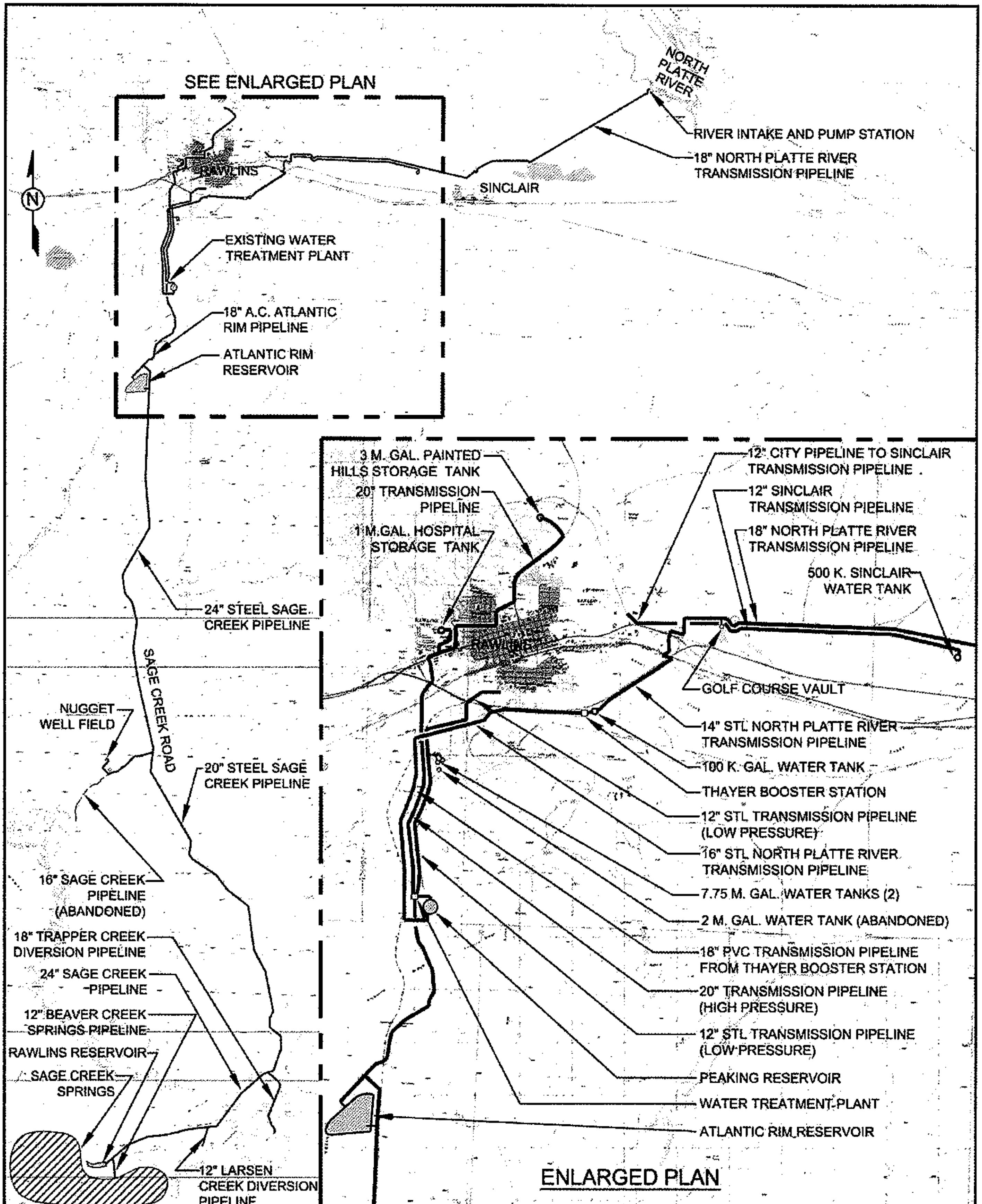
Brief History, Purpose, and Past Studies

1 BRIEF HISTORY

The City of Rawlins obtains water for its municipal needs from three separate sources. These sources are 14 springs located in the upper Sage Creek Basin, three Nugget Formation wells located approximately 14 miles south of the City, and the North Platte River from its diversion facility near the Town of Sinclair. The water from all three sources is treated at the City's Water treatment plant which utilizes diatomaceous earth filters as a means of mechanical filtration and chlorine gas for disinfection. Incorporated in and critical to the operation of the City's water supply system are a series of three earthen reservoirs – Rawlins Reservoir, Atlantic Rim Reservoir, and Peaking Reservoir. Figure 1-1 illustrates the major components of the Rawlins Water System.

The Sage Creek Basin springs have been in use since 1924. Water from the springs is collected in a series of collection pipelines located approximately 23 miles south of the Water treatment plant. The Sage Creek Pipeline runs between the Rawlins Reservoir and the Water treatment plant and consists of approximately 25 miles of 20-inch and 24-inch steel pipeline. Water from the Nugget Wells is also conveyed by the Sage Creek Pipeline. The Nugget wells (Nos. 1, 2 and 3) are artesian wells that were completed in the mid-1980's and had initial flows ranging from 350 GPM to 900 GPM (after stimulation). The City of Rawlins currently has water rights on the North Platte River for 2.01 cubic feet per second (CFS) which was acquired from the Union Pacific Water Company. The Union Pacific Water Company originally had water rights for 2.32 CFS, but opted to retain 0.31 CFS for railroad and domestic use. In 2002, the Town of Sinclair transferred 1.0 CFS of territorial water rights on the North Platte River to the City of Rawlins and bestowed to the City of Rawlins an additional 1.21 CFS of their water rights on the North Platte River. In exchange, the City of Rawlins agreed to deliver up to 1.21 CFS of potable water to the Town of Sinclair as well as construct and maintain any pipelines and facilities associated with the delivery of water to the Town of Sinclair.

In order to fully utilize the water from the Sage Creek Basin springs, a series of reservoirs were constructed and incorporated into the system. The first of these was the Rawlins Reservoir which was permitted in 1955 for 624 acre feet of water. Rawlins Reservoir is located about 4 miles upstream on Sage Creek from Highway 71 approximately 25 miles south of the city. Water can be conveyed from Rawlins Reservoir to the Water treatment plant through the Sage Creek Pipeline. The second reservoir constructed was the Peaking Reservoir which is located approximately 0.25 miles southeast of the water treatment plant. Peaking Reservoir was permitted in 1966 and is appropriated for 346.66 acre feet of water. The reservoir is primarily filled via the Sage Creek Pipeline, but can also accept water from the North Platte River. The last reservoir, and the most problematic, is the Atlantic Rim Reservoir. Atlantic Rim Reservoir was permitted in 1978 for 644.5 acre feet of water. The reservoir is located along Highway 71 approximately 2.25 miles south of the water treatment plant. The reservoir is filled via the Sage Creek Pipeline. The reliability, usability, and sustainability of the Atlantic Rim Reservoir have been in question for many years because it has leaked since its construction.



DATE: MAY 2010	Wester Wetstein & Associates — Consultants in Engineering and Hydrogeology	605 Plaza Court P.O. Box 2202 Laramie, WY 82073 (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE
JOB NO.: 7.009			RAWLINS WATER MASTER PLAN	1-1
SCALE: NONE			SYSTEM PLAN	

Once treated, the finished water is collected in a clear-well at the Water treatment plant where it is then conveyed to the City of Rawlins. Two pipelines draw water from the clear-well to serve two separate pressure zones. In addition to the clear-well storage, the City of Rawlins has 19.5 MG of storage from a series of 4 storage tanks, two storage tanks in each of the City's pressure zones.

As mentioned, the City of Rawlins currently operates under two pressure zones. The distribution system essentially overlaps both zones and isolation occurs at various interconnects. In addition to these two separate pressure zones, the City of Rawlins also purveys water to the Town of Sinclair. The Town of Sinclair can be considered a third pressure zone as water is delivered to a storage tank midway between Sinclair and Rawlins.

2 PURPOSE AND GOALS

In the past 30 years, the City of Rawlins has made significant improvements to its water supply system. These improvements include the construction of the Sage Creek Basin transmission pipeline, the construction of the North Platte River transmission pipeline and booster station, the upgrade to the Thayer booster station, the addition of the fourth diatomaceous earth filter to the water treatment plant, and the construction of a pretreatment facility which utilizes a sand ballasted clarification system. During this time period, there have been numerous studies conducted on the Rawlins' system; however, most of these studies have concentrated on the system's supply, resulting in the numerous system upgrades mentioned.

There are several goals of this study. The previous studies focused on the water supply component of the system and not very much work has been done on the system downstream of the water treatment plant. As with any water master plan, the population projections along with demand projections were developed along with examining the adequacy of the existing supplies to meet the projected demands. This study had a few additional items that are usually projects unto themselves. These include:

- Develop a working model of the distribution system. This was reportedly attempted in previous studies, but never completed.
- Review the financial status of the water system including billing rates, sinking funds, and overall financial operations.
- Evaluate the feasibility of using the wastewater effluent for irrigation purposes.
- Develop a graphical information system of the water system.
- Review the feasibility of rehabilitating Atlantic Rim Reservoir (added later in the master plan effort).

3 PAST STUDIES

Over the past 29 years, there have been numerous studies performed involving the Rawlins water system or some aspect of their system. Below is a list of these studies in chronological order.

- CTL/Thompson, Inc. Consulting Geotechnical and Materials Engineers, *Evaluation of Underseepage Atlantic Rim Reservoir Rawlins, Wyoming,* June, 1981
- James M. Montgomery, Consulting Engineers, *City of Rawlins, Wyoming Hydrogeologic and Water Supply Study Task Report No. 1, Phase I,* May, 1982
- James M. Montgomery, Consulting Engineers, *City of Rawlins, Wyoming Hydrogeologic and Water Supply Study Task Report No. 2, Phase II, III, IV,* July, 1982
- James M. Montgomery, Consulting Engineers, *City of Rawlins Water Development Master Plan Draft Report Summary for Public Hearing,* December, 1982
- James M. Montgomery, Consulting Engineers, *City of Rawlins Water Development Master Plan V. I,* May, 1983
- James M. Montgomery, Consulting Engineers, *City of Rawlins Water Development Master Plan V. II, Background Data and Reports,* May, 1983
- Anderson & Kelly, Inc., *Hydrogeologic Evaluation of the Nugget Aquifer Near Rawlins, Wyoming Level II Feasibility Study,* November, 1984
- James M. Montgomery, Consulting Engineers, *Rawlins Groundwater Project Level III, Summary of Interim Report and Nugget Aquifer Report,* January, 1986
- James M. Montgomery, Consulting Engineers, *Rawlins Groundwater Project Level III, Interim Report,* February, 1986
- James M. Montgomery, Consulting Engineers, *Rawlins Groundwater Project Level III, Nugget Aquifer Report,* February, 1986
- Jeffrey L. Hauff, *Report of a Class III Cultural Resource Inventory, Rawlins Groundwater Project, Lower Sage Creek Transmission Line, Carbon County, Wyoming,* July, 1986
- James M. Montgomery, Consulting Engineers, *City of Rawlins, Wyoming Sage Creek Water Transmission Pipeline and Wellfield Facilities, Legislative Executive Summary,* December, 1986
- Northern Engineering and Testing, Inc., *Report of Geotechnical Investigation for Phase II Sage Creek Water Line,* July, 1987
- Western Water Consultants, *City of Rawlins Water Supply Project Level II, Phase I Report,* November, 1997
- Western Water Consultants, *City of Rawlins Water Supply Project Level II, Executive Summary,* June, 1998
- Western Water Consultants, *City of Rawlins Water Supply Project Level II, Phase II Report,* June, 1998

- Western Water Consultants, *Rawlins Raw Water Storage Level II, Phase I and II Report,* October, 2006

- Western Water Consultants, *Rawlins Raw Water Storage Level II, Phase I and II Report, Executive Summary,* October, 2006

- Western Water Consultants, *Rawlins Raw Water Storage Level II, Phase III Report,* September, 2008

The water system studies performed in the 1980s resulted in improvements to the raw water supply from the Sage Creek Basin springs and the Nugget Aquifer wells. Work completed during this time period was concentrated on the development of the Nugget groundwater source and construction of the Sage Creek Springs pipeline. In the late 1990s, the Rawlins water system was again reviewed with the resulting recommendations shifting from a focus on the Sage Creek Basin source to the City's North Platte River water allotment. The North Platte River pipeline and booster station and the pre-treatment expansion of the water treatment plant were constructed as a result of these studies.

The 2006 review of the Rawlins water system again was focused on the City's supply and looked at the raw water storage capacity associated with the City's reservoirs. This study concentrated on the potential raw water supply limitations during drought periods and the existing reservoirs capabilities of meeting the City's demands during these stress periods. From these recent studies, the limitations of the pipeline from the Atlantic Rim Reservoir to the water treatment plant were highlighted along with the recommendation to abandon the Atlantic Rim Reservoir due to its seepage problems and to construct an alternative Peaking II Reservoir.

SECTION 2 – EXISTING SYSTEM

SECTION 2

Existing System

1 INTRODUCTION

The City of Rawlins obtains water for municipal use from three sources which is stockpiled in three large reservoirs upstream of the water treatment plant. The water treatment plant filters and treats the water to compliance with EPA primary and secondary water quality standards. Upon leaving the water treatment plant, finished water is collected in four storage tanks which feed the City's two pressure zones. These components are discussed further in this section and in other areas of this report. Plates 1 through 9 in Appendix A illustrate the system in more detail.

2 WATER SYSTEM

2.1 Sage Creek Springs Pipeline and Reservoirs

Water is conveyed to the water treatment plant via the Sage Creek Springs Pipeline and the North Platte River Pipeline. The Sage Creek Springs Pipeline conveys up to 6.92 CFS (3,100 GPM) of water from 14 springs in the Sage Creek Basin and up to 2.0 CFS (900 GPM) from three Nugget Formation Wells that offer artesian flow into the pipeline. The wells have reduced production since their inception and are typically only utilized during summer months at a reduced rate and are allowed to recover during lower demand periods. Along the Sage Creek Springs Pipeline are three reservoirs with a combined storage of 1,615 acre-feet. These reservoirs are Rawlins Reservoir, Atlantic Rim Reservoir, and Peaking Reservoir. Some of the storage goes unutilized due to water quality issues and operational limits. Refer to Section 4 for more detail on each of these facilities.

2.2 North Platte River Pipeline

The North Platte River Pipeline conveys water from the North Platte River Pump Station to Peaking Reservoir. Midway in the pipeline is a diversion to the Rochelle Ranch Golf Course to provide raw water for irrigation. Water must be boosted at Thayer Booster Station in order to reach Peaking Reservoir. Water from the North Platte River is subject to unpredictable turbidity from seasonal or climatic changes and is used only to supplement water from the Sage Creek Springs Pipeline. The City of Rawlins currently has water rights for 2.01 CFS (900 GPM) that it received from the Union Pacific and 1.0 CFS (448 GPM) that it received from the Town of Sinclair. The North Platte River Pump Station has a capacity of up to 4.22 CFS (1,890 GPM) which is sized to pump Rawlins' 3.01 CFS and the remaining 1.21 CFS held by the Town of Sinclair. Flow from the pump station is paced with variable frequency drives. Refer to Section 4 for more detail on the operations and water quality from the North Platte River.

3 TREATMENT

3.1 Treatment and Operations

The water treatment plant typically draws water directly from the Sage Creek Springs Pipeline and adds water from Peaking Reservoir when the pipeline cannot meet the current demand. Water from Atlantic Rim Reservoir may also be diverted into the pipeline if necessary to meet demand. The water treatment plant utilizes diatomaceous earth filters as a means of mechanical filtration and chlorine gas for disinfection. The water treatment plant can currently treat up to 8.0 MGD. It has proven sufficient for treatment of water that is sourced directly from the springs/wells. If water from Peaking Reservoir or Atlantic Rim Reservoir is used to supplement water from the Sage Creek Springs Pipeline, then the filters require additional backwash cycles as they tend to plug up faster with daphnia and other aquatic inhabitants that reside in the reservoirs. At times when demand is high enough to warrant the use of North Platte River water, periods of high turbidity are possible with seasonal or climatic weather changes. It is possible to overwhelm the diatomaceous earth filters with turbid water in Peaking Reservoir from the North Platte River. Water treatment operations, deficiencies, and recommended modifications will be further discussed in Section 4 of this report.

3.2 Finished Water

Finished water from the water treatment plant is collected in a clear-well. The level in the clear-well is controlled with an altitude control valve to maintain a constant level. Two pipelines draw water from the clear-well to serve the high and low pressure zones. The elevation of the water treatment plant is sufficient to serve the needs of both pressure zones. Both pipelines run through a meter house near the water treatment plant where the pressure in each line is controlled with altitude control valves set to the pressure of their respective pressure zones.

4 STORAGE

4.1 Tank Farm

Serving the low pressure zone is a pair of 7.75 MG tanks offering a total of 15.5 MG of storage. Each tank is approximately 200-ft in diameter and 35-ft in height. The high water line (HWL) of the tanks is nominally set at an elevation of 6,954. The levels in the tanks are controlled by an altitude control valve. The tank farm is located along Hwy 71 0.8 miles south of Interstate 80.

4.2 Hospital Tank

The first of two tanks serving the high pressure zone is the 1 MG hospital tank. The HWL of the tank is nominally set at an elevation of 7058.76 feet. The level in the tank is controlled with an altitude control valve. The tank is located approximately 0.3 mile northeast of the hospital.

4.3 Painted Hills Tank

The second of two tanks serving the high pressure zone is the 3 MG Painted Hills

Tank. The base of the tank was measured at an elevation of 7085 feet. The level in the tank is controlled with an altitude control valve. The tank is located 0.4 miles west of the 3rd Street and Higley Boulevard intersection.

4.4 High Pressure Zone Tanks Elevation Difference

The high pressure zone currently utilizes two tanks that have been installed at differing elevations. The Painted Hills Tank is installed approximately 26 feet higher than the hospital tank. Both tanks utilize altitude control valves to attempt to maintain the tank level. It is possible to fill both tanks as their respective HWLs are below the elevation of the water treatment plant; however, their effectiveness is questionable. The changeover in the tanks is highly dependent upon the dynamics of the system, area of demand, and altitude control valve set points. It is likely that the hospital tank endures much more cycling than the Painted Hills Tank. This is reinforced by the City's SCADA historian that shows historical levels in the hospital tank to be consistently higher and more volatile than the levels in the Painted Hills Tank. Depending on how the system is tuned will determine whether the higher tank operates with less storage capacity or less changeover.

5 DISTRIBUTION

5.1 Pressure Zone Overview

The City of Rawlins currently operates under two pressure zones. The distribution system essentially overlaps both zones and isolation occurs at various interconnects. Figure 6-1 in Section 6 shows the pressure zone boundary. Section 6 discusses the flow model of the distribution system and provides an overview of operations, deficiencies, and recommended improvements for the distribution system.

5.2 High Pressure Zone

The high pressure zone serves the upper elevations of the City. A 20-inch pipeline extends from the water treatment plant clear-well to 21st Street on the western side of Rawlins. The 20-inch main runs the length of the City along the northwestern end of town to the Painted Hills Tank. The hospital tank is filled through a 12-inch main fed from the 20-inch main. The high pressure zone is fed through various sized interconnecting mains.

5.3 Low Pressure Zone

The low pressure zone serves the lower elevations of the city and is supplied by a 14-inch diameter pipeline that is sourced from the water treatment plant clear-well and connects to the low pressure zone distribution system at the Donnel Street and Bennett Street intersection. The 14-inch pipeline is tied to the tank farm enroute to town. Two smaller 12-inch pipelines spur out before the tank farm to supply the TA Travel Center and the Wyoming State Penitentiary.

5.4 High to Low Zone Crossover and Isolation

The Rawlins distribution system was originally on a single pressure zone. With expansion and growth in the City, it evolved into the two zone system it is today. PMPC Civil Engineers of Saratoga, Wyoming conducted a pressure zone study for the City of Rawlins. The findings of that report are summarized here (PMPC, 2000). The high pressure zone is isolated from the low pressure zone at 15 locations. The zones are typically isolated through a simple valve. One connection has since been plugged off leaving 14 connected locations. Two of the connections utilize pressure reducing valves (PRVs) that allow water from the high pressure zone to supplement the low pressure zone. The PRVs are located at the intersection of 9th Street and Date Street and east of Highway 287 across from the entrance into the Painted Hills Subdivision. Three of the connections are also equipped with ¾-inch copper bypass lines that keep water from stagnating in the lines. With the differential pressure across the zones, flow in these bypass lines is estimated at 62 GPM. The high velocity through these bypass lines has lead to premature failure of these lines.

SECTION 3 – SERVICE AREA, POPULATION PROJECTIONS AND DEMAND

SECTION 3

Service Area, Population Projections, and Demand

1 INTRODUCTION

This chapter reviews the service area, population projections, and current and future demand for the City of Rawlins and the Town of Sinclair. This chapter also presents City of Rawlins, Town of Sinclair, and Carbon County population forecasts from: 1) the Economic Analysis Division of the Wyoming Department of Administration and Information (WDAI), and 2) past water master plan reports. The last section of this chapter presents the population growth rates used in estimating the future water demands.

2 SERVICE AREA

The service area for this study includes the incorporated and unincorporated areas of Rawlins currently served by the water supply and distribution system. Additionally, the incorporated and unincorporated areas of the Town of Sinclair are also included in this study since they have an agreement with the City of Rawlins for finished water from Rawlins' treatment facilities in exchange for the use of the Town of Sinclair's water rights to the North Platte River.

3 CITY OF RAWLINS, TOWN OF SINCLAIR, AND CARBON COUNTY HISTORICAL POPULATIONS

Historical populations compiled from US Census Bureau figures from 1900 through 2000 for the City of Rawlins and Carbon County are presented in Table 3-1 and are shown graphically in Figure 3-1. Table 3-1 indicates that the City of Rawlins and Carbon County

TABLE 3-1
U.S. CENSUS BUREAU
CITY OF RAWLINS, TOWN OF SINCLAIR, AND CARBON COUNTY DECENNIAL CENSUS FIGURES
1900 - 2000

	City of Rawlins				Town of Sinclair				Carbon County				City of Rawlins as % of Carbon County
Year	Pop.	Pop. Increase	% Change	% Annual Change	Pop.	Pop. Increase	% Change	% Annual Change	Pop.	Pop. Increase	% Change	% Annual Change	
1900	2,317	--	--	--	--	--	--	--	9,589	--	--	--	24%
1910	4,256	1,939	84%	6.3%	--	--	--	--	11,282	1,693	18%	1.6%	38%
1920	3,969	-287	-7%	-0.7%	--	--	--	--	9,525	-1,757	-16%	-1.7%	42%
1930	4,868	899	23%	2.1%	--	--	--	--	11,391	1,866	20%	1.8%	43%
1940	5,531	663	14%	1.3%	604	--	--	--	12,644	1,253	11%	1.0%	44%
1950	7,415	1,884	34%	3.0%	775	171	28.3%	2.5%	15,742	3,098	25%	2.2%	47%
1960	8,968	1,553	21%	1.9%	621	-154	-19.9%	-2.2%	14,937	-805	-5%	-0.5%	60%
1970	7,855	-1,113	-12%	-1.3%	445	-176	-28.3%	-3.3%	13,354	-1,583	-11%	-1.1%	59%
1980	11,547	3,692	47%	3.9%	586	141	31.7%	2.8%	21,896	8,542	64%	5.1%	53%
1990	9,380	-2,167	-19%	-2.1%	500	-86	-14.7%	-1.6%	16,659	-5,237	-24%	-2.7%	56%
2000	8,538	-842	-9%	-0.9%	423	-77	-15.4%	-1.7%	15,639	-1,020	-6%	-0.6%	55%

population trends have varied significantly since the first recorded U.S. Census figures were compiled in 1900.

Table 3-1 indicates that the City of Rawlins experienced the largest population increase in the decade of the 1970s (3,692 residents). Conversely, the City of Rawlins experienced the largest population decrease in the decade of the 1980s (-2,167 residents). In the last 50 years, population has increased by as much as 34% and has decreased by as much as 19% in a decade. The City of Rawlins has been a victim of large-scale boom and bust periods associated with the energy industry. As a result, the population datum does not trend with any predictable fashion. The population of Sinclair trends similar to the City of Rawlins.

4 WYOMING DEPARTMENT OF ADMINISTRATION AND INFORMATION POPULATION CENSUS

4.1 General

The Wyoming Department of Administration and Information, Economic Analysis Division estimates population projections for Wyoming cities and counties between U.S. Census Bureau decennial population censuses.

4.2 Population Estimates / Forecasts (1990 – 2020)

Table 3-2 summarizes the Wyoming Department of Administration and Information population estimates and forecasts for the City of Rawlins, Town of Sinclair, and Carbon County from 1990 through 2020. The data presented in Table 3-2 is also presented graphically in Figure 3-2. The WDAI predicts a population of 8,748 in 2020 for the City of Rawlins and 510 for the Town of Sinclair. The year 2020 projection in this report estimates a population of 11,358 with a potential of up to 12,473 if the large projects discussed in this report are seen to completion. In 2008, the WDAI predicted a population of 8,816 which City of Rawlins' officials openly disagree with and is discussed further in Section 5 of this report.

Data from Table 3-2 indicates that the City of Rawlins average annual population has decreased slightly by 0.7% between 1990 and 2000 and by 0.4% between 2001 and 2006. Carbon County has decreased by 4.4% between 1990 and 2000 and by 0.7% between 2001 and 2006. The WDAI estimates that the population is decreasing for both the City of Rawlins and Carbon County while the City of Rawlins is decreasing at a lesser rate. The Town of Sinclair has remained relatively constant.

5 PAST POPULATION PROJECTION STUDIES

Past population projections have been completed by other firms. In 1997, Western Water Consultants predicted a year 2020 population projection of 12,050 in their *City of Rawlins Water Supply Project, Level II, Phase I Report* (WWC, 1997). In 1986, James M. Montgomery, Consulting Engineers, Inc. completed a population projection which estimated a population of 25,000 in the year 2000 and 35,000 in the year 2025 in their *Rawlins Groundwater Project-Level III Interim Report* (JMM, 1986). The difficulty of attaining an accurate prediction is apparent from these past reports.

FIGURE 3-1
U.S. CENSUS BUREAU
CITY OF RAWLINS, TOWN OF SINCLAIR, AND CARBON COUNTY POPULATIONS
1900 - 2000

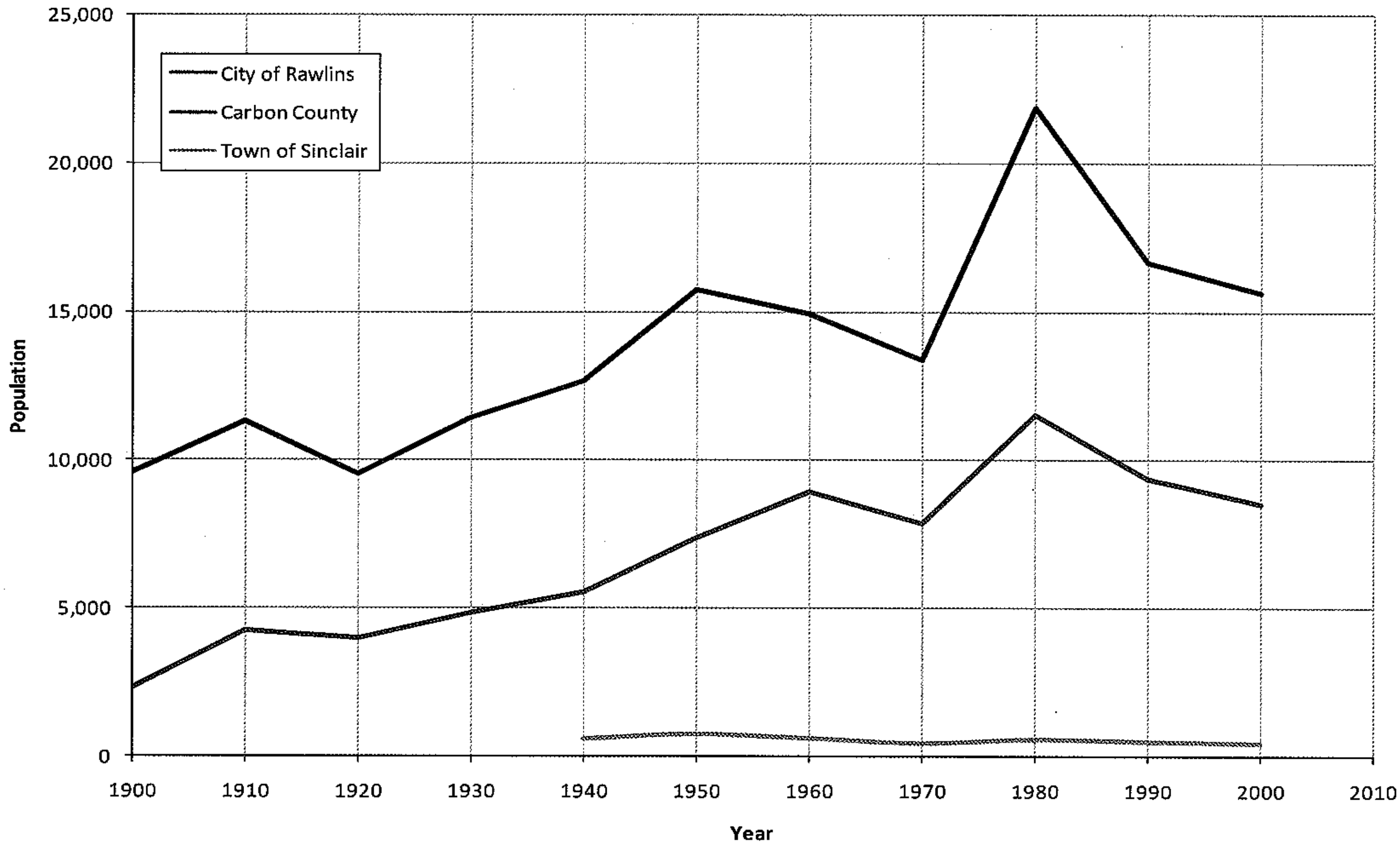


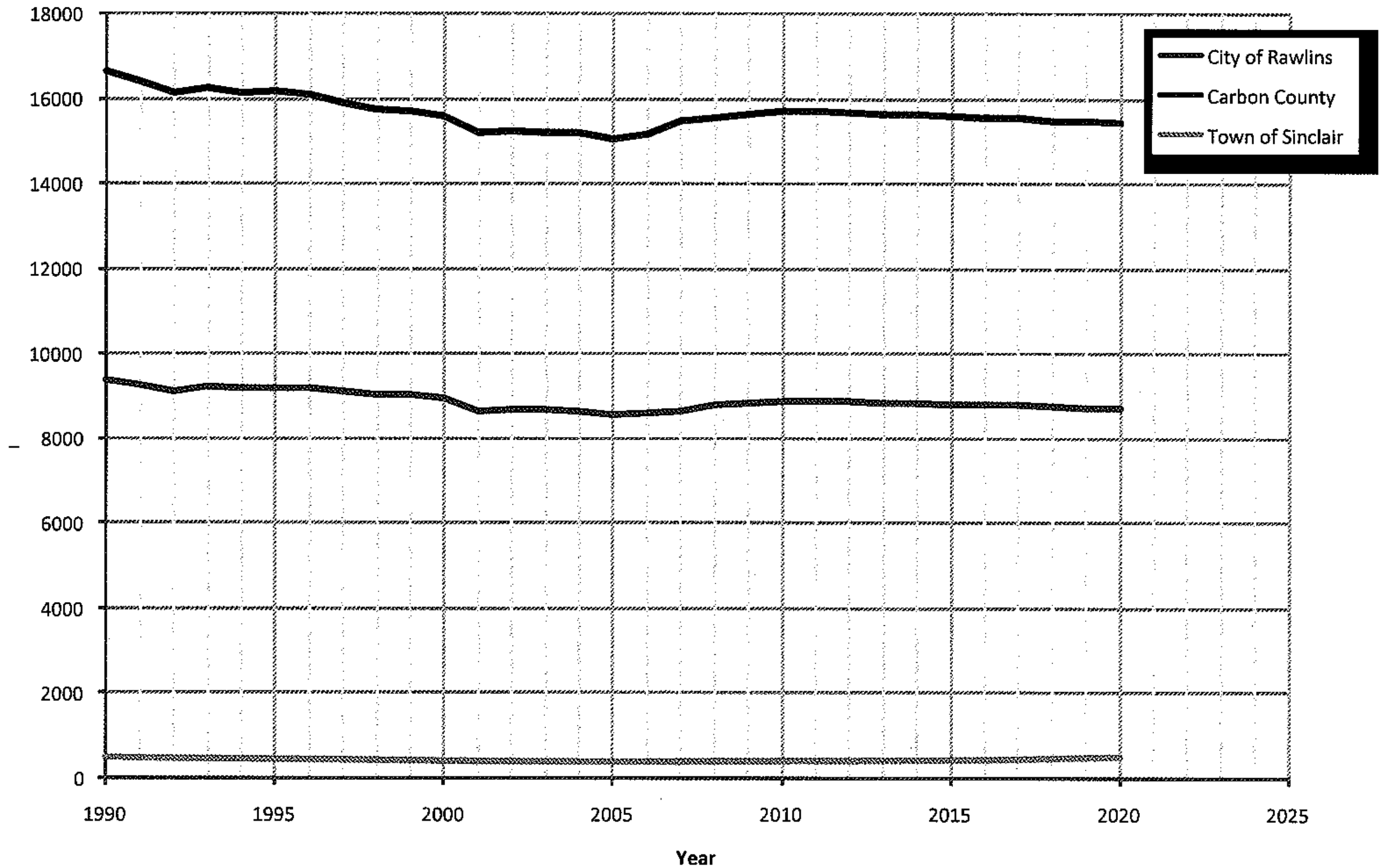
TABLE 3-2
CITY OF RAWLINS, TOWN OF SINCLAIR, AND CARBON COUNTY
CENSUS POPULATIONS, WDAI ESTIMATES, AND FORECASTS
1990 - 2020

	Carbon County		City of Rawlins		Town of Sinclair		
Year	Population	% Annual Change	Population	% Annual Change	Population	% Annual Change	Comments
1990	16659	--	9380	--	500	--	Census
1991	16406	-1.5%	9259	-1.3%	488	-2.4%	Estimate
1992	16149	-1.6%	9134	-1.4%	475	-2.7%	Estimate
1993	16282	0.8%	9230	1.1%	474	-0.2%	Estimate
1994	16150	-0.8%	9176	-0.6%	466	-1.7%	Estimate
1995	16174	0.1%	9211	0.4%	461	-1.1%	Estimate
1996	16091	-0.5%	9184	-0.3%	454	-1.5%	Estimate
1997	15914	-1.1%	9103	-0.9%	445	-2.0%	Estimate
1998	15757	-1.0%	9034	-0.8%	436	-2.0%	Estimate
1999	15730	-0.2%	9038	0.0%	430	-1.4%	Estimate
2000	15582	-0.9%	8977	-0.7%	423	-1.6%	Census
2001	15195	-2.5%	8655	-3.6%	414	-2.1%	Estimate
2002	15244	0.3%	8720	0.8%	411	-0.7%	Estimate
2003	15207	-0.2%	8694	-0.3%	408	-0.7%	Estimate
2004	15215	0.1%	8686	-0.1%	405	-0.7%	Estimate
2005	15051	-1.1%	8598	-1.0%	399	-1.5%	Estimate
2006	15165	0.8%	8621	0.3%	399	0.0%	Estimate
2007	15488	2.1%	8658	0.4%	405	1.5%	Forecast
2008	15560	0.5%	8816	1.8%	410	1.2%	Forecast
2009	15650	0.6%	8867	0.6%	414	1.1%	Forecast
2010	15730	0.5%	8912	0.5%	418	1.0%	Forecast
2011	15720	-0.1%	8907	-0.1%	421	0.7%	Forecast
2012	15690	-0.2%	8890	-0.2%	424	0.7%	Forecast
2013	15650	-0.3%	8867	-0.3%	427	0.7%	Forecast
2014	15620	-0.2%	8850	-0.2%	430	0.7%	Forecast
2015	15590	-0.2%	8833	-0.2%	433	0.7%	Forecast
2016	15580	-0.1%	8827	-0.1%	449	3.6%	Forecast
2017	15550	-0.2%	8810	-0.2%	464	3.4%	Forecast
2018	15500	-0.3%	8782	-0.3%	479	3.3%	Forecast
2019	15470	-0.2%	8765	-0.2%	495	3.2%	Forecast
2020	15440	-0.2%	8748	-0.2%	510	3.1%	Forecast

Source: Wyoming Dept. of Administration & Information, Economic Analysis Division

FIGURE 3-2

WYOMING DEPARTMENT OF ADMINISTRATION AND INFORMATION
CITY OF RAWLINS, TOWN OF SINCLAIR, AND CAMPBELL COUNTY POPULATION CENSUS, ESTIMATES, AND FORECASTS
1990 - 2020



6 POPULATION PROJECTION

6.1 Overview

There are a number of external factors that may influence the future population of the City of Rawlins and thus it was decided to pursue a model that shows a moderate growth rate for the City of Rawlins. The population model outlined below was developed using the information presented above while taking into account the known external factors that will have a significant impact on the City of Rawlins' population. These external factors include nearby construction and energy development projects in the area as well as adjustments to the U.S. Census data to better correspond to the utilities use by residents as monitored by the City of Rawlins.

6.2 Baseline Population Model

The baseline model uses data from the U.S. Census Bureau for the population of Rawlins in 1970, 1980, 1990, and 2000. Between 2001 and 2007, the populations are as estimated by the WDAI for the City of Rawlins and the Town of Sinclair. Current projections from the WDAI show the population declining which is unlikely to occur with the potential development from the energy industry. For the purpose of forecasting, the WDAI's forecast for the state of Wyoming was utilized to forecast the population of Rawlins, which averages to 0.8% population increase per year between 2009 and 2020. The forecast data between 2009 and 2020 was extrapolated out to the year 2038. The WDAI's estimate and projections can be seen in Figure 3-3 and are referred to as "WDAI Population Estimate and Projection."

6.3 Baseline Population Discrepancy

City of Rawlins officials disagree with the population figures given by the U.S. Census and the WDAI. The WDAI also uses the U.S. Census to determine population estimates. City officials have reviewed a number of indicators such as building permits, water and sewer usage, driver's license records, and believe the current population to be approximately 10,500. To correct the WDAI estimates so that they agree with the City's official estimates, a correction factor was implemented between years 2001 through 2008. The population between these years was increased by 210 residents per year. This results in the modified population base to show approximately 10,500 residents in 2008. All figures after 2008 are based on this correction. The baseline population model can be seen in Figure 3-3 and is referred to as "Rawlins Modified Base Population," which includes the population correction to reflect the population which City officials agree upon.

6.4 Additional Population Projection Considerations

There are currently five major projects being proposed within Carbon County that are pending approval. The projects will each have unique impacts on the City of Rawlins. Reports for these projects have been attained from the BLM or from DEQ which were submitted to these agencies for permitting purposes. These projects are:

Atlantic Rim Natural Gas Field
This project is proposed by Anadarko E & P Company and consists of developing up to 2,000 new gas wells to obtain natural gas resources in Carbon County (BLM, 2006).

The BLM has published an Environmental Impact Statement which includes a full socioeconomic analysis. The report estimates that the City of Rawlins will receive 362 temporary and 511 long-term workers during the peak year (2012). The number of workers will decrease after 2006.

It is estimated that approximately half of the long-term workers will bring their families to the City. The City's average is 2.39 residents per household. After the well field is complete, it is estimated that 40 jobs will remain for long-term maintenance of the wells. Table 3-3 shows the workforce timeline for the Atlantic Rim Natural Gas Field project.

TABLE 3-3
BUREAU OF LAND MANAGEMENT
FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE
ATLANTIC RIM NATURAL GAS FIELD DEVELOPMENT PROJECT:
CARBON COUNTY, WY
PROJECT POPULATION FORECAST

	Population Class				
Year	Temporary	Permanent	Indirect	Family	Total
2008	-	-	-	-	0
2009	91	128	-	152	370
2010	181	256	-	303	740
2011	272	383	-	455	1,110
2012	362	511	-	607	1,480
2013	339	484	-	572	1,396
2014	317	455	-	536	1,307
2015	294	425	-	500	1,219
2016	272	396	-	464	1,131
2017	249	366	-	428	1,043
2018	226	337	-	391	954
2019	204	307	-	355	866
2020	181	278	-	319	778
2021	158	249	-	283	690
2022	136	219	-	247	602
2023	113	190	-	210	513
2024	91	160	-	174	425
2025	68	131	-	138	337
2026	45	101	-	102	249
2027	23	72	-	66	160
2028	-	40	-	28	68
2029	-	40	-	28	68
2030	-	40	-	28	68
2031	-	40	-	28	68
2032	-	40	-	28	68
2033	-	40	-	28	68
2034	-	40	-	28	68
2035	-	40	-	28	68
2036	-	40	-	28	68
2037	-	40	-	28	68
2038	-	40	-	28	68

Medicine Bow Fuel and Power

The second project is the Coal-to-Liquids Project proposed by Medicine Bow Fuel & Power, LLC (CH_2MHill, 2007). The coal to liquids facility will use an advanced gasification and liquefaction process to convert coal resources into products that meet critical energy needs. The estimated project cost is $2.0 billion. The construction of this project has the potential to greatly impact the City of Rawlins. The project occurs approximately 13 miles south of Medicine Bow. It is likely that Rawlins, Medicine Bow, Hanna, Elk Mountain, Laramie, and Casper will share the impact of this project. The report estimates that 2,000 workers will be necessary to complete the construction of the project in addition to the estimated 230 jobs that will be taken by current residents. Construction of the project will peak in the second year. To assess the impact of this project in regards to the future population of Rawlins, it is estimated that 40% of the population influx for this project would be borne by the City of Rawlins. The report estimates an additional 374 jobs created as an indirect result of the project such as restaurant employees, medical staff, retail positions, etc. At the conclusion of construction, it is estimated that 450 permanent jobs will be created at the facility for operations. It was also estimated in the report that 50% of the workers will be bringing their families. Family members were again estimated at the rate of 2.39 people per household. The workforce schedule is shown in Table 3-4 below and reflects only 40% of the workforce that will likely impact the City of Rawlins. Note that the report's construction outline indicates that construction will start in 2008. The project has not commenced and the timeline indicated in the report has been shifted one year to indicate the commencement of construction to occur in 2009. Table 3-4 shows the workforce timeline for the Medicine Bow Fuel and Power project.

TABLE 3-4
CH2MHILL
INDUSTRIAL SITE PERMITTING APPLICATION: MEDICINE BOW FUEL & POWER, LLC COAL-TO-LIQUIDS PROJECT
CARBON COUNTY, WYOMING
PROJECT POPULATION FORECAST

Year	Population Class				Total
	Temporary	Permanent	Indirect	Family	
2008	-	-	-	-	-
2009	374	-	65	260	699
2010	863	-	150	600	1,612
2011	418	-	72	291	781
2012	160	180	59	236	635
2013	-	180	31	125	336
2014-2038	-	180	31	125	336

Continental Divide-Creston Natural Gas Field

The third project is the Continental Divide-Creston Natural Gas Field, for which, an Environmental Impact Statement is currently being prepared by the BLM. The impact of this project should be less substantial than the Atlantic Rim Natural Gas Field due to the time schedule spanning 15 years and, therefore, is not included in this forecast.

Seminoe Road Gas Development Project
The fourth project is the Seminoe Road Gas Development Project which proposes a much smaller number of wells than the two other gas fields previously stated and it is assumed that the projects overall impact will be insignificant and, therefore, is not included in this population projection.

Chokecherry and Sierra Madre Wind Energy Project
The last project in the area is the Chokecherry and Sierra Madre Wind Energy Project. The project involves the construction of a wind farm in Carbon County. The BLM is just getting started on the Environmental Impact Statement. Construction of wind turbines typically occurs off site and only their erection occurs on site. It is assumed that a relatively small crew will be responsible for erecting the wind farm turbines. The impact of this project is not included in this population projection.

6.5 Town of Sinclair

The same methodology was applied to the historical data for the Town of Sinclair with the exception of the correction described in paragraph 5.3.

6.6 Summary

The projections for the City of Rawlins and Town of Sinclair are summarized in Table 3-5 and are shown graphically in Figure 3-3.

TABLE 3-5
CITY OF RAWLINS & TOWN OF SINCLAIR PROJECTION SUMMARY
2008 - 2038

	City of Rawlins	Town of Sinclair	Total	
Year	Population	Population	Population	% Annual Change
2008	10,922	426	11,349	--
2009	12,091	475	12,565	10.7%
2010	13,476	532	14,009	11.5%
2011	13,075	516	13,591	-3.0%
2012	13,386	529	13,915	2.4%
2013	13,066	516	13,582	-2.4%
2014	13,052	515	13,568	-0.1%
2015	13,039	515	13,554	-0.1%
2020	12,985	513	13,498	-0.4%
2025	12,932	511	13,443	-0.4%
2030	13,058	516	13,574	1.0%
2035	13,464	532	13,996	3.1%
2038	13,870	548	14,418	3.0%

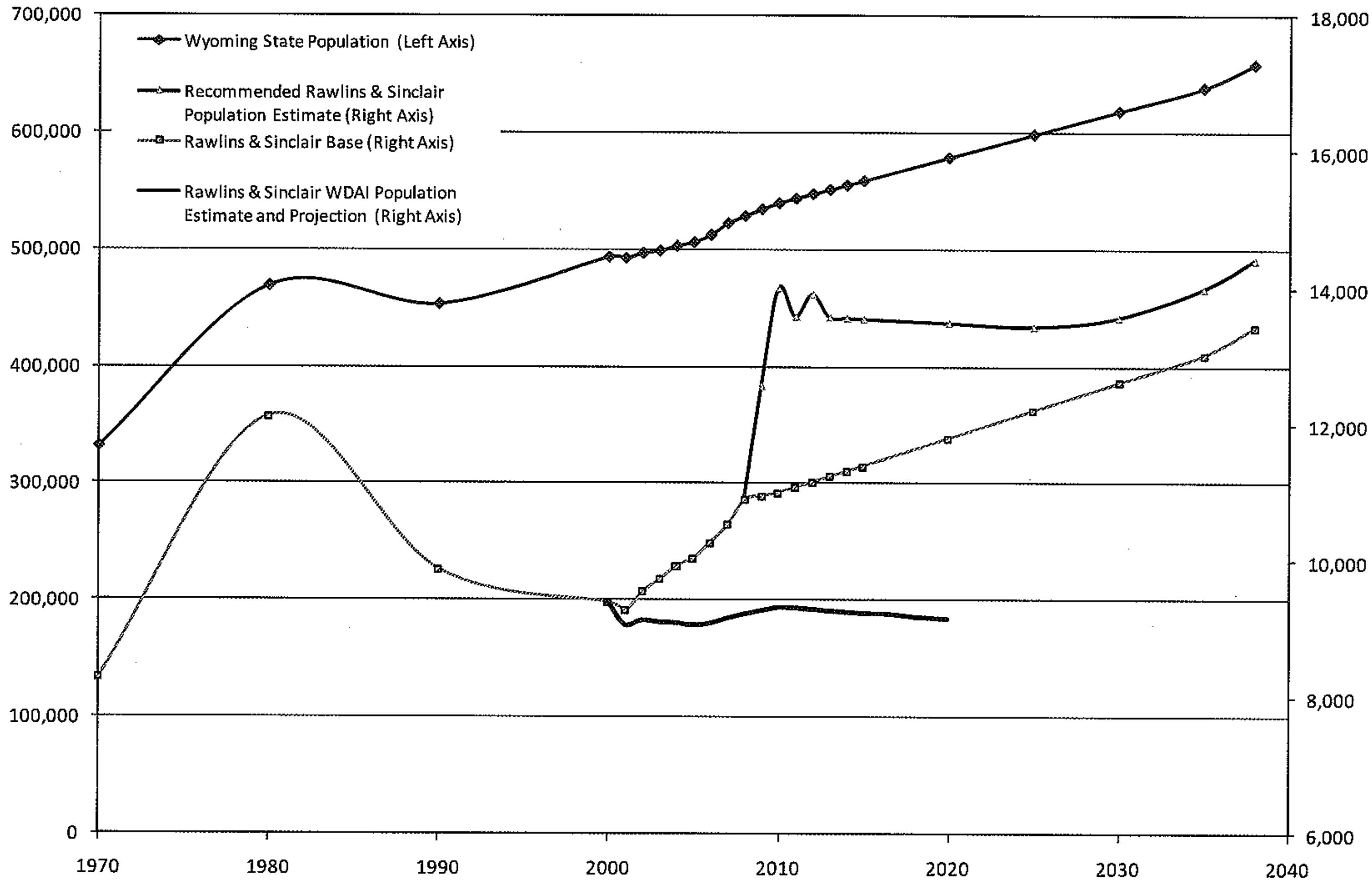
7 RECOMMENDATIONS

As can be seen from Figure 3-3, impacts from major projects in the area may have significant impact on the population of the City of Rawlins and the Town of Sinclair in the near future. The short-term population estimate peaks at 14,009 in the year 2010 and will likely remain near that level through the year 2030. After the year 2030, the population of the City of Rawlins and the Town of Sinclair will likely resume a growth rate similar to the State of Wyoming. The long-term population peak for the two municipalities is 14,418 people in 2038.

Figure 3-3 shows both the modified baseline population projection estimate and the recommended population estimate which includes impacts from currently planned projects in the area. The timeline utilized for these projects is likely the worst case scenario. These projects are in the planning and permitting stages and their actual construction dates are only estimates. They provide a better indication of when necessary components or upgrades to the current system should be implemented as opposed to just utilizing the peak population projection in the future. Any of these projects may also be abandoned due to unpredictable economic conditions, thus any upgrades that these projects may warrant should consider the realistic completion of these projects before initiating these upgrades to the City of Rawlins' water system.

There is a great deal of uncertainty associated with predicting the population for Carbon County. The area has seen a number of periods where economic conditions stimulated the influx of population only to be followed by a rapid decline. Population projections, both past and current, vary widely which illustrates the difficulty these endeavors present. The method presented in this report is the best estimate that can be made with the information currently available.

FIGURE 3-3
HISTORICAL AND ESTIMATED CITY OF RAWLINS & TOWN OF SINCLAIR POPULATIONS
1970 - 2038



8 FUTURE DEMAND

8.1 Average Daily Demand

Finished water production provided by the City was used in conjunction with population estimates to determine the average daily water usage per person. Population estimates shown below are modified as previously described above to better coincide with the City's records. The usage and population figures are shown in Tables 3-6 and the average daily use per capita is summarized in Table 3-7. Between 2003 and 2008, usage has averaged 201 gallons per capita per day (GPCD). This coincides well with the figures reported in previous master plans. WWC reported usage at 206 GPCD (WWC, 1997) and JMM reported 202 GPCD (JMM, 1983).

Table 3-6
Finished Water Production (MG) and Estimated Population
2003 - 2008

Month	2003	2004	2005	2006	2007	2008
January	34.74	39.53	37.28	38.86	44.18	51.4
February	31.95	35.83	34.76	34.63	50.48	45.8
March	35.35	37.35	39.47	44.22	39.11	48.2
April	38.84	36.21	41.13	39.63	40.08	46.5
May	57.23	60.73	55.53	91.13	78.26	58.5
June	83.10	98.07	92.76	120.86	105.36	94.7
July	119.43	100.72	128.89	123.85	130.15	127.5
August	106.71	99.85	108.05	109.88	113.96	125.1
September	54.39	61.81	81.43	77.80	83.00	76.7
October	48.58	35.78	41.63	45.48	44.13	46.7
November	35.26	33.43	35.60	34.33	42.54	37.5
December	39.18	37.80	39.38	35.48	46.42	39.8
Total	684.78	677.12	735.92	796.15	817.64	798.5
Population	9,732	9,931	10,047	10,280	10,533	10,906

*Population estimate as described in Section 6 of this Chapter

Table 3-7
Average Monthly Water Use (GPCD)
2003 - 2008

Month	2003	2004	2005	2006	2007	2008	Average
January	115.1	128.4	119.7	121.9	135.3	151.9	128.7
February	117.3	124.4	123.6	120.3	165.3	149.8	133.4
March	117.2	121.3	126.7	138.8	119.8	142.7	127.7
April	133.0	121.5	136.5	128.5	126.8	142.1	131.4
May	189.7	197.3	178.3	286.0	239.7	173.0	210.7
June	284.6	329.2	307.8	391.9	333.4	289.5	322.7
July	395.9	327.1	413.8	388.6	398.6	377.3	383.6
August	353.7	324.3	346.9	344.8	349.0	370.1	348.1
September	186.3	207.5	270.2	252.3	262.7	234.4	235.5
October	161.0	116.2	133.7	142.7	135.2	138.3	137.8
November	120.8	112.2	118.1	111.3	134.6	114.6	118.6
December	129.9	122.8	126.4	111.3	142.1	117.8	125.1
Average	192.8	186.3	200.7	212.2	212.7	200.0	**200.8**

8.2 Peak Month Ratio

Rawlins' water usage typically peaks in July due to increased residential and municipal irrigation. Average usage peaks 384 GPCD in July. The peak monthly usage to average day ratio is 1.91 between the years of 2003 and 2008. This figure also corresponds well to the previous ratio calculated by JMM at 1.88 (JMM, 1983). WWC did not calculate this figure, but recalling their peak month usage of 391 GPCD and average day usage of 206 GPCD would result in a ratio of 1.90.

8.3 Peak Day Ratio

Production records from the water treatment plant have documented daily flows from 2005 through 2009. The highest daily production was recorded for each of those years to determine peak day usage. The results are summarized in Table 3-8.

Table 3-8
Peak Day Water Usage
2005 - 2009

Year	Date	Peak Day Finished Water Production (MG)	Peak Day Usage Per Capita (GPCD)	Peak Day Usage (MGD) @ 2.16 Ratio
2005	7/21/2005	4.681	465.9	2.3%
2006	6/28/2006	4.409	428.9	2.0%
2007	7/4/2007	4.706	446.8	2.1%
2009	8/6/2008	4.800	439.5	2.2%
2009*	7/17/2009	4.256	-	-
Average		4.570	445.3	2.2%

*2009 Daily Peak Production Year to Date as of 8/18/2009

8.4 Future Water Demands

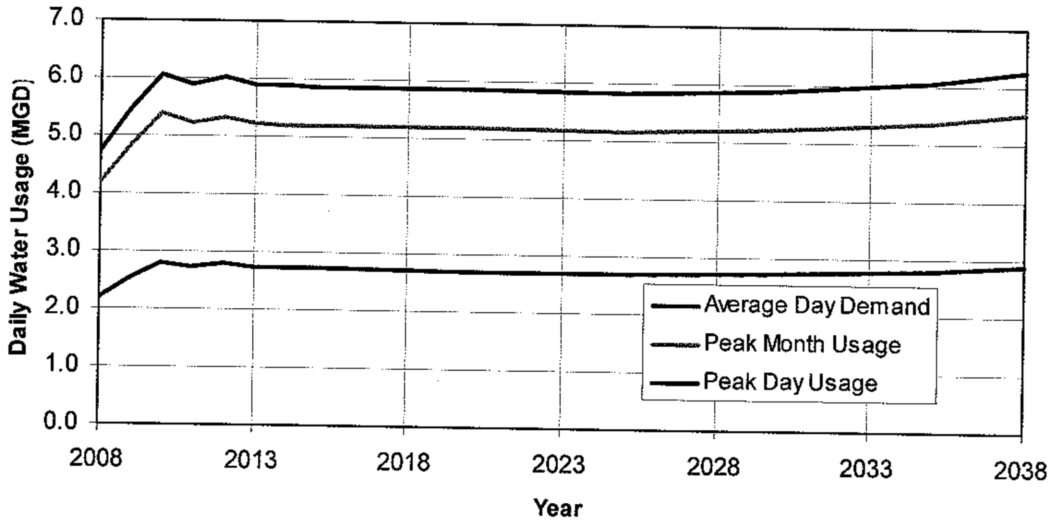
Future demands for the Rawlins water can be estimated using the future population projections and average usage figures. Average daily demand on the water system is projected to increase from 2.2 million gallons per day (MGD) to 2.9 MGD. Peak month usage is expected to increase from 4.2 MGD to 5.5 MGD and peak day usage will increase from 5.7 MGD to 7.5 MGD. The latter two figures were calculated from peak month ratio and peak day ratios described previously. The estimates are summarized in Table 3-9 and shown graphically in Figure 3-4.

Recall that the population projections estimate includes a number of projects that have been planned in the region. Bear in mind that any of these projects may or may not be completed and their given timelines are tentative at best. Figure 3-3 reviews a population estimate that does not include these projects which is expressed by the 'Rawlins and Sinclair Base' population trend line. These projections may be used for planning future upgrades that are necessary to meet the demands. These figures are dependent upon the completion of said projects, and any planning efforts should review the projects to determine their completion status and adjust the demand figures accordingly.

Table 3-9
Future Demand Projection
2008 - 2038

Year	Population	Avg. Day Demand (MGD) @ 200.8 GPCD	Peak Month Usage (MGD) @ 1.91 Ratio	Peak Day Usage (MGD) @ 2.16 Ratio
2008	10,922	2.2	4.2	4.7
2009	12,565	2.5	4.8	5.5
2010	14,009	2.8	5.4	6.1
2011	13,591	2.7	5.2	5.9
2012	13,915	2.8	5.3	6.0
2013	13,582	2.7	5.2	5.9
2014	13,568	2.7	5.2	5.9
2015	13,554	2.7	5.2	5.9
2020	13,498	2.7	5.2	5.9
2025	13,443	2.7	5.2	5.8
2030	13,574	2.7	5.2	5.9
2035	13,996	2.8	5.4	6.1
2038	14,418	2.9	5.5	6.3

Figure 3-4
Future Demand Projection
2008 - 2038



SECTION 4 – WATER SUPPLY

SECTION 4

Water Supply

1 INTRODUCTION

This chapter reviews the use, availability, reliability, and operations of the water sources currently in use by the City of Rawlins. Each water source is summarized and any deficiencies are discussed. Remedial actions for deficiencies are summarized and prioritized at the end of this section.

2 SAGE CREEK SPRINGS

2.1 Background

The City of Rawlins has been using 14 springs located in the upper Sage Creek Basin. The springs have been in use since 1924. The City owns senior water rights to 6.92 cubic feet per second (CFS) or approximately 3,100 gallons per minute (GPM) from the Sage Creek Basin. Water from the springs is collected in a series of collection pipelines located approximately 23 miles south of the water treatment plant. The Sage Creek Pipeline runs between the Rawlins Reservoir and the water treatment plant and consists of approximately 25 miles of 20-inch and 24-inch steel pipeline. Water from the Nugget Wells is also conveyed by the Sage Creek Pipeline.

2.2 Yield

The springs have been a fairly consistent and reliable water source for the City of Rawlins. In 1997, Western Water Consultants tabulated the flow data from the springs between 1988 and 1997 in their *City of Rawlins Water Supply Project, Level II Phase I Report* (WWC, 1997). The data from that report is summarized in Table 4-1 which shows the average monthly flow from the springs and the standard deviation of the data. The City of Rawlins provided monthly flow data between 2003 and 2008 and is summarized in Table 4-2.

Tables 4-1 and 4-2 are shown on the following page.

Table 4-1
Sage Creek Springs Monthly Flow Average
January 1988 through May 1997

Month	Average (MG)	Std. Dev
January	46.51	17.0
February	46.77	15.8
March	43.80	13.8
April	57.30	15.4
May	77.81	28.3
June	81.73	25.5
July	74.55	20.6
August	60.93	12.8
September	50.98	8.7
October	49.13	7.9
November	45.44	7.9
December	43.43	6.1
Total	678.39	86.5

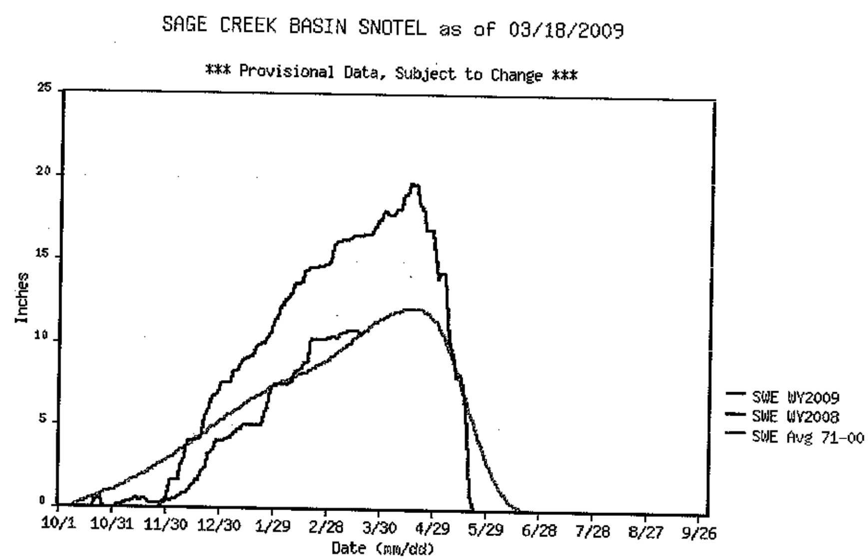
*Data presented in table is from the report *City of Rawlins Water Supply Project, Level II Phase I Report*, by WWC in 1997.

Table 4-2
Sage Creek Springs Monthly Flow Average
2003 through 2008

Month	Average (MG)	Std. Dev
January	44.24	2.9
February	38.88	2.0
March	49.20	12.4
April	75.28	18.7
May	95.28	18.6
June	96.35	30.0
July	85.01	31.5
August	68.48	21.1
September	60.51	12.4
October	53.26	8.4
November	48.80	5.3
December	48.21	4.8
Total	763.51	103.0

The effective yield of the springs is highly dependent upon the amount of precipitation received during any given year. Comparing Tables 4-1 and 4-2, it appears that the springs produced more water than in previous years. The results in Table 4-2 are higher because of an exceptionally wet winter in 2008 which significantly increased the snowpack in the Sage Creek Basin area. The United States Department of Agriculture - Natural Resource Conservation Service maintains records of snowpack records around the state (NRCS, 2009). Figure 4-1 illustrates the amount of winter precipitation received in 2008 in the Sage Creek Basin area.

Figure 4-1
NRCS Snotel Data
Sage Creek Basin Area
Data from 2009 to present, 2008, and 1971-2000 Average



Steve Golnar

From: Kara Choquette [Kara.Choquette@tac-denver.com]
Sent: Tuesday, January 04, 2011 6:12 PM
To: Steve Golnar
Cc: Marla Brown
Subject: RE: Jan. 18 invite

Hi Steve and Marla – Yes, we can come to present to City Council on Tuesday, Jan. 18. Thank you for the opportunity! We'll prepare a short presentation to update the Council, and we'll bring the simulations of the wind energy project if you think that would be of interest.
We will talk about Power Company of Wyoming and the wind energy project, and TransWest Express and the power line project. By the way, we just learned that public scoping for the TWE Project will be in Rawlins in early March, so we can mention that to the Council as well.
Anything else you need from us, just let me know. The presenter will be myself and Garry Miller, director of land and environmental affairs for both the PCW and TWE projects.
Thanks again and see you soon!
Kara

From: Steve Golnar [mailto:citymanager@rawlins-wyoming.com]
Sent: Monday, January 03, 2011 9:57 AM
To: Kara Choquette
Cc: Marla Brown
Subject: RE: Jan. 18 invite

1/12/2011 at noon.
-Steve

From: Kara Choquette [mailto:Kara.Choquette@tac-denver.com]
Sent: Sunday, January 02, 2011 6:56 PM
To: Steve Golnar
Subject: Jan. 18 invite

Hi Steve – Sorry I missed your call last week! Thanks very much for the invite to come to the Jan. 18 City Council meeting. I am checking schedules with the team and will get back to you as soon as possible to confirm the date. What's the deadline I need to meet so that you can have it in time for the Jan. 18 agenda?
Happy New Year!
Kara

Kara Choquette
Director of Communications
Power Company of Wyoming LLC
TransWest Express LLC
555 Seventeenth Street, Suite 2400
Denver, CO 80202
Direct: 303.299.1395
Cell: 720.289.7833
kara.choquette@tac-denver.com
www.powercompanyofwyoming.com
www.transwestexpress.net

2.3 Water Quality

The overall water quality from the Sage Creek Basin is extremely good. The total dissolved solids are low and if there is no turnover in Atlantic Rim or Peaking Reservoirs, it is very low in turbidity. Because of the high quality of water, diatomaceous earth filters were chosen as the method of treatment when the water treatment plant was built. In conjunction with this study, water samples were taken from the springs and Atlantic Rim Reservoir. The sample from the springs was a blended sample of all of the spring water entering the system. Water quality from all of Rawlins' water sources is shown in Table 4-3.

The samples were taken on July 31, 2008 after the high runoff from the springs and snow melt. The higher concentration of dissolved constituents from the Sage Creek Springs suggests that the water quality from the springs changes seasonally and the water during the high runoff periods is lower in total dissolved solids than later in the year when the water comes from the issuing formation and not from snow melt.

From discussions with the water treatment staff, there is a reluctance to use the water from Rawlins Reservoir. During the recent years of drought, it was attempted to use the water from the reservoir when the Atlantic Rim Reservoir got extremely low, but the water was so foul that the taste and odor problems could not be overcome at the water treatment plant. If water was diverted from Rawlins Reservoir shortly after the large flows from the spring, the water might be fresh enough and low enough in turbidity that water treatment plant could effectively treat the water from Rawlins Reservoir. This would require some monitoring, but would help keep Atlantic Rim Reservoir filled during subsequent warmer months. The complete water quality analysis is included in Appendix B.

Table 4-3
Water Quality Summary
Sample Date: July 31, 2008

ANALYTE	SAGE CREEK SPRINGS	RAWLINS RESERVOIR	ATLANTIC RIM RESERVOIR	NUGGET NO. 1 WELL	NUGGET NO. 2 WELL	NUGGET NO 3 WELL	NORTH PLATTE RIVER MAX RANGE	NORTH PLATTE RIVER TYPICAL RANGE	WWTP EFFLUENT
Calcium mg/L	50	30	20	2	2	2	16 - 78	30 - 60	110
Magnesium mg/L	4.2	4.5	4.9	1	1	1	0.7 - 28	6 - 19	70
Sodium mg/L	3.2	3	8.3	254	273	254	6 - 57	13 - 36	340
Potassium mg/L	3.3	2.6	1.3	. 2	2	2	0.3 - 7.9	1.6 - 3.7	30
Carbonate mg/L	0	9	12	48	36	12	0 - 36	0	53
Bicarbonate mg/l	180	97	38	378	439	415	58 - 224	130 - 170	270
Chloride mg/L	2.3	1.6	1.8	6	8	7	0 - 30	3 - 15	290
Fluoride mg/L	0.1	0.1	0.2	1	1.1	1.6	0 - 1.2	0.3 - 0.7	0.5
Nitrate as N mg/L	0.28	0.06	<0.05	0	0	0.1	0 - 0.18	0.05 - 0.1	0.18
Nitrite as N mg/L	<0.05	<0.05	<0.05	NA	NA	NA	<0.05	<0.05	<0.05
Sulfate mg/L	28	16	42	160	163	160	19 - 210	50 - 110	710
Total Dissolved Solids mg/L	180	11	110	648	698	596	98 - 470	200 - 340	1700
Total Alkalinity as CaCO3 mg/L	150	95	51	390	420	360	55 - 172	100 - 140	310
Hardness as CaCO3 mg/L	140	93	70	9	9	9	54 - 280	150 - 200	560
pH	7.6	8.8	9.2	8.8	8.9	8.7	6.6 - 9.1	7.6 - 8.3	9.1
Conductivity umhos/cm	320	210	200	1000	1000	923	128 - 719	290 - 510	2620
Turbidity							1 - 600	2 - 20	

3 NUGGET WELLS

3.1 Background

The Nugget Well No. 1 was completed in 1984 and it was productive enough to prompt the WWDC to fund two additional wells. The three wells are completed in the Nugget Formation and offer artesian flow. The Nugget Well Nos. 1, 2, and 3 initially flowed 350 GPM, 650 GPM, and 85 GPM, respectively, with no back pressure (JMM, 1986). Well No. 3 was stimulated by fracturing the formation with high pressure water and sand mixture which increased flow to 900 GPM. At the time of construction, the wells exhibited a shut-in pressure of 140 PSI. Flow from the wells depends on the actual back pressure imposed from the Sage Creek Pipeline which, under typical operating conditions, is 115 feet of head. The back pressure imposed by the Sage Creek Pipeline is dependent upon head-loss in the pipeline which corresponds to the amount of water being conveyed through the pipeline.

3.2 Yield

In an attempt to preserve and sustain the wells, the City of Rawlins has reduced their use of the Nugget Wells. It is believed that reducing the use of the Nugget Aquifer will allow the aquifer to recover. Usage data from the City of Rawlins shows that in recent years, the City has relied on the well field only to augment water from the Sage Creek Springs during the late summer months. Table 4-4 shows the monthly flow average between 1988 and 1997. Table 4-5 shows the monthly flow average between 2003 and 2008.

Table 4-4
Nugget Wells Monthly Flow Average
January 1988 through May 1997

Month	Average (MG)
January	16.09
February	15.62
March	19.04
April	21.89
May	17.93
June	19.74
July	23.18
August	23.31
September	20.89
October	16.67
November	13.82
December	9.55
Total	217.72

*Data presented in table is from the report *City of Rawlins Water Supply Project, Level II Phase I Report*, by WWC in 1997.

Table 4-5
Nugget Wells Monthly Flow Average
2003 through 2008

Month	Average (MG)
January	0.00
February	0.00
March	0.00
April	0.00
May	1.08
June	3.06
July	11.20
August	19.50
September	15.59
October	7.35
November	0.00
December	0.00
Total	57.79

3.3 Water Quality

The water from the Rawlins Nugget well field is a sodium bicarbonate type with fairly high sodium and sulfates. As can be seen on Table 4-3, there is a substantial difference in water quality between the Sage Creek Basin sources and the Nugget

Formation. The water from the Nugget Formation has a relatively high concentration of total dissolved solids and is very soft. But the water from the Sage Creek Basin has very low total dissolved solids and is slightly hard. The water quality from the Nugget Formation is fairly stable with time; in contrast the water from the Sage Creek Basin appears to change slightly from season to season. The water from the Nugget wells is best blended with water from either the Sage Creek Basin or the North Platte River.

4 NORTH PLATTE RIVER

4.1 Background

The City of Rawlins currently has water rights on the North Platte River for 3.01 cubic feet per second (CFS) which was acquired from the Union Pacific Water Company (2.01 CFS) and from a recent water right transfer from the Town of Sinclair (1.0 CFS). The Union Pacific Water Company originally had water rights for 2.32 CFS, but opted to retain 0.31 CFS for railroad and domestic use. In 2002, in addition to the transfer of 1.0 CFS, the Town of Sinclair bestowed to the City of Rawlins their water rights on the North Platte River for 1.21 CFS. In exchange, the City of Rawlins agreed to deliver up to 1.21 CFS of potable water to the Town of Sinclair as well as construct and maintain any pipelines and facilities associated with the delivery of water to the Town of Sinclair.

4.2 North Platte River Booster Station

The North Platte River Pump Station (NPRPS) has a capacity of 4.21 CFS (1,890 GPM) and provides a discharge pressure of 182 PSI which is necessary to overcome frictional losses and the 303 feet of elevation difference to Thayer Booster Station (TBS). The pumps add 420 feet of total dynamic head. Water is conveyed through approximately 12 miles of pipeline to the TBS. Water can be diverted to the golf course approximately 10 miles west of the NPRPS. Two 300-horsepower pumps are installed in the NPRPS. Only one pump typically operates at a time. The pumps are paced with variable frequency drives. The TBS also has the ability to backflow from Peaking Reservoir to provide water to the golf course in the event that the NPRPS is inoperable.

4.3 Thayer Booster Station

The Thayer Booster Station (TBS) has the capability of boosting the water supplied by the NPRPS to a discharge pressure of 196 PSI which is necessary to overcome frictional losses and 410 feet of elevation difference to Peaking Reservoir. The pumps add 409 feet of total dynamic head. Water is conveyed 4.5 miles to the reservoir. Redundant 300-horsepower pumps are installed at TBS. Only one pump typically operates at a time. TBS also has the ability to back-feed from Peaking Reservoir to the golf course. There is a 100,000 gallon storage tank installed at TBS to ensure adequate net positive suction head for the pumps.

4.4 Water Quality

The total dissolved solids and overall water quality are quite good measured nearer to Sinclair. As shown on Table 4-3, the water from the North Platte River varies significantly in turbidity during the year. It is also susceptible to high turbidity after storm events in the summer months. This turbidity is a main problem with the water from the North Platte River. The diatomaceous earth filters at the Rawlins water treatment plant are designed to treat the low turbidity water from the Sage Creek Basin. Therefore, at certain times during the year, the water from the North Platter River is very difficult to treat and its use may be restricted.

4.5 Raw Water Irrigation

During summer months, the NPRPS provides irrigation water to the Rochelle Municipal Golf Course. The unpredictability of the water quality in the North Platte River makes it ideal for irrigation. The golf course currently fills its reservoir via the North Platte River Pipeline during summer months. Operation of the NPRPS during summer months has typically been for golf course use only. The NPRPS is pumped at a reduced rate of approximately 700 GPM to reduce head loss in the pipeline and minimize pumping cost.

There are currently five major projects being proposed in the area.

In 2008, the City of Rawlins only utilized about 23% of their total water right to the North Platte River. This report identifies other areas where raw water from the North Platte River might be used for irrigation. This water resource will play a key role in meeting the future demands for the City whether it is used for raw water irrigation or to augment water from the Sage Creek Springs and the Nugget Wells. Using raw water from the North Platte River for irrigation would also have the benefit of reducing the load on the water treatment plant which currently serves finished water for irrigating the cemetery and nearby municipal parks and schools.

4.6 Pumping Cost

In order to provide a means of comparison between options proposed in the Rawlins Master Plan, it is necessary to have a good understanding of the pumping costs associated with the North Platte River transmission system. The system currently supplies the municipal golf course with raw irrigation water and can also supply raw water to Peaking Reservoir. In order for the water to reach Peaking Reservoir, it must be boosted at the TBS. The pressure and flow figures presented in this memo are based on the hydraulic grade lines presented on Sheet 6 of the *North Platte Pipeline* drawings completed by WWC Engineering in 2004 (WWC, 2004). Costs expressed here do not include any maintenance or personnel costs.

The average power cost for these two pump stations was calculated based on monthly electric utility bills and monthly pumping records for 2008. The City of Rawlins provided monthly electric bills for 2008. The records did not include the specific billing period for which they were applicable so the bill could not be correlated directly to pumping records. The average pumping cost is to be based on an average spanning as many months as possible; therefore, this will have minimum effect on the result. The pumping records and figures presented in this document are based on data that was pulled from the City's SCADA system. The SCADA system does not report totalized flows in either of the booster stations, only instantaneous flow rates. Historical records were typically polled at 1-hour intervals and the total flow for a month was calculated by numerically integrating the flow rate data over time. The flows calculated here are an approximation and will not likely correspond with the City's records; however, they are reasonable approximations. Table 4-6 shows the monthly electrical costs for TBS and NPRPS and the monthly flows from the TBS, NPRPS, golf course, and the back-feed through TBS. The color coding in the table is explained later.

Table 4-6

NPRPS, TBS Electrical Billing And Associated Totalized Flows for 2008

	Electrical Billing		NPRPS Avg.	Totalized Flow (MG)			
Approx Usage Date	TBS	NPRPS	Pump Rate (GPM)	TBS	NPRPS	Golf Course Flow	TBS Back-Feed
January, 2008	$ 4,635.56	$ 951.95	1,504	7.33	7.47	0.00	0.00
February, 2008	$ 6,674.46	$ 5,434.10	1,494	42.00	42.09	0.00	0.01
March, 2008	$ 7,247.21	$ 1,814.45	1,503	47.90	48.42	0.00	0.00
April, 2008	$ 175.63	$ 5,236.20	603	0.00	4.67	4.69	0.00
May, 2008	$ 138.21	$ 2,453.56	758	0.00	5.73	5.02	0.00
June, 2008	$ 112.80	$ 2,721.44	541	0.00	13.97	13.98	0.00
July, 2008	$ 87.54	$ 3,324.96	627	0.00	17.83	17.73	0.00
August, 2008	$ 63.12	$ 3,334.34	1,026	0.00	25.77	19.96	0.00
September, 2008	$ 66.84	$ 3,099.14	817	0.00	6.47	6.38	0.00
October, 2008	$ 68.65	$ 1,215.42	798	0.00	3.02	2.88	0.00
November, 2008	$ 130.23	$ 260.04	-	0.01	0.00	0.00	0.04
December, 2008	$ 202.55	$ 462.15	-	0.03	0.00	0.00	0.04
Total	$19,602.80	$30,307.75		97.28	175.43	70.64	0.10

The average pumping cost can be calculated by dividing the total cost over a specified period of time by the amount of water pumped over that same period of time. Table 4-7 shows the cost to pump 1 million gallons for each of the booster stations. Note that the color indicated in Table 4-7 corresponds to the data range used in Table 4-6.

Table 4-7

Average Pumping Cost for TBS and NPRPS

TBS Average Jan-March	
Total Flow (MG)	97.24
Total Cost	$18,557.23
Cost to Pump per 1 MG	$ 190.84

NPRPS Average Feb-Sept	
Total Flow (MG)	167.96
Total Cost	$28,633.61
Cost to Pump per 1 MG	$ 170.48

The pumping costs for the TBS and NPRPS are similar. This is not surprising since both stations both provide similar boost in head pressure (409 feet and 420 feet, respectively). The cost to pump 1 million gallons from TBS is $190.84 and from NPRPS is $170.48. Note also that the NPRPS is pumped at full capacity when used to augment Peaking Reservoir and is typically reduced when pumping only to the golf course. This reduces head loss in the transmission pipeline and also the required boost incurred by the NPRPS and, therefore, reduces the pump costs during these months. The range used to calculate the pump cost spans periods where water was delivered to the golf course and to Peaking Reservoir and is an approximate average between the two scenarios. When the NPRPS is operating at full capacity and pumping to Peaking Reservoir, pump costs would be similar to the pump costs at the TBS since they flow the same amount of water at very similar lift conditions.

In summary, the City of Rawlins pumped approximately 175 million gallons from the North Platte River for an approximate total cost of $30,300 in 2008. Of those 175 million gallons, approximately 71 million gallons was diverted to the golf course and approximately 98 million gallons was delivered to Peaking Reservoir through TBS. The electrical cost for TBS to deliver that quantity of water was approximately $19,600.

5 IN-TOWN WELLS

5.1 Cemetery Well

The cemetery well was permitted on February 2, 1977. The well was drilled to a total depth of 320 feet. The static water level was reported as 75 feet and was adjudicated at 250 gallons per minute in 1988. Therefore, the well must have been making 250 gallons per minute at some point in time. It is not known why the use of the well was terminated, but it is thought that the production dropped off and it was just easier to take treated water from the water system than to pull the pump and try to rehabilitate the well.

5.2 Penitentiary Well

There are two wells at the penitentiary; however, only one is registered with the SEO. No further information is available on the well. The north well is 140 feet deep and the south well is 340 feet deep. Both are reported to have 15 HP pumps claiming to pump 250 GPM. This information was included in correspondence from the SEO office regarding the penitentiary well. Documentation to permit the well was sent to the owner, but there is no evidence of it being returned to the SEO. A water analysis was found on this well and the water contained too many dissolved constituents to serve as potable water, but was satisfactory for irrigation purposes.

6 RAW WATER STORAGE

6.1 Peaking Reservoir

6.1.1 Background

Peaking Reservoir was permitted in 1966 and is appropriated for 346.66 acre feet of water per Permit No. 7185. The reservoir is located approximately 0.25 miles southeast of the water treatment plant. The reservoir is primarily filled via the Sage Creek Pipeline, but can also accept water from the North Platte River via the Thayer Booster Station.

6.1.2 Operations

Water stored in Peaking Reservoir is usually very high quality as it is most typically supplied by water from the Sage Creek Springs. The water treatment plant typically tries to process water directly from the Sage Creek Pipeline, but if the yield from the springs is less than the demand from the City, water is typically first diverted from Peaking Reservoir to meet demand. The City tries to keep Peaking Reservoir as full as possible. When excess water is available and

Peaking Reservoir is full, water is then diverted to secondary storage reservoirs such as Rawlins Reservoir and Atlantic Rim Reservoir.

6.2 Atlantic Rim Reservoir

6.2.1 Background

Atlantic Rim Reservoir was permitted in 1978 for 644.5 acre feet of water per Permit No. 8016. The reservoir is located along Highway 71 approximately 2.25 miles south of the water treatment plant. The reservoir is filled via the Sage Creek pipeline.

The reliability, usability, and sustainability of the Atlantic Rim Reservoir have been in question for many years. The reservoir has leaked since its construction and leakage has been estimated at 216,000 gallons per day (WWC, 2008). To minimize leakage, the City has been forced to operate the Atlantic Rim Reservoir at reduced capacity. The leakage is believed to have been caused by either the presence of soluble minerals in the foundation soils or the presence of highly weathered and fractured bedrock in the deeper foundation of the reservoir. It is believed that the prolonged seepage through the foundation of the reservoir may have compromised the reservoir's structural integrity; however, this remains unconfirmed.

The leakage effluent from the Atlantic Rim Reservoir has flowed down the landscape to form a pair of wetland lakes. The lakes are located approximately one mile southwest of Atlantic Rim Reservoir. Any attempt to repair or decommission Atlantic Rim Reservoir will need to consider these artificial wetlands which are dependent upon the seepage from Atlantic Rim Reservoir. The BLM has established a recreation area at these wetlands, and has expressed interest in sustaining these wetlands. Therefore, it is likely that a provision will need to be established to maintain a continuous feed of water necessary to maintain the wetlands in the event of repair or decommissioning of the reservoir.

6.2.2 Operations

Atlantic Rim Reservoir is currently used to augment Peaking Reservoir. When Peaking Reservoir is full and the flow available from the Sage Creek Springs exceeds the City's demand, water is diverted into Atlantic Rim Reservoir. Due to leakage in the reservoir, the City has been inclined to operate the reservoir at a lesser capacity.

6.3 Rawlins Reservoir

6.3.1 Background

Rawlins Reservoir was permitted in 1955 for 624 acre feet of water per Permit No. 6271. The reservoir is located approximately 25 miles south of the City and west of Highway 71. Water can be conveyed from Rawlins Reservoir to the water treatment plant through the Sage Creek Pipeline.

6.3.2 Operations

The Rawlins Reservoir can be used to augment Peaking and Atlantic Reservoirs. But due to poor water quality, this reservoir is rarely used. The Rawlins Reservoir is plagued with taste and odor issues due to algae growth. Water quality in the reservoir is considered the worst of the three storage reservoirs along the Sage Creek Pipeline.

7 DEFICIENCIES

7.1 Atlantic Rim Reservoir Leak

The Atlantic Rim Reservoir has leaked since it was first constructed in the early 1980s. Several studies have been conducted to evaluate the seepage from the reservoir and an attempt was made in the early 1980s to line the leaky portions with bentonite. The reservoir was drained and eight truck loads of bentonite were brought in and "tilled" in the bottom of the reservoir. Some of the early studies suggested lining the reservoir with a synthetic liner, but this was never done due to cost. Previous studies have lead to the direction of constructing a new reservoir and abandoning the existing Atlantic Rim Reservoir. Based on those studies, it was expected to cost almost $1 million to abandon the reservoir and another $10 million to construct a new reservoir. It appeared that it would be much less expensive to rehabilitate the existing reservoir than to construct an entirely new reservoir. The cost of lining was researched during the course of this study and an allowance of $2 million dollars was included and the result was approximately a $7 million savings to rehabilitate the existing Atlantic Rim Reservoir.

7.2 Adequate Raw Water Storage

From previous studies it was demonstrated that the City could meet their water demand by solely pumping from the North Platte River. Unfortunately, the water treatment plant is designed to treat the water from Sage Creek Basin which is very low in turbidity and total dissolved solid. A mass balance study was conducted on Peaking Reservoir wherein the flow from the Sage Creek Basin was used for the year 1997 which is the worst year on record for flow from that area. The demand was set at the 30-year planning horizon and Rawlins could meet the year round demand by pumping from the North Platte River provided Peaking Reservoir was full on May 1 of each year. Unfortunately, the peak flow periods from the Sage Creek Basin are usually during the months of May, June and July. If Peaking Reservoir is full during this timeframe, there is no room to store the high flows from the Sage Creek Basin. Therefore, additional storage beyond just the Peaking Reservoir is required in the system. The excess flows can either be stored in Atlantic Rim Reservoir or a new reservoir constructed to replace Atlantic Rim Reservoir.

7.3 Atlantic Rim Reservoir to Water Treatment Plant Pipeline

The 18-inch A.C. (asbestos cement) pipeline spans nearly 13,000-feet between Atlantic Rim Reservoir and the water treatment plant, and has seen an increased number of operational and maintenance issues over the last several years. This pipeline is used to supply water directly from the springs or the storage reservoirs along the Sage Creek Pipeline to the water treatment plant. Water may also be diverted to Peaking Reservoir. It is often desirable to supply water directly from the Sage Creek Springs to the water treatment plant as it is of the highest quality. By bypassing Atlantic Rim Reservoir, the pipeline is subject to the full pressure generated by approximately 470 feet of elevation difference which translates to just over 200-PSI. The pipeline has consistently proven unable to withstand the high pressure as there is a failure of the pipeline almost every time the pipeline is valved off at the water treatment plant. The City avoids closing the valve on this pipeline in anticipation of a failure.

The pipeline is also a bottleneck in the system as it is undersized for the rating of the Sage Creek Pipeline. The new Sage Creek Pipeline is 24-inch steel and is rated for up to 5,280 gallons per minute (JMM, 1987). At a typical flow rate of 3,000 gallons per minute, the head loss associated with the 18-inch A.C. pipe is 67.8 feet-water. This assumes that the flow characteristics of the aged A.C. pipe can be approximated by a Hazen-Williams coefficient of 90. If the pipeline is upgraded to 24-inch PVC with a Hazen-Williams coefficient of 150, the head loss is reduced to 7 feet-water. At the design capacity of the Sage Creek Pipeline, 5,280 gallons per minute, the head loss in the pipeline is increased to 193 feet-water in the 18-inch A.C. pipe and 18.5 feet-water if the pipeline was upgraded to 24-inch PVC.

The Sage Creek Pipeline was originally intended to be relief to the Atlantic Rim Reservoir and, therefore, the 18-inch A.C. pipeline to the WTP should not have been subjected to a pressure greater than the elevation difference between the WTP and Atlantic Rim Reservoir. Operators report pressures ranging from 150- to 180-PSI at the inlet of the WTP, which far exceeds the elevation difference of approximately 120-feet and indicates that the full pressure of the Sage Creek Pipeline is imposing upon the pipeline.

Another consequence of operating the pipeline in this manner is the increased back pressure on the Nugget Well Field. Design pressure of the Miller Hill Vault was to be 115-feet. If the inlet to the WTP is 150-PSI, then the pressure at Atlantic Rim Reservoir is 98-PSI excluding friction losses which would result in an even higher pressure. The Sage Creek Transmission Pipeline and Well Field Project Plans (JMM, 1987) included a hydraulic gradeline for 3,000-GPM, and by extrapolating that line with a starting pressure of 98-PSI at Atlantic Rim Reservoir indicates that the Miller Hill Vault is operating with 123-PSI or 285-feet of head. This reduces the yield from the Nugget Well Field significantly. A scoping meeting for project improvements was conducted on August 5, 2009 and in that meeting City personnel indicated that the Nugget Well Field was only yielding a total of 250-GPM which is significantly reduced from the 700-GPM they have produced in the past. This could be a direct result from not breaking pressure at Atlantic Rim Reservoir. The pressure on the Sage Creek Pipeline should be verified in the Miller Hill Vault.

7.4 Nugget Wells Declining Yield

The actual capacity of the well field is dependent upon backpressure applied to the wells and how aggressively they are utilized. At the time of construction, production of the wells was projected to decline due to interference between the wells, turbulent losses associated with the flow from each well, and back pressure imposed on the wells from the transmission pipeline. Long term flow rates for the wells were projected in the 1983 report *Rawlins Groundwater Project-Level III Interim Report* by James M. Montgomery, Consulting Engineers, Inc. (JMM, 1986). The report estimated that the total yield from the well field would be 730 GPM if three wells were completed in the Nugget Formation and operated with 115 feet of backpressure for 40 years. The report also discussed the viability of installing a booster station downstream of the convergence of the wells which would effectively reduce the backpressure on the wells to zero. At zero backpressure, the three wells were projected to produce 1,035 GPM after 40 years of use (Montgomery, 1983).

In 1997, the shut-in pressure on the wells was tested at 100 PSI, a 40 PSI reduction since construction. Shut-in pressure of the wells has not been measured since 1997, so it has not been determined how much the aquifer has recovered due to the reduced utilization.

7.5 Use of Raw Water for Irrigation

The City of Rawlins currently utilizes a great deal of finished water to irrigate the City's parks and cemetery. The largest of these facilities are the cemetery and new ball fields at the north end of the City. At this time, the City does not maintain water usage records for these areas, so usage is estimated as follows. The City wished to look into using wastewater effluent for irrigation. A review of the effluent quality determined that the effluent is unsuitable for irrigation as the cost of the required treatment equipment is prohibitively high. Refer to Appendix B for water quality analyses. The irrigated area of these facilities is 40 acres and 30 acres, respectively. The City currently irrigates about half of the cemetery's acreage as the remainder is reserved for expansion. The National Gardening Association recommends watering lawn and turf at a rate of 1-inch per week. Under current operation, the City irrigates a total of 50 acres at these two facilities, and at this rate, the City of Rawlins likely distributes 1.35 MG of finished water every week to these two facilities alone. This could increase to 1.90 MG each week if the cemetery is expanded to full capacity. At an assumed water treatment cost of $1.25 per thousand gallons treated, this translates into a savings of nearly $7,000 per month during summer months. Additional nearby parks could also be converted to utilize raw water which would further increase the cost savings.

Utilizing raw water rather than treated water for irrigation would also reduce the demand on the water treatment plant. It has been speculated that the plant will need to be expanded in the future to accommodate additional demand. If the demand can be reduced enough, the future expansion could be limited or eliminated, which would result in a substantial savings.

There are currently two options that would facilitate the use of raw water for irrigating the cemetery and nearby parks. The first option is to utilize water from the North Platte River pipeline. This would require the installation of a small booster station to provide necessary pressure to reach the cemetery, 6,900-feet of 8-inch pipeline, 5,500-feet of 6-inch pipeline, and 1,500-feet of 4-inch pipeline. The second option would be to utilize one or both of the existing wells that once served the cemetery and the old penitentiary. The wells would also be able to meet the demand of the cemetery and some of the smaller, nearby parks and only about 3,300-feet of 6-inch pipeline would be required. In either case, it is recommended that the existing city water system remain connected to each facility in the event that the raw water system must be brought down for maintenance. This would require appropriate back-flow prevention and valving be installed at each location where raw water is utilized.

7.6 Water Treatment

A very cursory evaluation was made of the treatment plant to determine if the facility used to house the Actiflo system could be adapted for pre-treatment of the water prior to going to the diatomaceous earth filters in the water treatment plant. An immediate solution was not obvious. But simply installing screens to remove the daphnae and shrimp from Peaking Reservoir would be a great help. The staff reported no problems meeting the limits set forth for organics and trihalomethanes. A more detailed study should be conducted relative to pre-treatment. It is estimated that if screens were a solution to many of the problems, this be could studied and screens installed for approximately $100,000.

7.7 Optimal Use Raw Water Sources

The City currently utilizes water from three very different sources. These are the springs in the Sage Creek Basin, the Nugget Wells, and the North Platte River. Each use of these sources offers their own unique benefits and drawbacks. Additionally, this report identifies a fourth source, resurrecting the cemetery and penitentiary wells for raw-water irrigation of City-owned facilities. All of these sources are constrained by issues with water quality, yield, seasonal influences, pumping and treatment costs, filtration, and potability. The City also uses earthen reservoirs for storage of raw water for use during peaking periods. The reservoirs also offer the potential for detention and settling as well as blending of various sources.

The Platte River Recovery Implementation Program (PRRIP) will further influence the use of water from the North Platte River as it will pose seasonal depletion threshold limits. It also offers benefits to the City if water from other, non-tributary sources (the Nugget wells and proposed cemetery and penitentiary wells) can be fed back to the river. This effectively results in a credit that would allow the City to draw additional water in excess of the threshold from the river during years of higher demand. Platte River Basin endangered species may also influence future use of the North Platte River.

The system primarily uses water from the springs in the Sage Creek Basin as it is their best quality source and also offers minimal operating cost as it is a gravity fed collection and transmission system. The springs cannot sustain peak demand in the summer months without adequate storage and/or supplementation from other sources. This will be an even bigger issue in the future as demand increases. Optimal use of the City's sources and reservoirs would provide for the most cost effective means of delivery as well as considerations for providing water of the highest quality by effectively using the City's existing reservoirs and water treatment facility.

An operational study should be completed to ensure that the City utilizes existing water sources effectively and in compliance with future regulation of the North Platte River. An operational study and report can be completed for an estimated $30,000.

8 RECOMMENDED IMPROVEMENTS

8.1 Replace Atlantic Rim Reservoir to Water Treatment Plant Pipeline

The 12,855 feet 18-inch A.C. pipeline currently connecting the Atlantic Rim Reservoir and Sage Creek Pipeline to the water treatment plant (WTP) has encountered numerous failures due to the degradation of the pipeline and is also undersized for the upper Sage Creek Pipeline's capacity. Replacement of this pipeline was recommended by WWC (WWC, 1997) and is still a priority for replacement due to ongoing failures. WWC provided a preliminary design and construction costs. These costs have been updated for today's economy as well as some minor modifications to the design.

The first design change was the use of Class 165 PVC in place of the previously proposed Class 300 steel pipeline. The primary reason is one of cost as steel prices have increased significantly since 1997. This also reduces the costs for corrosion protection along the pipeline.

It should be noted that the original design of the Sage Creek Pipeline called for breaking pressure at Atlantic Rim. The elevation difference between the high water line of Rawlins Reservoir and the water treatment plant is approximately 475 feet which would be the worst case for pressure during a static condition and should not be imposed on the line between Atlantic Rim and the WTP. A pressure relief valve will be installed on the inlet works to ensure that excess pressure can be vented to the reservoir. A pressure reducing station on the pipeline would also reduce the pressure on the lower portion of the pipeline.

The project would consist of installing 12,855 feet of new 20-inch PVC pipeline alongside of the existing 18-inch A.C. pipe and making connections to the Atlantic Rim Reservoir and the water treatment plant. The existing A.C. pipeline may be abandoned or possibly utilized as a transmission line as described in Section 8.7. The existing pipeline will need to remain online during construction.

A cost estimate was prepared for the project. Total construction cost is estimated at $2,201,087 and the total project cost, including engineering and other related items, is $3,024,484. The costs are summarized in Table 4-8. A project site layout is shown in Figure 4-2.

Atlantic Rim Reservoir to WTP Pipeline Estimate

Table 4-8

Project Cost Estimate for Replacement of Pipeline between Atlantic Rim Reservoir and Water Treatment Plant

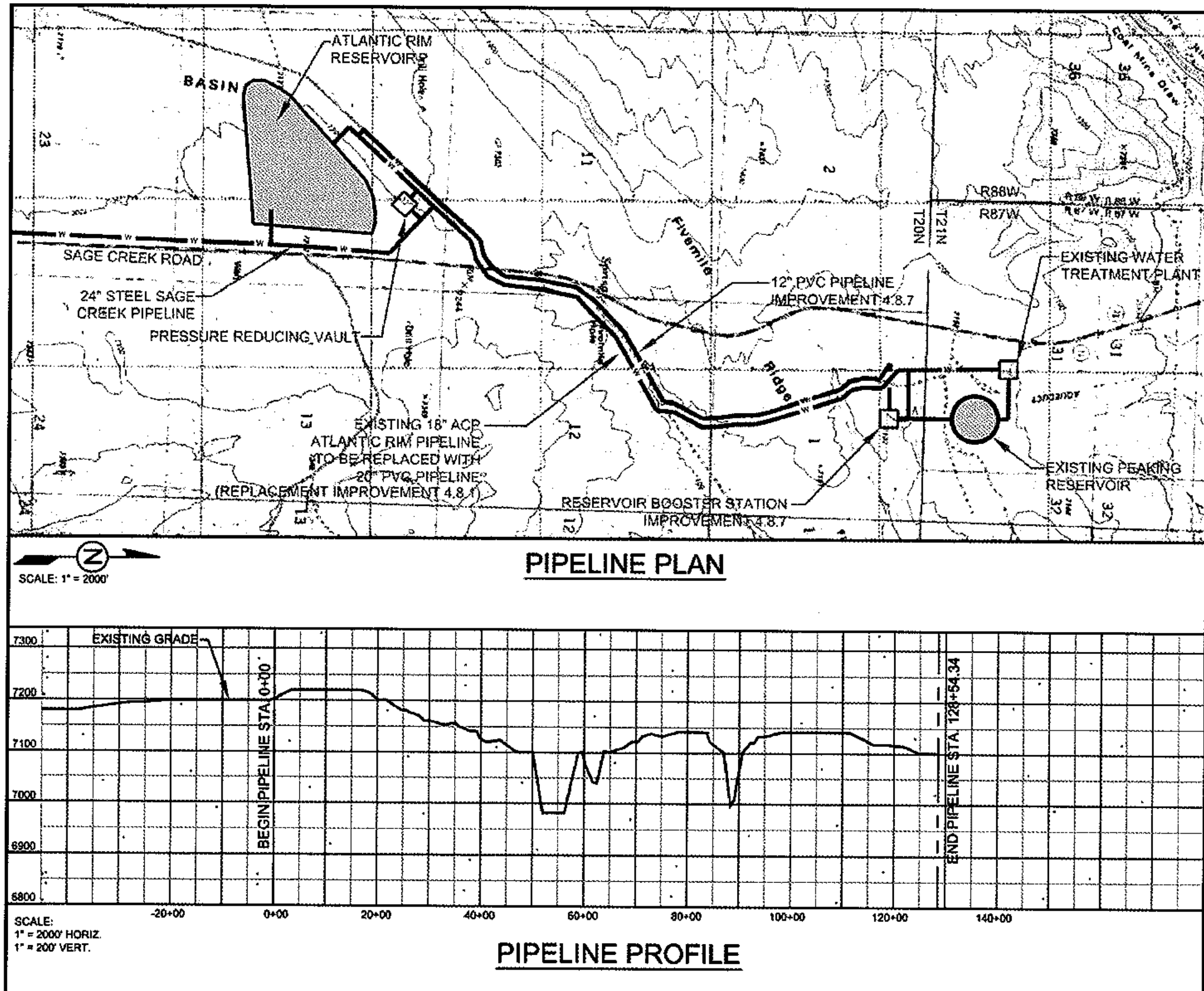
Prepare Final Plans and Specifications	$	220,108.70
Permitting and Mitigation	$	10,000.00
Legal Fees	$	10,000.00
Acquisition of Access and ROW	$	-
Subtotal	$	240,108.70

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	**Mobilization and Bonds (8% of total)**	LS	1	$ 176,086.96	$ 176,086.96
2	**Pipe and Appurtenances**				
	20" PVC Pipe, 165# Class	LF	11,000	$ 80.00	$ 880,000.00
	Valving and connection at the WTP	LS	1	$ 50,000.00	$ 50,000.00
	Atlantic Rim Pipeline Connection	LS	1	$ 40,000.00	$ 40,000.00
	Road Crossings	EA	1	$ 400,000.00	$ 400,000.00
	Blowoffs , Assume every 1/2 mile	EA	5	$ 10,000.00	$ 50,000.00
	AVAR Assemblies (excl. Manhole) on Transmission Line. Assume every 1/2 mile	EA	5	$ 2,500.00	$ 12,500.00
	Miscellaneous Fittings	EA	20	$ 3,000.00	$ 60,000.00
	Pressure Relief Valve and Vault to Atl. Rim Res.	LS	1	$ 50,000.00	$ 50,000.00
	Cathodic Protection	LS	1	$ 8,000.00	$ 8,000.00
3	**Revegetation**				
	Pipeline corridor 0+00 to 128+55, 25' wide	AC	8	$ 1,500.00	$ 12,000.00
4	**Concrete**				
	Manhole for AVAR Valves	EA	5	$ 2,500.00	$ 12,500.00
5	**Updated Outlet Works**	EA	1	$ 250,000.00	$ 250,000.00
6	**Unscheduled Items**	LS	1	$ 200,000.00	$ 200,000.00
	Total Construction Cost				**$ 2,201,086.96**

Total Project Cost

Construction Cost Subtotal	$	2,201,086.96
Engineering (10% of Construction Cost)	$	220,108.70
Subtotal	$	2,421,195.65
15% Contingency	$	363,179.35
Subtotal	$	2,784,375.00
Total Project Cost	**$**	**3,024,483.70**



REVISION	DATE	BY	DESCRIPTION

WARNING — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED: RJW	DATE: MAY, 2010
DRAWN: DKM	JOB NO.: 7.009
CKD: LKW	SCALE: AS SHOWN

Wester Wetstein & Associates — Consultants in Engineering and Hydrogeology

CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
PIPELINE

FIGURE 4-2

8.2 Install a Booster Pump in the Nugget Well Field Vault

The Miller Hill Vault was originally constructed with the intent of adding booster pumps in the future. Currently there are two 8-inch lines installed directly into the well supply header to allow for the addition of pumps. There also exists a tee with a blind flange for connecting the discharge of the pumps to the Sage Creek Pipeline. The addition of booster pumps will require 3-phase power be brought to the site which is a significant expense and accounts for approximately 55% of the construction cost. The redundant pumps are estimated to be 50-horsepower each which is adequate to pump 1,035 GPM with 115-feet of total dynamic head. The pumps will utilize variable frequency drives to help match the pressure of the Sage Creek Pipeline and telemetry will be integrated into the City's SCADA system to provide control and monitoring functions. The project also includes ventilation and dehumidification improvements to provide an optimum environment for the new electrical controls.

A cost estimate was prepared for the project. Total construction cost is estimated at $341,280 and the total project cost, including engineering and other related items, is $475,848. The costs are summarized in Table 4-9.

Table 4-9
Project Cost to Install Pumps in Miller Hill Vault

Prepare Final Plans and Specifications	$ 34,128.00
Permitting	$ 5,000.00
Legal	$ 5,000.00
Acquisitioon of Access and ROW	$ -
Subtotal	$ 44,128.00

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	Mobilization/Demobilization/Bond & Insurance (8%)	LS	1	$ 25,280.00	$ 25,280.00
3	Pumps, Motors, & Adjustable Speed Drives	LS	1	$ 42,000.00	$ 42,000.00
4	Dehumidifier & Ventilation Improvements	LS	1	$ 24,000.00	$ 24,000.00
5	Telemetry & Controls	LS	1	$ 18,000.00	$ 18,000.00
6	Fittings & Pipe Supports	LS	1	$ 12,000.00	$ 12,000.00
7	Installation	LS	1	$ 40,000.00	$ 40,000.00
8	Install Electricity to Site	LS	1	$ 180,000.00	$180,000.00
	Total Construction Cost				$341,280.00

Total Project Cost

Construction Cost Subtotal	$341,280.00
Engineering (10% of Construction Cost)	$ 34,128.00
Subtotal	$375,408.00
15% Contingency	$ 56,311.20
Subtotal	$431,719.20
Total	**$475,847.20**

8.3 Install an Impermeable Liner in Atlantic Rim Reservoir

To install an impermeable liner in Atlantic Rim Reservoir, it will be necessary to drain the reservoir and allow the bottom to dry or muck out the wet material in the bottom of the reservoir. Because the City relies so heavily on this reservoir, it probably cannot be drained until the end of summer and the lining operation should take place as early in the fall as possible depending on how the reservoir dries out after draining. It will be necessary to remove and replace the rip rap along the edges of the reservoir so the sides can be lined and the lining will have to be keyed in at the surface to keep it in place.

Two forms of lining were evaluated. The first was HDPE lining. This lining is quite strong and not subject to ultraviolet deterioration. The second lining is composed of PVC and has to be installed and then covered with a foot or two of fill. This lining system is much more aesthetically pleasing than the HDPE liner, but is slightly more expensive to install. The HDPE lining system seemed to be the system preferred by the suppliers and geotechnical engineers. Table 4-10 is the estimated costs for installing a PVC liner in Atlantic Rim Reservoir.

Table 4-10
Cost Estimate to Install Impermeable Liner in Atlantic Rim Reservoir

Design Engineering	$	143,625.01
Permitting	$	5,000.00
Legal	$	10,000.00
Subtotal	$	158,625.01

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	Mobilization and Bonds (8 Percent)	LS	1	$ 106,388.89	$ 106,388.89
2	Remove Rip Rap	LS	1	$ 46,000.00	$ 46,000.00
3	Strip and Stockpile 2' of Cover Soil	CY	74000	$ 2.30	$ 170,200.00
4	Excavate Anchor Trench	LF	4800	$ 2.50	$ 12,000.00
5	PVC 30 mil	SF	1680757	$ 0.25	$ 420,189.25
6	PVC Installation	SF	1680757	$ 0.10	$ 159,671.92
7	Cover Soil Placement	CY	74000	$ 2.85	$ 210,900.00
8	Geotextile Separation Layer + Installation	SF	450000	$ 0.14	$ 60,750.00
9	Backfill Anchor Trench & Replace Rip Rap	CY	14750	$ 3.40	$ 50,150.00
10	Miscellaneous	LS	1	$ 200,000.00	$ 200,000.00
	Total Construction Cost				**$ 1,436,250.06**

Total Project Cost

Construction Cost Subtotal	$ 1,436,250.06
Engineering (10% of Construction Cost)	$ 143,625.01
Subtotal	$ 1,579,875.06
15% Contingency	$ 236,981.26
Subtotal	$ 1,816,856.32
Total Project Cost	**$ 1,975,481.33**

8.4 Install Raw Water Irrigation Pipeline and Booster Station for Cemetery and Parks

The City may utilize raw water for irrigational purposes through the installation of approximately 2.5 miles of transmission pipeline and a small booster station. The North Platte River Pipeline would be tapped north of exit 215 along Interstate 80. See Figure 4-3 for alignment of the proposed pipeline and location of the booster station. The booster station may be located anywhere east of Higley Boulevard. The shown location was selected for convenience and is believed to be easily attainable by the City.

The booster station will consist of an 8-foot by 12-foot building that will house a single booster pump and 100-gallon hydropneumatic pressure tank. It is recommended that a variable frequency drive be used to control the booster pump to better match demand and minimize the size of the required pressure tank.

This estimate assumes the connection of the cemetery, north ball fields, and the Rawlins High School for a total irrigated area of 74 acres. An irrigation rate of 1.2 inches per week was utilized to add a small safety factor over the National Gardening Association's recommendation of 1 inch per week. This results in a total weekly irrigation of 2.41 MG. The Grounds Superintendent for the City of Rawlins was consulted to get the watering schedule for the parks and cemetery. The cemetery is watered during the day between 8:00 AM and 5:00 PM. The zones are operated manually. All other parks and recreation facilities use automatic watering systems to operate between 11:00 PM and 7:00 AM. This results in a peak flow rate of 397 gallons per minute which corresponds to the irrigation rate required by the cemetery during daytime watering hours. Note that this also is based on the total acreage of the Cemetery. The Cemetery is currently half-developed, so the current watering requirements are approximately half of this flow rate.

The pressure available at the connection to the North Platte River pipeline is 98 feet-water based on the high water line of the Thayer tank and the hydraulic grade line presented in the as-built North Platte Pipeline plans (WWC-NPR Plans, 2004). There is 164 feet of elevation difference (42.6-PSI) between the cemetery and the pipeline connection. The booster pump will need to provide approximately 80-PSI of total dynamic head and be rated at 30-HP for these flow conditions. Pressure reducing valves may be required at the Rawlins High School and the north ball fields depending on their respective irrigation systems.

Raw water will be delivered from the North Platte River Pump station and then run through the raw water booster pump described here; therefore, the total operating costs are the sum of the two stations at these said flow rates. The pumping costs for the North Platte River Pump Station were previously described in Section 4.6 which resulted in $170.48 per million gallons pumped. This figure was based on actual billing for the NPRPS. Assuming the raw water booster station operated at an efficiency of 65% and electrical costs are $0.06 per kilowatt-hour, it would cost $53.62 per million gallons pumped. The total operating cost to deliver raw water from the North Platte River to the said facilities would be $224.10 per million gallons. If treatment costs $1.25 per thousand gallons from the water treatment plant, the same million gallons delivered for irrigation would cost $1,250.00. If this water processed through the water treatment plant was actually sourced from the North Platte River, pumping costs from the NPRPS and the Thayer Booster station also need to be included which add an additional $361.32 per million gallons pumped. If the irrigation season spans four months or 17 weeks, then the irrigation system will have delivered over 41 MG in a season. If that 41 million gallons is delivered through the water treatment plant, irrigation would cost $51,250 (additional pumping cost would be added if supplemental water is delivered from the North Platte River) and only $9,200 if the irrigation water is delivered through the raw water booster station. This improvement has the potential to save approximately $42,400 per year and has the added benefit of reducing or even eliminating expansion of the water treatment plant. Annual operating costs are tabulated in Table 4-11.

Table 4-11

Cost Comparison for Delivery of Irrigation Water From the Water Treatment Plant and Proposed Raw Water Irrigation Booster Station

	N. Platte River Pump Cost per MG	Thayer Booster Station Pump Cost per MG	Raw Water Booster Station Pump Cost per MG	Water Treatment Cost per MG	Total Cost Per MG
Finished Irrigation Water from Treatment Plant	$ 170.48	$ 190.84	$ -	$ 1,250.00	$1,611.32 *
Raw Irrigation Water from North Platte River	$ 170.48	$ -	$ 53.62	$ -	$ 224.10

* When supplying water from the Water Treatment Plant, costs may or may not include pumping costs from the North Platte River Booster Station and Thayer Booster Station as water can be supplied direclty from the Sage Creek Basin.

Any location that will utilize raw water from the North Platte is recommended to maintain the facility's current connection to the City's distribution system. At each of these locations it will be necessary to install the proper valving and back-flow prevention components so that the City has the capability of utilizing either the raw water or treated water systems. These backflow prevention devices will be required to prevent raw water from entering the City's finished water system. For this application, reduced pressure principle backflow preventers are the only backflow prevention devices approved by the Wyoming DEQ. If there are potable water facilities on the same distribution network that is used for irrigation, these shall be considered separately and on a case-by-case basis.

A cost estimate was prepared for the project. Total construction cost is estimated at $618,696 and the total project cost, including engineering and other related items, is $858,521. The costs are summarized in Table 4-12. A site layout is presented in Figure 4-3. The use of raw water from existing wells will be discussed later and the cost to use the existing wells for irrigation is less expensive than constructing a raw water booster station and pipelines. Therefore, this improvement is not recommended at this time.

Table 4-12
Cost Estimate for Proposed Raw Water Booster Station

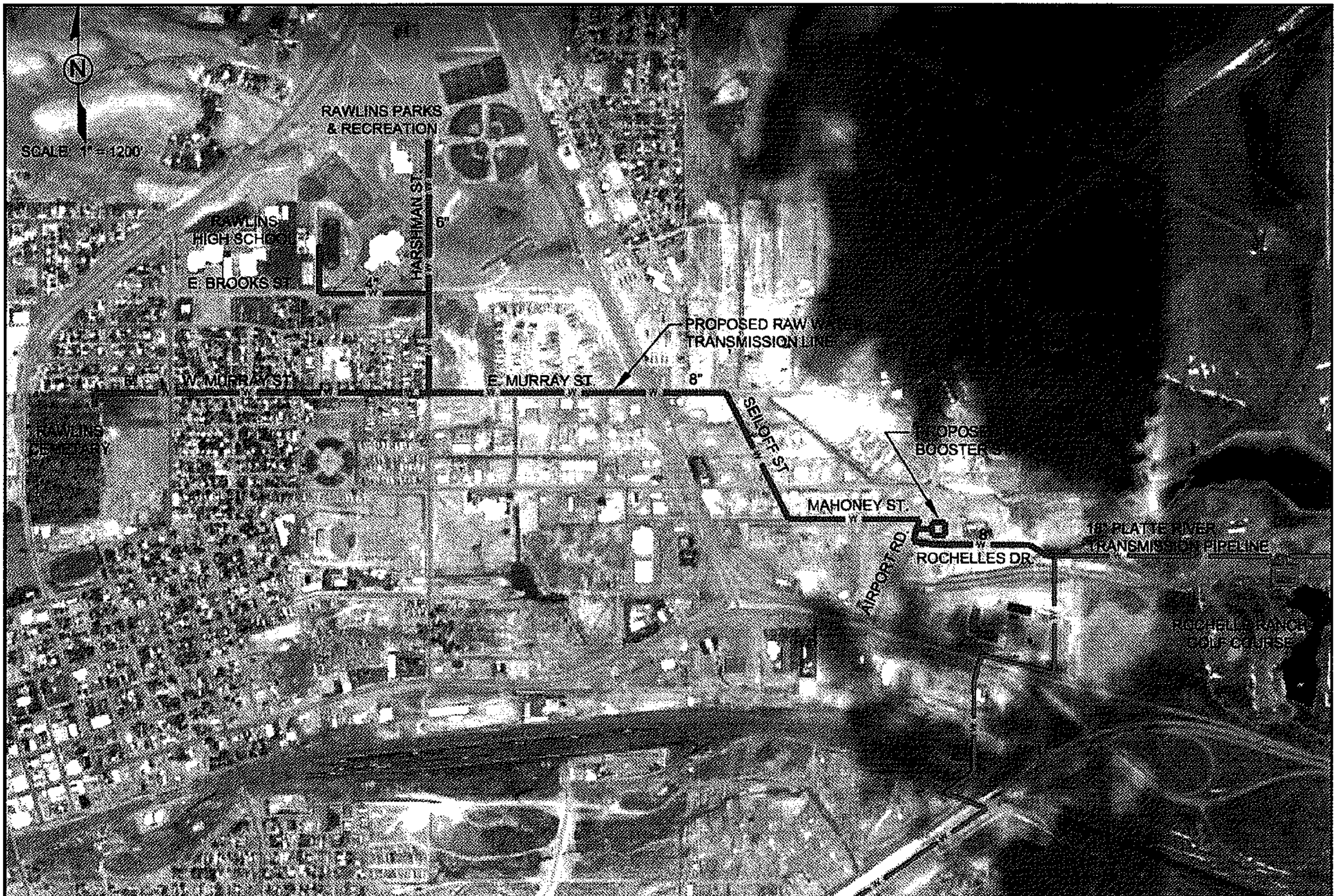
Prepare Final Plans and Specifications	$ 61,869.60
Permitting	$ 5,000.00
Legal	$ 5,000.00
Acquisition of Access and ROW	$ 4,000.00
Subtotal	$ 75,869.60

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	Mobilization and Bonds	L.S.	1	$ 48,296.00	$ 48,296.00
2	Pump Building (8 x 12)	L.S.	1	$ 28,800.00	$ 28,800.00
3	Pump and VFD	L.S.	1	$ 55,000.00	$ 55,000.00
4	HVAC	L.S.	1	$ 8,000.00	$ 8,000.00
5	Interior Piping	L.S.	1	$ 5,000.00	$ 5,000.00
6	100 Gallon Hydropneumatic Tank	E.A.	1	$ 4,500.00	$ 4,500.00
7	Interior Electrical and Telemetry	L.S.	1	$ 8,000.00	$ 8,000.00
8	Backflow Preventers & valving @ cemetary, school, park	E.A.	3	$ 5,000.00	$ 15,000.00
9	8-inch PVC	L.F.	6900	$ 35.00	$241,500.00
10	6-inch PVC	L.F.	5520	$ 30.00	$165,600.00
11	4-inch PVC	L.F.	1500	$ 26.00	$ 39,000.00
	Total Construction Cost				$618,696.00

Total Project Cost

Construction Cost Subtotal	$618,696.00
Engineering and Permitting (10% of Construction Cost)	$ 61,869.60
Subtotal	$680,565.60
15% Contingency	$102,084.84
Subtotal	$782,650.44
Total	**$858,520.04**



DATE: MAY, 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology, 605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE
JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	4-3
SCALE: AS SHOWN		PROPOSED IRRIGATION PIPELINES	

8.5 Connect In-Town Wells for Irrigation

The City may opt to utilize the existing cemetery and penitentiary wells in lieu of routing water from the North Platte River pipeline for raw water irrigation. The two wells are each adjudicated for 250 gallons per minute which is adequate to irrigate the cemetery, north ball fields, and Rawlins High School as described in the previous section. The wells also offer the benefit of being closer to the said irrigated areas and thus require substantially less pipeline.

In order to bring the wells online, a pump test should be conducted to verify the production of each of the wells and also verify that the water quality is suitable for irrigation purposes. The current wellhead configuration and well control building condition is unknown and therefore it is assumed that a pitless adapter will be installed on each well and a small well control building will be constructed to house the electrical equipment, controls, and pressure tank. Each of the wells shall be controlled with a variable frequency drive to maintain constant pressure and a SCADA system shall be installed to allow proper lead/lag/assist controls. The SCADA system may also be omitted and utilize the penitentiary well only as a supplemental source to the cemetery well. In other words, only allow it to activate if the cemetery well cannot maintain the desired pressure. The penitentiary well is designated as the supplemental well due to it being located further from the areas to be irrigated. It is recommended to install a small pressure tank on systems with variable frequency drives and thus a 40-gallon hydro-pneumatic tank will be installed inline with each well. The project will require a total of 3,550 feet of 6-inch PVC pipeline and 1,500 feet of 4-inch PVC pipeline. Figure 4-4 shows a layout of the system.

The cemetery is the high point of the system with an elevation of approximately 6,840 feet. The ball fields and the school field are approximately 6,780 feet. The cemetery well is 320 feet in depth. If a pumping level of 260-feet below ground level is assumed and the pump delivers 35-PSI to the cemetery irrigation system, the cemetery pump would need to provide approximately 150-PSI of total dynamic head which would yield about 70-PSI at the other fields before head loss is accounted for. At a flow rate of 250 gallons per minute, the pump would require approximately 34 horsepower assuming an efficiency of 65%. At this rate, it would cost about $84 per 1.0 million gallons pumped. The penitentiary well is located at a lower elevation of approximately 6,860 feet in elevation, but is 384 feet deep. Assuming a pumping level of 310 ft below grade, 3-PSI of head loss, and maintaining 35-PSI at the cemetery, the pump will need to provide approximately 172-PSI of total dynamic head. Operating at 250 gallons per minute, the pump will require about 39-horsepower. The pumping cost of this well will be about $96 per 1.0 million gallons pumped. The pumping costs as well as installation costs of this option are significantly cheaper than utilizing a raw water booster station from the North Platte River pipeline. The pumping costs shown here assume a cost of $0.05 per kilowatt-hour.

Similar to the previous option of using North Platte River water, it is recommended that the City maintain its current connection to finished water and install appropriate valving and backflow prevention at sites that are to utilize raw irrigation water.

The condition of the wells is unknown and should be verified before any part of this project commences. It is recommended that a video survey be conducted on the wells, take geophysical logs, and conduct a pump test to prove the wells' usefulness.

The recommended budget for investigating the wells is $85,000. This includes televideo surveys of the wells, furnishing, installing and removing test pumps from each well, conducting pumping tests, geophysical logs, and water quality analyses. This budget also allows for an overview of the Nugget Wells. The total construction cost to tie in both wells is estimated at $712,524. The costs are summarized in Table 4-13, and a site layout of the project is shown in Figure 4-4.

Table 4-13
Cost Estimate to Tie In Cemetery and Penitentiary Wells for Irrigation

Prepare Final Plans and Specifications	$ 51,173.91
Permitting	$ 5,000.00
Legal	$ 5,000.00
Acquisition of Access and ROW	$ 4,000.00
Subtotal	$ 65,173.91

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	Mobilization and Bonds	LS	1	$ 37,739.13	$ 37,739.13
2	Well Control Building	LS	2	$ 12,000.00	$ 24,000.00
3	Pump and VFD	LS	2	$ 30,000.00	$ 60,000.00
4	HVAC	LS	2	$ 2,500.00	$ 5,000.00
5	Interior Piping	LS	2	$ 10,000.00	$ 20,000.00
6	40 Gallon Hydropneumatic Tank	EA	2	$ 3,000.00	$ 6,000.00
7	Interior Electrical and Telemetry	LS	2	$ 3,000.00	$ 6,000.00
8	Backflow Preventers & valving @ cemetary, school, park	EA	3	$ 5,000.00	$ 15,000.00
9	Well Pitless Adapter	LF	2	$ 9,500.00	$ 19,000.00
10	6-inch PVC	LF	9,000	$ 30.00	$270,000.00
11	4-inch PVC	LF	1,500	$ 26.00	$ 39,000.00
12	Road Boring	LF	40	$ 250.00	$ 10,000.00
	Subtotal				$511,739.13

Total Project Cost

Construction Cost Subtotal	$511,739.13
Construction Engineering	$ 51,173.91
Subtotal	$562,913.04
Contingency (15 Percent)	$ 84,436.96
Subtotal	$647,350.00
Total	**$712,523.91**

LEGEND

—W— PIPELINE

(W) WELL

DATE: MAY, 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology, 605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE
JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	4-4
SCALE: AS SHOWN		IRRIGATION PLAN	

8.6 Install Booster Pump between Atlantic Rim Reservoir and Peaking Reservoir

The Atlantic Rim Storage Reservoir has been underutilized for many years due to a steady leak through the foundation of the reservoir. Additional studies have been funded by the WWDC regarding the construction of additional storage for the City of Rawlins. These studies have outlined the possibilities for constructing an additional reservoir or increasing the storage of the City's existing reservoirs (WWC, 2006 and WWC, 2008). Use and storage of water from the North Platte River will become increasingly important in the future. An alternative that was not discussed in those studies was the possibility of using the Atlantic Rim Reservoir to store water from the North Platte River. This could be accomplished by first filling or augmenting Peaking Reservoir with water from the North Platte River and then lifting the water to the Atlantic Rim Reservoir through the use of a small booster station installed near the water treatment plant.

There is approximately 90 feet of elevation difference between the high water lines of Peaking Reservoir and Atlantic Rim Reservoir. If the booster station is sized to pump 2.0 million gallons per day, or 1,890 gallons per minute, the pump would require 50 horsepower. It is recommended that the transmission pipeline from Peaking Reservoir to Atlantic Rim Reservoir be a dedicated line to allow the water treatment plant to utilize water from the Sage Creek Basin directly while pumping water from the North Platte River to Atlantic Rim Reservoir. The construction of this project would include the construction of small pump station with redundant 50 horsepower pumps and approximately 13,000 feet of 12-inch PVC pipeline.

This improvement is dependent upon two other improvements outlined in this section. The first is the requirement that Atlantic Rim Reservoir be properly rehabilitated through the installation of an impermeable liner as described in Section 4.8.3. The second dependence is more of a recommendation as it will minimize the cost of installing the PVC pipeline. If this project is done concurrently with the improvements described in Section 4.8.1, which is the replacement of the main transmission pipeline between Atlantic Rim Reservoir and the water treatment plant, the installation costs of the 12-inch pipeline described here could be reduced since the construction crew will be on site and even more so if the 20-inch pipeline and 12-inch pipeline are installed in the same trench.

Another possibility of reducing the cost of this improvement is to utilize the existing 18-inch A.C. pipeline instead of installing new PVC pipeline. If the existing A.C. pipeline is converted for service as described here, it would operate under substantially less pressure than it does currently. The integrity of the existing A.C. pipe should be verified and approved for this service.

A cost estimate follows for this project. The estimate is based on the assumption that new 12-inch PVC pipeline will be installed independently of the replacement pipeline between Atlantic Rim Reservoir and the Rawlins water treatment plant. No reductions are made for the option of installing the pipeline concurrently in an adjacent trench to the new pipeline between Atlantic Rim Reservoir and the Rawlins Water treatment plant trench as described in this section. Total construction cost is estimated at $1,131,300 and the total project cost, including engineering and other related items, is $1,564,225. The costs are summarized in Table 4-14. A site layout is presented in Figure 4-2.

Table 4-14
Cost Estimate to Install Booster Station and Pipeline from Atlantic Rim Reservoir to Peaking Reservoir

	Prepare Final Plans and Specifications	$ 113,130.00
	Permitting and Mitigation	$ 15,000.00
	Legal Fees	$ 5,000.00
	Acquisition of Access and ROW	-
Subtotal		$ 133,130.00

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit Cost	Cost
1	**Mobilization and Bonds (8 Percent)**	LS	1	$ 83,800.00	$ 83,800.00
2	**Booster Station**				
	Pump Building (8 x 12)	LS	1	$ 100,000.00	$ 100,000.00
	Redundant Pumps	LS	1	$ 60,000.00	$ 60,000.00
	HVAC	LS	1	$ 10,000.00	$ 10,000.00
	Interior Piping	LS	1	$ 20,000.00	$ 20,000.00
	Interior Electrical and Telemetry	LS	1	$ 15,000.00	$ 15,000.00
	Yard Piping	LS	1	$ 40,000.00	$ 40,000.00
3	**Pipeline**				
	AVAR Assemblies	EA	5	$ 2,000.00	$ 10,000.00
	Valves and Fittings	EA	25	$ 1,500.00	$ 37,500.00
	Blowoffs	EA	5	$ 3,500.00	$ 17,500.00
	Highway Bore	LF	100	$ 500.00	$ 50,000.00
	12-inch PVC	LF	13,000	$ 45.00	$ 585,000.00
4	**Concrete**				
	Manholes for AVAR	EA	5	$ 2,500.00	$ 12,500.00
5	**Unscheduled Items**	LS	1	$ 90,000.00	$ 90,000.00
	Subtotal				$1,131,300.00

Total Project Cost

Construction Cost Subtotal		$1,131,300.00
Engineering (10% of Construction Cost)		$ 113,130.00
	Subtotal	$1,244,430.00
15% Contingency		$ 186,664.50
	Subtotal	$1,431,094.50
	Total Project Cost	**$1,564,224.50**

SECTION 5 – WATER RIGHTS

SECTION 5

Water Rights

1 INTRODUCTION

The City of Rawlins has a variety of surface and groundwater rights. The City's surface, groundwater, and storage rights are shown in Table 5-1 at the end of this section. The surface water rights include fourteen Sage Creek Springs, diversion rights on Sage Creek, and diversion rights on the North Platte River. These water rights were documented fairly thoroughly in the Montgomery 1983 report and further discussed in the WWC 1997 report. This is summary of the water rights held by the City of Rawlins with discussion of the elements not contained in the earlier studies.

2 SURFACE WATER RIGHTS

The City has a 2.01 CFS water right on the North Platte River with an October 4, 1900 priority which was obtained through the Union Pacific Railroad. In 2002, the City entered into a 50-year joint powers agreement with the Town of Sinclair to use their water rights which pre-dates the City's North Platte River diversion rights. The Town of Sinclair has territorial rights totaling 4.21 CFS. Of these 4.21 CFS water rights, 1.0 CFS was transferred to the City of Rawlins for the 50-year period of the agreement. In return, the City of Rawlins provides the Town of Sinclair treated water for a fee.

While the Sage Creek Springs have very early water rights, the municipal use of the water from the springs is somewhat later (1923) and renders the municipal use of water from the springs junior to some of the other surface water rights in the Sage Creek Drainage. There are irrigation rights which are senior to the Sage Creek Spring water rights for municipal use and, during the summer of 2003, it became necessary to pay for the cost of hay that could not be grown under the senior water rights because of diverting water from the springs and Rawlins Reservoir for municipal use. At the time, the Rochelle golf course was being developed and water was not available from the North Platte River. The following year raw water was available from the North Platte River and water was released from Rawlins Reservoir to meet the downstream appropriator's needs.

3 GROUNDWATER RIGHTS

The groundwater rights include the Rawlins Nugget Wells, the City of Rawlins No. 2 well near Miller Hill, the Cemetery No. 1 Well and the Penitentiary Well No. 2. The priority statuses of these water rights are quite junior to the surface water rights, but because they are non-tributary to the North Platte River, they are of key value.

The completed City of Rawlins No. 2 well is in the Lakota Formation and flows approximately 70 gallons per minute (GPM) at the surface. This well was connected to the old wood stave transmission pipeline from the North Platte River and was allowed to flow freely into the drainage for an extended period of time. Currently, this well is not connected to Nugget Well Field or the new Sage Creek Pipeline. With the current back pressure on the Nugget Well Field, the well potential is very small. Should booster pumps be installed at the Miller Hill vault to alleviate the back pressure, this well could be connected to the Nugget Well Field piping fairly inexpensively and could provide a modest 70 to 80 GPM of additional groundwater to the City.

The Nugget Formation wells were drilled in the early 1980s. These artesian wells have a shut-in pressure of approximately 140-PSI. The yield from these wells is limited somewhat by the back pressure on the Sage Creek Pipeline. This was recognized during the design of the Sage Creek Pipeline and provisions were made in the control vault for the Nugget Wells at Miller Hill to install booster pumps to increase the yield from the well field. With the back pressure on the Nugget Formation Wells, the yield from this source is only about 300 to 350 GPM. However, with the installation of booster pumps, the yield from the wells can be increased from 700 to 1000 GPM.

The Cemetery No. 1 Well and the Penitentiary Well No. 2 are situated within the City limits. The Cemetery No. 1 Well was used to irrigate the cemetery until production fell off. The Penitentiary Well No. 2 was used at the old State Penitentiary for miscellaneous purposes and was eventually turned over to the City after the new prison was constructed. Each well has a reported capacity of 250 GPM and the Cemetery No. 1 Well is adjudicated at 250 GPM. From water quality analyses, the water from these wells has too many dissolved constituents for drinking purposes, but should serve fine for irrigation purpose.

By using these wells to irrigate the cemetery, the baseball diamonds, football fields and soccer field, there will be a large demand taken off the water treatment plant and extend its current life by several years.

4 STORAGE RIGHTS

The City also has storage rights on Rawlins Reservoir, Peaking Reservoir, and Atlantic Rim Reservoir amounting to 1,615.16 acre feet. Rawlins Reservoir is filled from the flow in Sage Creek. Atlantic Rim Reservoir is filled by storing water from the Sage Creek Springs. Peaking Reservoir can be filled from either the flow from Sage Creek Springs or pumping from the North Platte River. While there is a total water right of 6.15 cubic feet per second (CFS) from the Sage Creek Springs, the maximum diversion rate to Peaking and Atlantic Rim Reservoirs is 5.25 CFS.

5 INSTITUTIONAL CONSTRAINTS

As is well-documented in previous reports, the State of Wyoming and the State of Nebraska went to the U.S. Supreme Court to settle a lawsuit over the North Platte River. One outcome of the North Platte River settlement was the development of the Platte River Recovery Implementation Program in 1997. During the course of developing this plan, baseline benchmarks or thresholds were established for use of water by the different municipalities. These benchmarks were based on the maximum water consumption of the City of Rawlins between the years of 1992 and 1996. Different benchmarks were established for the irrigation and non-irrigation season. There are two forms of benchmarks; the first is surface water depletions and the second is groundwater accretions.

While the City diverts surface water from the North Platte River Basin for municipal use, part of the diversion is returned to the North Platte River through its wastewater treatment plant. The amount diverted and not returned to the river is the amount of the depletion. Groundwater from the Nugget wells is taken and used by the municipality, and part of this water goes back into the North Platter River. Because this water would not have made it to the North Platte River if the City had not intercepted it through the well completions, conveyed it to Town and used it, the groundwater is an accretion. The benchmark is determined by subtracting the groundwater accretion from the surface water depletion to obtain a total depletion from the system. Table 5-2 shows the depletions, accretions, and benchmarks for the City of Rawlins during the irrigation (May 1 to October 1) and non-irrigation seasons.

Table 5-2
North Platte River Depletions, Accretions, and Benchmarks
for the City of Rawlins

Season	Surface Water Depletions (AF)	Groundwater Accretions (AF)	Total Benchmark (AF)
Irrigation	1,362	21	1341
Non-Irrigation	609	147	462
Total Annual	1,971	168	1,803

Records from 2008 were provided by the City and show depletions during the irrigation season (May 1 – October 1) of 1,201 AF and during the non-irrigation season depletions of 538 AF which were over the benchmark by 76 AF. No action on behalf of the State was required since other municipal users above Pathfinder Reservoir were below their benchmarks.

The City has been advised to use the Miller Hill Wellfield in the summertime only as needed to meet peak period demand. This operation philosophy was based on maintaining as much residual pressure in the well field as possible. At the time the City was advised to use only the Miller Hill Wellfield during the summer months, the concept of benchmarks was just being conceived by the States and federal agencies. Because the groundwater acts as accretion or a credit, by using more groundwater, more surface water can be used. In periods when it appears that the City may exceed its benchmark, the Miller Hill Well field can be used to mitigate the surface water depletions.

6 PATHFINDER MODIFICATIONS

There has been and will continue to be water rights administration in dry years during the months of February, March, and April for the benefit of Pathfinder Reservoir, which has a storage water right with a priority date of December 6, 1904. During such water rights administration, the City of Rawlins can continue to utilize its surface water rights that are senior to Pathfinder Reservoir. The City has senior water rights for 3.01 cubic feet per second (CFS), which includes 1.00 CFS provided through agreements with the Town of Sinclair. In addition, the City can utilize water from the Miller Well Field, as the production from these wells does not impact flows in the North Platte River.

The State of Wyoming, through the Wyoming Water Development Program, is pursuing a partnership with the Bureau of Reclamation (USBR) for the construction of the Pathfinder Modification Project. The project would increase the existing capacity of Pathfinder Reservoir by 53,493 acre feet to recapture storage space lost to accumulated sediment. This increased capacity would be administered through two accounts: the "Environmental Account" and the "Wyoming Account."

The "Environmental Account" consists of 33,493 acre feet of the proposed 53,493 acre foot enlargement and will be operated for the benefit of the endangered species and their habitat in central Nebraska. The Environmental Account is the state's contribution to the Platte River Recovery Implementation Program on behalf of its water users. It will serve as the reasonable and prudent alternative under the ESA for the depletions occurring in Wyoming on or before July 1, 1997.

The State of Wyoming has the exclusive right to contract with the USBR for the use of the remaining 20,000 acre feet of the enlargement capacity in the "Wyoming Account." The USBR, under contract with Wyoming, will operate the 20,000 acre feet of storage account to provide an annual firm yield of 9,600 acre feet.

The first priority for use of water in the "Wyoming Account" is to serve as a supplemental water supply for Wyoming's municipalities during times of water rights regulation. However, the state needs to maintain the flexibility to use water from the "Wyoming Account" for other purposes if it is not needed by the municipalities during times of water right regulation. Therefore, the municipalities will be restricted from re-marketing the water under the terms of the contracts. The state will enter into readiness-to-serve contracts with the municipalities. Under the contracts, the municipalities would pay an annual fixed readiness-to-serve charge to protect their use of water when needed. The readiness-to-serve charge will be based on the annual operation and costs for the Pathfinder Modification Project and will likely be between $5.00 and $7.50 per acre foot per year.

In February each year, the municipalities could evaluate runoff forecasts and determine how much of the water reserved for them in the account would be needed that year. The municipalities would provide written notice to the WWDC as to the amount of water needed and a check for the service charge for the water. If the municipalities do not need the water requested in February, the WWDC would allow the municipalities to turn back the water and be reimbursed for the service charges paid for the returned water. The service charge would be based on the development cost of the Pathfinder Modification Project and would likely be between $25.00 and $30.00 per acre foot per year.

If the municipality needs to use its allocation of water in the "Wyoming Account" during water rights administration, the municipality could continue to utilize its water supply. After the water rights administration is lifted, the municipality, in consultation with the State Engineer's Office, would calculate the depletions (diversions less return flow) that occurred during water rights administration and subtract the water provided by its senior water rights and groundwater. The balance, plus any conveyance loss considerations, would be deducted from the municipality's allocation in the "Wyoming Account."

While the City of Rawlins currently has sufficient senior water rights and production from the Miller Well Field to meet its current water demands in February, March, and April, the City may want to contract with the Wyoming Water Development Office for 700 acre feet per year from the "Wyoming Account" to ensure it can withstand water rights administration in the future. This will assure that Peaking or Atlantic Rim Reservoir can be filled before May 1 each year.

Table 5-1
Rawlins' Surface, Groundwater, and Storage Water Rights Summary
Page 1 of 3

Sage Creek Springs

Permit No.	Facility	Priority	Proof No.	Appropriation in CFS
16721	Spring No. 1	3/27/1923	29287	0.15
16722	Spring No. 2	3/27/1923	29284	0.20
16723	Spring No. 3	3/27/1923	29285	0.46
16724	Spring No. 4	3/27/1923	29286	0.33
16725	Spring No. 5A	3/27/1923	29288	0.04
16726	Spring No. 5B	3/27/1923	29289	0.08
16727	Spring No. 5C	3/27/1923	29290	0.14
16728	Spring No. 5D	3/27/1923	29291	0.72
16729	Spring No. 6	3/27/1923	29292	0.18
16730	Spring No. 7	3/27/1923	29293	0.40
16731	Spring No. 8	3/27/1923	26294	0.30
16732	Spring No. 9A	3/27/1923	29295	0.15
16733	Spring No. 9B	3/27/1923	29296	0.15
16734	Spring No. 9C	3/27/1923	29297	0.30
16735	Spring No. 9D	3/27/1923	29298	0.34
16736	Spring No. 9E	3/27/1923	29299	0.31
16737	Spring No. 10	3/27/1923	29276	0.12
16738	Spring No. 11	3/27/1923	29277	0.58
16739	Spring No. 12	3/27/1923	29278	0.40
16740	Spring No. 13	3/27/1923	29279	0.58
16741	Spring No. 14A	3/27/1923	29280	0.04
16742	Spring No. 14B	3/27/1923	29281	0.15
16743	Spring No. 14C	3/27/1923	29282	0.03
16744	Spring No. 15	3/27/2023		
			Total	**6.15**

Surface Water Rights

Permit No.	Source	Priority	Proof No.	Appropriation in CFS
2860	North Platte River (Union Pacific)	10/4/1900	7963	2.01
2949	Sage Creek (Mary Middlewood)	12/5/1900	7745	3.92
11509	Sage Creek (Allen N. & Celia A. McManis)	5/27/1912	15593	3.68
15403	Sage Creek (Allen N. & Celia A. McManis)	2/17/1919	16715	0.57
			Total	**10.18**

Storage Rights

Permit No.	Facility	Priority	Proof No.	Storage Right in Acre-Feet
6271	Rawlins Reservoir	1/28/1955	26435	624
7185	Peaking Reservoir	6/7/1966	29095	346.66
8016	Atlantic Rim Reservoir	7/20/1978	34025	644.5
			Total	**1615.16**

Table 5-1 Cont'd
Rawlins' Surface, Groundwater, and Storage Water Rights Summary
Page 2 of 3

Groundwater Rights

Permit No.	Source	Priority	Proof No.	Appropriation in GPM
306	City of Rawlins No. 2 Well	9/27/1954		120
726	Penetentiary Well # 2	12/10/1957		250
37510	Cemetery #1 Well	2/7/1977		
70332	Rawlins Nugget Well No. 1	5/24/1985		350
70333	Rawlins Nugget Well No. 2	5/24/1985		500
70334	Rawlins Nugget Well No. 3	5/24/1985		500
72687	Enl. Rawlins Nugget Well No. 2	5/8/1986		500
72688	Enl. Rawlins Nugget Well No. 3	5/8/1986		400
			Total	**2620**

Sage Creek Springs Enlargements for Peaking Reservoir

Permit No.	Facility	Priority	Proof No.	Appropriation in CFS
6240E	Spring No. 1	6/7/1966	29048	0.15
6241E	Spring No. 2	6/7/1966	29045	0.2
6242E	Spring No. 3	6/7/1966	29046	0.46
6243E	Spring No. 4	6/7/1966	29047	0.33
6244E	Spring No. 5A	6/7/1966	29049	0.04
6245E	Spring No. 5B	6/7/1966	29050	0.08
6246E	Spring No. 5C	6/7/1966	29051	0.14
6247E	Spring No. 5D	6/7/1966	29052	0.72
6248E	Spring No. 6	6/7/1966	29053	0.18
6263E	Spring No. 7	6/7/1966	29054	0.40
6249E	Spring No. 8	6/7/1966	29055	0.30
6250E	Spring No. 9A	6/7/1966	29056	0.15
6251E	Spring No. 9B	6/7/1966	29057	0.15
6252E	Spring No. 9C	6/7/1966	29058	0.30
6253E	Spring No. 9D	6/7/1966	29059	0.34
6254E	Spring No. 9E	6/7/1966	29060	0.31
6255E	Spring No. 10	6/7/1966	29037	0.12
6256E	Spring No. 11	6/7/1966	29038	0.58
6257E	Spring No. 12	6/7/1966	29039	0.40
6258E	Spring No. 13	6/7/1966	29040	0.58
6259E	Spring No. 14A	6/7/1966	29041	0.04
6260E	Spring No. 14B	6/7/1966	29042	0.15
6261E	Spring No. 14C	6/7/1966	29043	0.03
6262E	Spring No. 15	6/7/1966	29044	0.77
			Total*	**6.92**

Maximum Diversion to Peaking Reservoir Limited to 5.25 CFS Under Permit No. 23074D, Proof 29036

Table 5-1 Cont'd
Rawlins' Surface, Groundwater, and Storage Water Rights Summary

Sage Creek Springs Enlargements for Atlantic Rim Reservoir

Permit No.	Facility	Priority	Proof No.	Appropriation in CFS
6645E	Spring No. 1	6/7/1966	32676	0.15
6646E	Spring No. 2	6/7/1966	32672	0.2
6647E	Spring No. 3	6/7/1966	32673	0.46
6648E	Spring No. 4	6/7/1966	32674	0.33
6649E	Spring No. 5A	6/7/1966	32677	0.04
6650E	Spring No. 5B	6/7/1966	32678	0.08
6651E	Spring No. 5C	6/7/1966	32679	0.14
6652E	Spring No. 5D	6/7/1966	32680	0.72
6653E	Spring No. 6	6/7/1966	32681	0.18
6654E	Spring No. 7	6/7/1966	32682	0.40
6655E	Spring No. 8	6/7/1966	32675	0.30
6656E	Spring No. 9A	6/7/1966	32683	0.15
6657E	Spring No. 9B	6/7/1966	32684	0.15
6658E	Spring No. 9C	6/7/1966	32685	0.30
6659E	Spring No. 9D	6/7/1966	32686	0.34
6660E	Spring No. 9E	6/7/1966	32687	0.31
6661E	Spring No. 10	6/7/1966	32688	0.12
6662E	Spring No. 11	6/7/1966	32689	0.58
6663E	Spring No. 12	6/7/1966	32690	0.40
6664E	Spring No. 13	6/7/1966	32691	0.58
6665E	Spring No. 14A	6/7/1966	32692	0.04
6666E	Spring No. 14B	6/7/1966	32693	0.15
6667E	Spring No. 14C	6/7/1966	32694	0.03
6668E	Spring No. 15	7/20/1978		
			Total	**6.15**

Maximum Diversion to Atlantic Rim Reservoir Limited to 5.25 CFS Under Permit No. 6644E, Proof 34025

SECTION 6 – DISTRIBUTION

SECTION 6
Distribution

1 INTRODUCTION

After the water is treated at the Rawlins water treatment plant, it is conveyed to the City via two pipelines. The City has a low pressure zone and a high pressure zone, and there is a 12-inch pipeline that feeds the low pressure zone and a 20-inch pipeline that services the high pressure zone. Tied onto the pipeline feeding the low pressure zone, are two 7.5 million gallon reservoirs known as the Tank Farm. There are two storage tanks that service the high pressure zone. The first of these tanks is the hospital tank situated on the east side of City with a capacity of 1 million gallons and the second, the Painted Hills tank, is situated on the north side of City and has a capacity of 3 million gallons. For reasons unknown, the Painted Hills tank and hospital tank are not constructed to the same elevation even though they serve the same pressure zone.

The dividing line between the low pressure system and the high pressure system is shown on Figure 6-1 (located at the end of this section) with the high pressure zone located generally above an elevation of 6,800 feet MSL. As indicated earlier, the low pressure system in the southern part of the City is served by a single 12-inch pipeline coming from the water treatment plant, but in addition to this pipeline, there are two pressure reducing stations (PRVs) on the distribution piping that connect the high pressure zone to the low pressure zone. These PRVs allow water to flow from the high pressure zone to the low pressure zone if pressure falls below a set point in the low pressure system. The PRVs are located at the intersection of 9th Street and Date Street and east of Highway 287 across from the entrance into the Painted Hills Subdivision. In addition to these two pressure reducing stations, the two zones are connected at twelve (12) other locations and are isolated from each other through the use of closed valves. Three of these connections are equipped with ¾-inch copper bypass lines that keep water from stagnating in the lines.

The distribution system consists of pipelines ranging in size from 4-inch to 20-inch with a few smaller diameter lines servicing specific areas ranging in size from 1¼- to 2-inch. During the course of this study, the leaks that were experienced over the past two years were plotted and these locations are shown on Plates 7 and 8 in Appendix A. There were 10 areas where the number of breaks appeared to be anomalously high. Most of these correspond to areas with low resistivity soils identified in a study conducted by the Ductile Iron Pipe Research Association (Ductile Iron Pipe Research Association, 2008).

Another requirement of this study was to determine the quantity and locations of permitted septic systems within the distribution area. The WDEQ office has record of 7 septic systems within the project area. These are shown on Plate 2 in Appendix A.

2 DISTRIBUTION SYSTEM MODELING

The water system was modeled by Olsson Associates using the H2ONet modeling program. The computer modeling showed the operational capacity of the distribution system to be in fairly good shape. Figures 6-2 through 6-5, located at the end of this section, show the head loss in the pipes at different times during peak day demand conditions. A few deficiencies were identified. There is quite a bit of head loss in the pipeline running in the alley between State Street and Hugas Street on the south side of the City. This line is shown in blue. Similarly, a second pipeline between Inverness Boulevard and Mctavish Court, on the northeast side of City, also shown in blue, indicates there is 5 to 10 feet of head loss in this pipeline. The transmission pipeline feeding the low pressure zone is shown as having high head loss (greater than 10 feet), however this pipeline is quite long and this amount of head loss is quite reasonable.

It was noted when looking at the diurnal cycle in the development of the model that the tank levels at the Tank Farm varied very little during the course of the day. Part of this is due to the fact that the tanks float on the system and if sufficient water is coming from the water treatment plant there is no need to take water from storage. Also, the tanks run in parallel so that water is added and removed from each tank simultaneously. The piping to the tanks needs to be modified so that they can operate in series or independently from each other so that the water goes through one tank and then into the second tank. This will maintain a turnover in the tanks, and will keep the water much fresher and help avoid water quality issues in the future. The connection piping between the tanks will need to have an isolation valve so that the tanks can be operated independently to allow one tank to be taken off-line for repair and/or servicing while maintaining the other tank in service. It is envisioned that the pipe modification work at the tanks can be done when the tanks are taken off-line for repainting. The cost of making the piping changes is very small and does not warrant development of project or project budget.

The distribution system modeling also showed the need for a third pressure reducing station to allow the flow of water from the high pressure zone to the low pressure zone at Spruce and Pine Streets. This will also require the construction of about 725 feet of 12-inch pipeline. This will essentially connect the 12-inch pipeline on Gallup Street to the 10-inch pipeline on W. Pine Street (see Figure 6-7).

3 DEFICIENCIES

As indicated earlier, there were relatively few deficiencies detected in the modeling effort. There are a couple of items that the City planned to do in the near future that required significant expenditures. So that these items remain fresh in the City planning and are taken into account in the economic analysis, they are included as deficiencies in the distribution system.

3.1 Tank Farm Painting

The City had their tanks inspected a few years ago and the hospital and Painted Hills tanks have recently been painted. The City plans to re-paint the Tank Farm tanks in the near future. Costs were obtained from contractors for performing this work and the resultant cost estimate is shown on Table 6-1. While the tanks are being painted, a flanged fitting can be installed above ground on each tank to connect the two tanks together in series. With the addition of minimal piping, water can flow into one tank, flow to the next tank and then back into the transmission pipeline. The estimated project cost is $2,059,401 and is summarized in Table 6-1.

Table 6-1
Cost Estimate to Paint Tank at the Tank Farm

	Design Engineering	$ 150,066.00
	Permitting	$ 6,000.00
	Legal	$ 5,000.00
Subtotal		$ 161,066.00

Construction Cost Estimate (Per Tank)

No.	Description	Unit	Quantity	Unit Cost	Cost
1	Exterior	SF	53,500	$ 2.70	$ 144,450.00
2	Top Interior incl. Framing (1.22X Area)	SF	38,400	$ 6.60	$ 253,440.00
3	Floor	SF	31,400	$ 6.60	$ 207,240.00
4	Walls	SF	22,000	$ 6.60	$ 145,200.00
		Subtotal		Cost Per Tank	$ 750,330.00
				Cost for Two Tanks	$ 1,500,660.00

Total Project Cost

Construction Cost Subtotal		$ 1,500,660.00
Construction Engineering @ 10% of Construction Cost		$ 150,066.00
	Subtotal	$ 1,650,726.00
15% Contingency		$ 247,608.90
	Subtotal	$ 1,898,334.90
	Total Project Cost	**$ 2,059,400.90**

3.2 Northeast Rawlins Looping Line

Although the modeling did not show a great deal of problems in the northeast section of Rawlins, the area east of the U.S. 287 bypass is basically served by a single pipeline. Since it is anticipated that much of the future residential development along with new schools will be built in this area, there was concern about potential problems with quantity and quality should this pipeline fail. Therefore, the City wants to install a second pipeline shown on Figure 6-6 to loop the area being served. The pipeline runs from Harsman Street to the U.S. 287 bypass and ties into the 8-inch pipeline on Inverness Boulevard. Plans are being developed for a subdivision east of the Recreation Center between Harshman Street and Higley Boulevard. Should this development occur, much of the cost of this project will be paid by the developer. However, for purposes of this report, we have included the entire cost of the project. The estimated project cost is $340,621 and is summarized in Table 6-2.

Table 6-2
Cost Estimate to Construct Second Looping Line to North East Rawlins Residents and Schools

	Design Engineering	$ 26,136.00
	Permitting	$ 5,000.00
	Legal	$ 5,000.00
Subtotal		$ 36,136.00

Construction Cost Estimate

No.	Description	Unit	Quantity	Unit cost	Cost
1	Mobilization	LS	1	$ 19,360.00	$ 19,360.00
2	12-inch Diameter Pipeline in Streets (incl. fittings)	LF	800	$ 115.00	$ 92,000.00
3	Highway Bore Under U.S. 287 Bypass	LF	200	$ 400.00	$ 80,000.00
4	12-Diameter Pipeline in Open Ground (incl. fittings)	LF	1000	$ 70.00	$ 70,000.00
	Total Construction Cost				$261,360.00

Total Project Cost

Construction Cost Subtotal		$261,360.00
Engineering (10% of Construction Cost)		$ 26,136.00
	Subtotal	$287,496.00
Contingency (15%)		$ 43,124.40
	Subtotal	$330,620.40
	Total	**$366,756.40**

3.3 New PRV Station at Spruce Street and Pine Street

As indicated earlier, the modeling revealed that the low pressure issues in the low pressure zone on the east side of City could be alleviated with a pressure reducing station near the intersection of Spruce St. and Pine St. This will involve constructing about 725 feet of 12-inch pipeline to take water from the 12-inch pipeline on Gallup Street to the 10-inch pipeline on W. Pine Street. It was no known if it would be necessary to try to bore Spruce Street. However, there is enough money in the cost of the PRV station accommodate this if necessary. The PRV station and associated piping are shown on Figure 6-7. The estimated project cost is $386,205 and is summarized in Table 6-3.

Table 6-3

Cost to Install PRV Station and 12-inch Pipeline

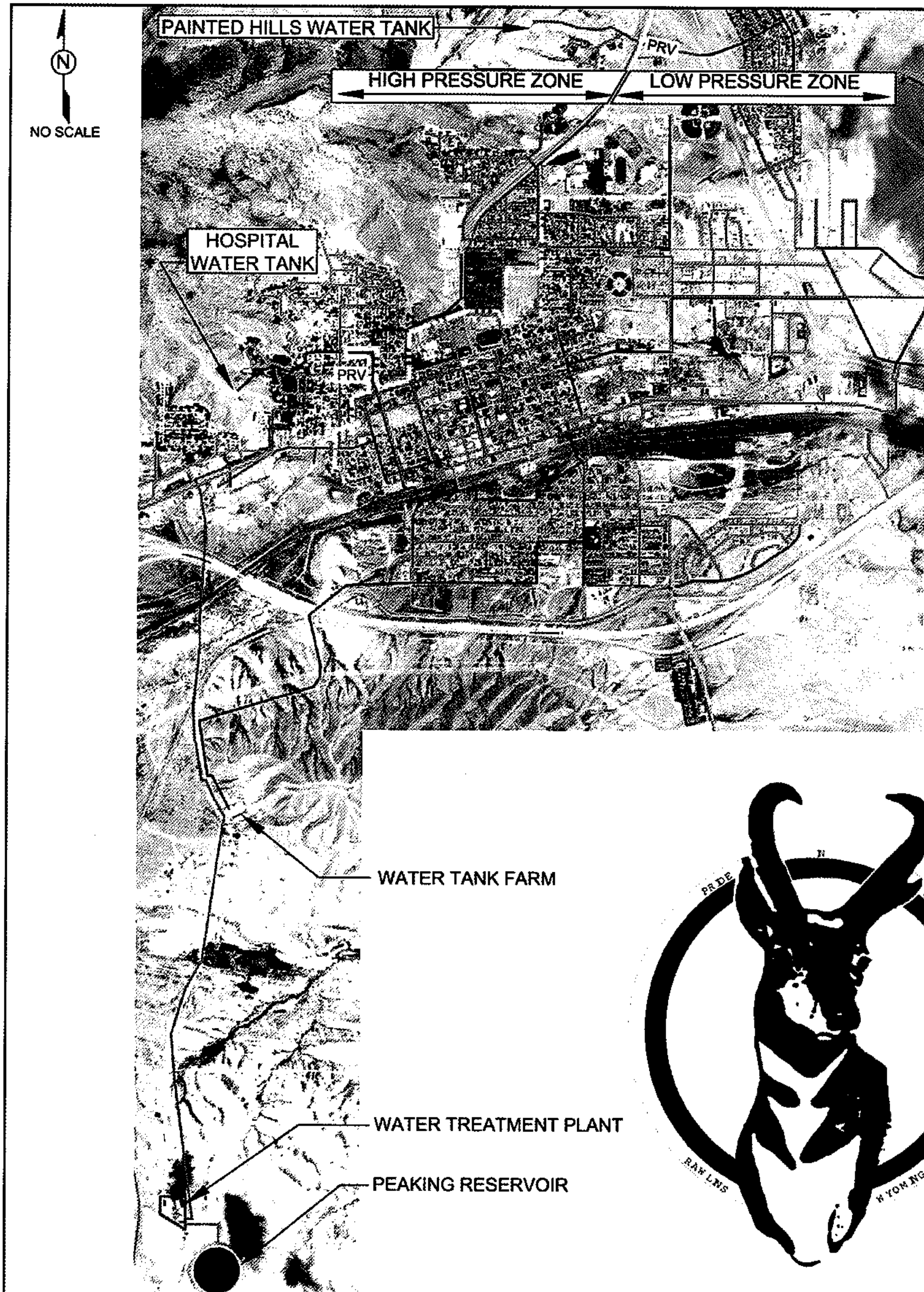
Design Engineering	$	27,194.50
Permitting	$	5,000.00
Legal	$	10,000.00
Subtotal	$	42,194.50

Construction Cost Estimate

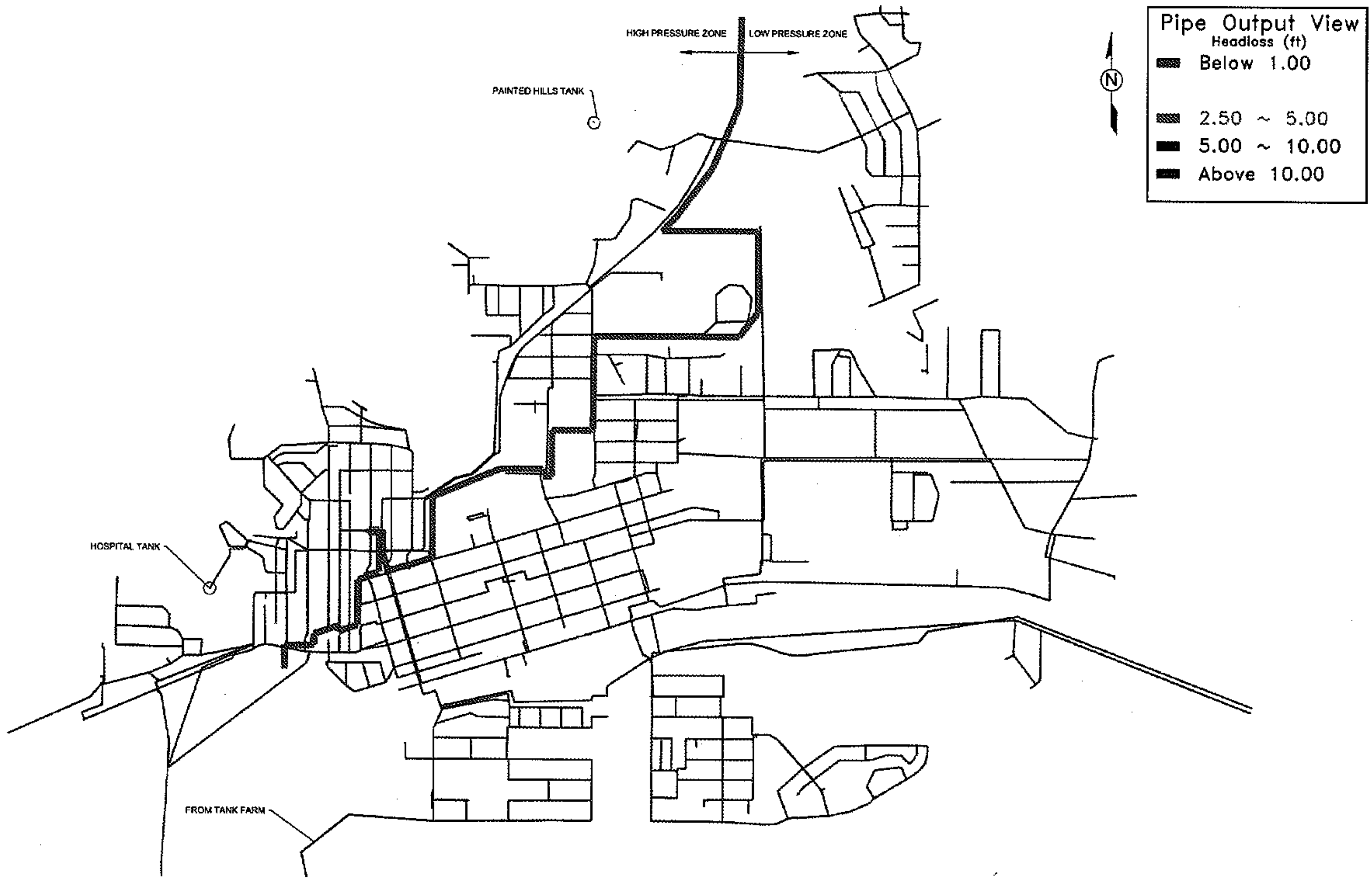
No.	Description	Unit	Quantity	Unit Cost	Cost
1	Mob/Demob Bonds & Insurance	LS	1	$ 8,070.00	$ 8,070.00
2	12-Inch Pipeline	LF	725	$ 60.00	$ 43,500.00
3	12-Inch Valves w/Valve Boxes	EA	4	$ 2,500.00	$ 10,000.00
4	12-inch x 12-inch Tapping Sleeve	EA	1	$ 6,000.00	$ 6,000.00
5	12-inch x 10-inch Tapping Sleeve	EA	1	$ 6,000.00	$ 6,000.00
6	Right of Way	LS	1	$ 10,000.00	$ 10,000.00
7	Asphalt Repair	SY	725	$ 35.00	$ 25,375.00
8	PRV and Vault	LS	1	$ 163,000.00	$ 163,000.00
		Subtotal			$ 271,945.00

Total Project cost

Construction Cost Subtotal	$ 271,945.00
Construction Engineering (10% Construction Cost)	$ 27,194.50
Subtotal	$ 299,139.50
15% Contingency	$ 44,870.93
Subtotal	$ 344,010.43
Total	**$ 386,204.93**



DATE: MAY, 2010	Wester Wetstein & Associates Consultants in Engineering and Hydrogeology 605 Plaza Court P.O. Box 2202 Laramie, WY 82073 (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE
JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	6-1
SCALE: AS SHOWN		HIGH/LOW PRESSURE BOUNDARY PLAN	



REVISION	DATE	BY	DESCRIPTION

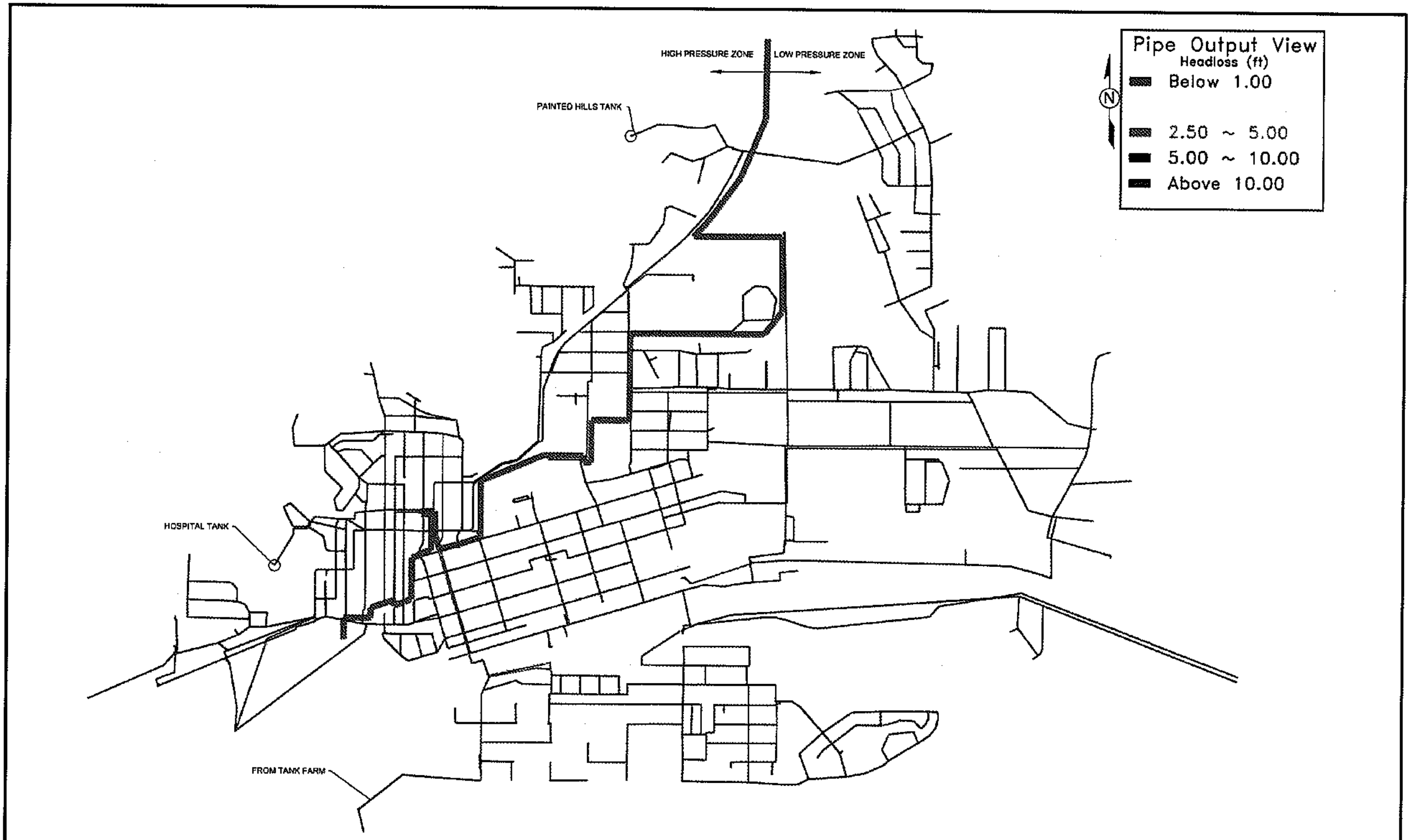
WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED: RJW	DATE: MAY, 2010
DRAWN: DKM	JOB NO.: 7.009
CK'D: LKW	SCALE: NONE

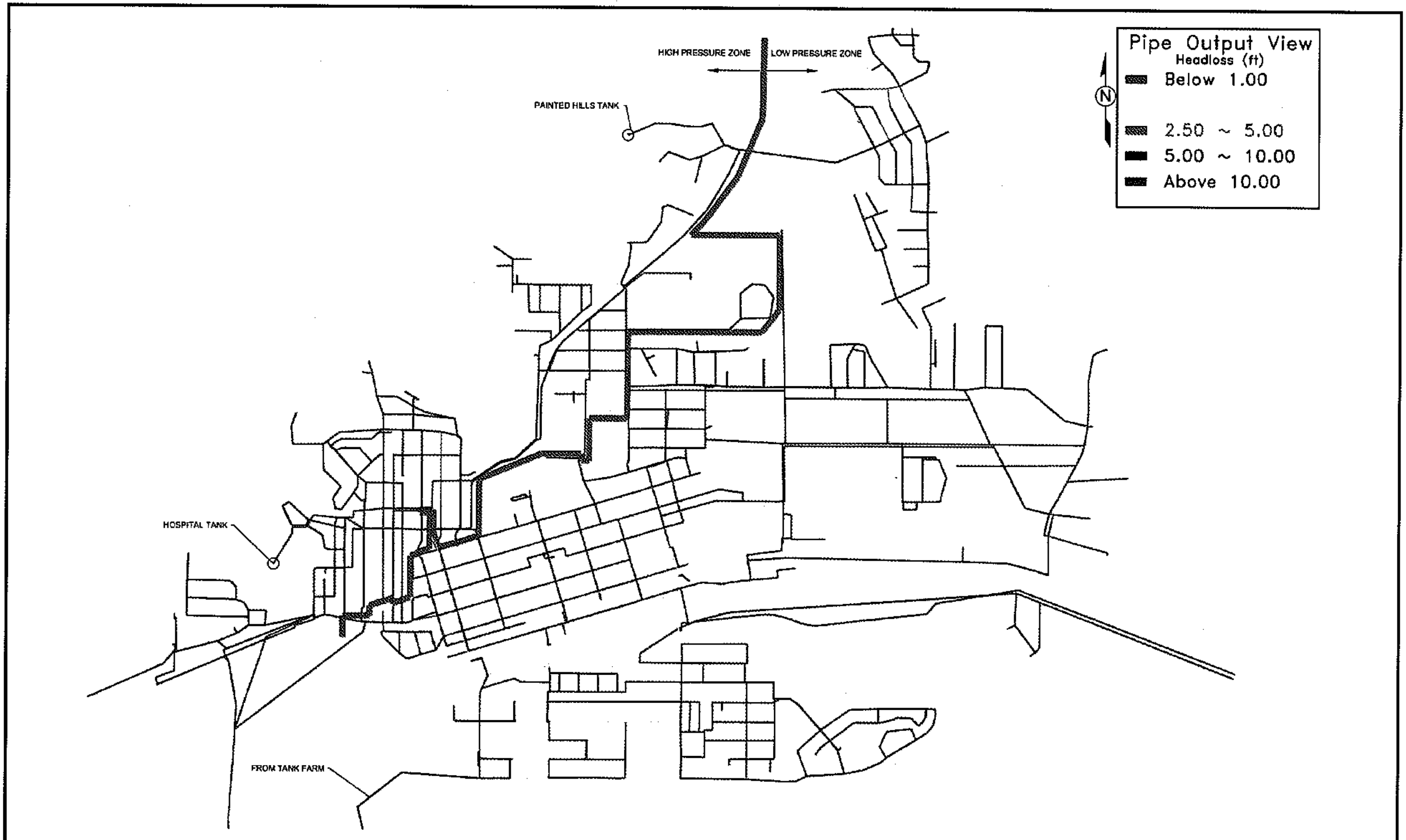
Wester Wetstein & Associates — Consultants in Engineering and Hydrogeology

CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
WATER SYSTEM MODELING RESULTS - 12 A.M.

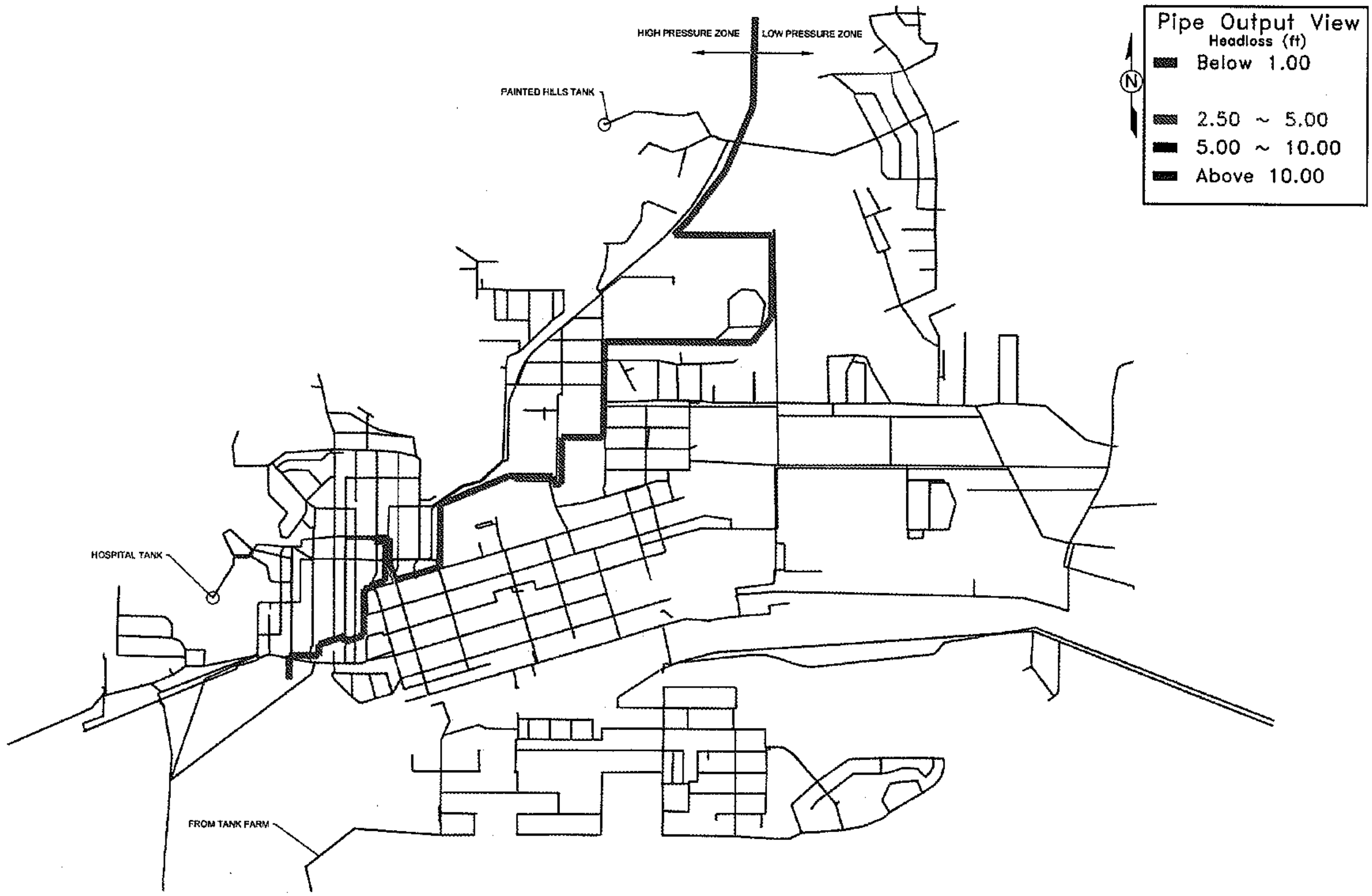
FIGURE 6-2



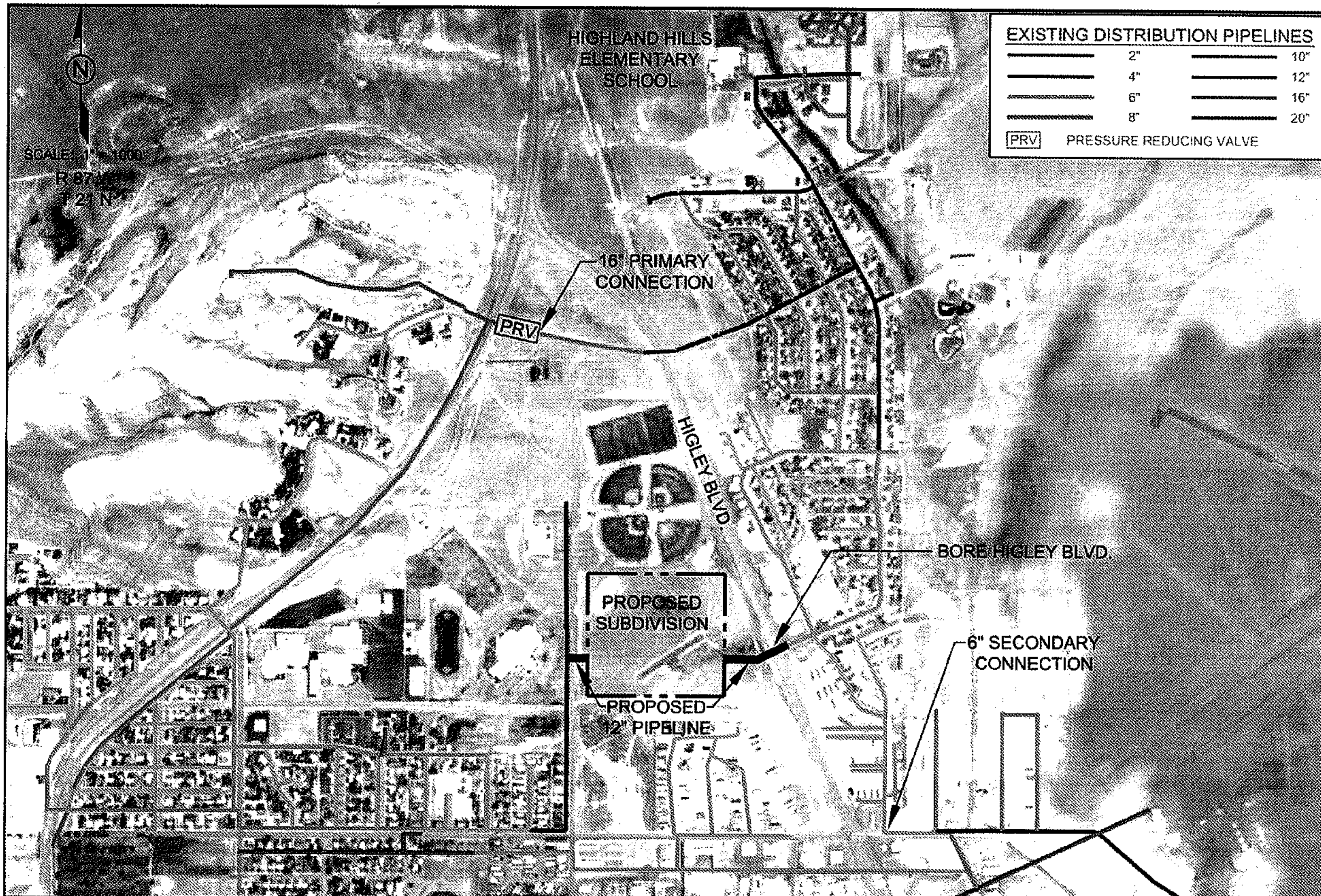
REVISION	DATE	BY	DESCRIPTION	WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED: RJW	DATE: MAY, 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology	CITY OF RAWLINS, WYOMING	FIGURE
					DRAWN: DKM	JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	
					CK'D: LKW	SCALE: NONE		WATER SYSTEM MODELING RESULTS - 7 A.M.	6-3



REVISION	DATE	BY	DESCRIPTION	WARNING 0 1/2 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED: RJW	DATE: MAY, 2010	Wester Wetstein & Associates Consultants in Engineering and Hydrogeology	CITY OF RAWLINS, WYOMING	FIGURE
					DRAWN: DKM	JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	6-4
					CK'D: LKW	SCALE: NONE		WATER SYSTEM MODELING RESULTS - 5 P.M.	



REVISION	DATE	BY	DESCRIPTION	WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED: RJW	DATE: MAY, 2010	Wester Wetstein & Associates Consultants in Engineering and Hydrogeology	CITY OF RAWLINS, WYOMING	FIGURE
					DRAWN: DKM	JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	6-5
					CK'D: LKW	SCALE: NONE		WATER SYSTEM MODELING RESULTS - 7 P.M.	



DATE: MAY, 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology 605 Plaza Court P.O. Box 2202 Laramie, WY 82073 (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE 6-6
JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	
SCALE: AS SHOWN		PROPOSED SUPPLEMENTARY CONNECTION TO N.E. RAWLINS	

DATE: MAY, 2010	Wester Wetstein & Associates, Consultants in Engineering and Hydrogeology, 605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-9220	CITY OF RAWLINS, WYOMING	FIGURE 6-7
JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	
SCALE: AS SHOWN		PROPOSED 12" WATER MAIN	

SECTION 7 – WATER TREATMENT

SECTION 7

Water Treatment

1 INTRODUCTION

In accordance with Task 2 of the project, Olsson Associates completed a cursory review of the existing water supply system. There were very few written records associated with the City's water treatment facility planning and design activities. Olsson's review consisted primarily of face-to-face and telephone interviews of the current water treatment staff, as well as equipment suppliers/manufacturers.

The City of Rawlins water treatment plant was constructed in 1984. The initial construction included three diatomaceous earth (DE) filter vessels, each of which has a maximum production capacity of approximately 1,400 gallons per minute. A fourth diatomaceous earth filter vessel was added to the facility in 1996, giving the facility a firm production capacity of 8 million gallons per day (MGD). DE filtration is an effective direct treatment technology for removal of relatively low levels of turbidity.

Due to concerns for organic constituents in some of the City's raw water sources (i.e. the Rawlins Reservoir and the North Platte River), the City conducted a pilot of the Actiflo process in 1999. The Actiflo process is a compact, conventional-type water clarification system used in drinking water and wastewater applications. It uses micro-sand as a seed for floc formation. The micro-sand provides surface area that enhances flocculation and acts as a ballast or weight. The resulting sand ballasted floc allows for clarifier designs with high overflow rates and short retention times. In drinking water applications, the Actiflo process is appropriate for use in any application that would benefit from physical-chemical treatment including coagulation, flocculation and settling. The process has demonstrated efficient removal/reduction of turbidity, color, total organic carbon, algae and other typical water contaminants. The pilot program demonstrated an ability to handle the water contaminants of concern.

Following completion of the pilot program, improvements to the facility were constructed in 2003. In addition to the Actiflo process, a powdered activated carbon (PAC) system was incorporated into the design. The PAC technology has a successful history of removing taste and odor from public drinking water supplies. For the City of Rawlins, the PAC was stored in dry form in a small silo in the water treatment plant addition. The material feed was controlled by a gravimetric feeder to meter the PAC into a water solution educator that created a PAC slurry to the point of application. A serpentine basin with submerged diffused air headers was designed to keep the PAC mixed and in contact with the source water.

2 TREATMENT ISSUES

Upon construction of the Actiflo and PAC improvements, the diatomaceous earth filters experienced considerable plugging of the diatomaceous earth supported on the septum of the filter element. The plugging, caused primarily by polymer carryover from the Actiflo process, increased the frequency of cleaning each unit. The DE also experienced plugging from the powdered activated carbon, but not as severely as the polymer. Due to the issues associated with the plugging of the DE filters, as well as the high costs to operate the pretreatment facilities, the City discontinued the use of the Actiflo and PAC technologies in 2004.

3 RECOMMENDATIONS

The DE filters continue to produce exceptional water, but the City is still concerned about organic constituents in light of regulatory changes to the Surface Water Treatment Rule. As the City's water sources become challenged in light of regulatory changes, as well as the anticipated increase in water demand resulting from growth, the City must be prepared to address its future water treatment needs. A variety of technologies are available to the City, but capital costs for the implementation of any technology can be expensive for a city like Rawlins. The building that once housed the PAC and Actiflo processes is currently unused. The City could reevaluate the Actiflo unit's benefits and investigate an alternate means of PAC addition. Consideration of multiple feed points for the PAC slurry, based upon pH of the incoming water, may benefit overall performance and adsorption.

The City could also evaluate conversion of the PAC/Actiflo structural units to a membrane process, or a more conventional filtration including coagulation, flocculation and sedimentation. Hollow fiber or flat sheet membranes are becoming common to the water treatment industry. Membrane systems can be applied in a number of ways as a stand-alone option or in conjunction with other conventional and new technologies as part of an integrated treatment train.

The water treatment plant in its current operation would benefit from a good form of mechanical screening of the water prior to treatment in the DE filters to remove the daphnia and other living organisms from the water prior to entering the plant. A 16-inch duplex-type strainer with quick opening cover, stainless steel basket and mesh liners would protect the diatomaceous earth filter vessels.

SECTION 8 – ECONOMIC ANALYSIS AND WATER SYSTEM FINANCING

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

SECTION 8

Economic Analysis and Water System Financing

1 INTRODUCTION

This chapter reviews the City of Rawlins' finances as they pertain to their water system. Financial data was examined in order to determine the status of the existing finances. The examination revealed that for fiscal year 2008-09 there was a budget forecast shortfall of $239,743.00 between revenues and expenses (revenues of $1,692,650 and expenses of $1,932,393). Actual revenues and expenses turned out to yield a $178,082.23 surplus (revenues of $1,698,811.68 and expenses of $1,522,729.31). The practice of understating revenues and overstating expenses when assembling the water department budget appears to have occurred for many years and is ongoing. This is not a recommended practice.

As requested in the Scope of Services, recommendations for water rates adjustments and financing structures are made for two different scenarios at the end of this chapter. The first scenario involves developing a revenue structure that would allow the system to become completely self-supporting without the benefit of current assistance programs. The second scenario assumes implementing the recommended improvements with assistance from existing funding agencies and their programs.

2 ANALYSIS OF REVENUES vs. EXPENSES

In 2008, Rawlins made significant modifications to their water enterprise accounting practices. These changes cleared up previous ambiguities in cost accounting for the water department. While these changes bring the cost accounting into better compliance with generally accepted accounting practices, it makes drawing comparisons between the department's prior years and present performance impossible.

The City of Rawlins has just completed one full fiscal year using its newly configured revenue and expenses accounts. Budget line items that previously made water-related finances difficult to track have been changed. As mentioned above and based strictly on the budgeted numbers, revenues generated by the water enterprise were not forecast to cover all the expenses. Revenue from all sources is budgeted at $1,865,100.00 for FY 2009-10. The budgeted expenses totaled from both the treatment plant and the utilities division amount to $2,149,557.00. That amounts to a budget shortfall of $284,457.00. As noted above, a similar forecast of revenue shortfall was shown in the 2008-09 budget when in fact a surplus resulted.

As of June 30, 2009 the city had $1,840,694.61 surplus balance in its water enterprise account. Of this $454,811.98 was in the WWDC reserve fund and $255,584.47 was in the water department's Wyostar account. To force the budget to balance it is the practice to simply show a "Beginning Fund Balance" of whatever amount is needed to make the budget balance. This is not a recommended practice.

As occurred in the FY 2008-09 budget, the actual FY 2009-10 revenues and expenses are likely to be more closely matched than the budgeted numbers. A conservative budgeting practice is to over-estimate expenses and under-estimate the revenues. If the budget can be made to work in that scenario, then any decreases in expenses or increases in revenues will accrue to the benefit of the department and its budget. This technique will make the budget easier to meet, but it also makes it significantly less valuable as a financial management tool.

Direct comparisons cannot be drawn from prior years because of the change in accounting practices made in 2008. A general review of a seven-year history of the revenues and expenses was put together by the City Finance Department, beginning with FY 2001-02. During that period, modest increases in revenues were noted. FY 2007-08 revenues were 36% higher than the revenues generated in FY 2001-02. Conversely, the expenses showed a 31% decline. However, most of the decline is related to changes in the amounts transferred out of the Water Fund into other accounts. The City has a significant, but undefined operating and maintenance balance in its water enterprise account. Additionally it has a capital project sinking fund of $454,812 in its WWDC Reserve capital projects account.

3 WATER FUND EXPENSES

3.1 Background

Until recently, it was difficult to get an accurate picture of the City of Rawlins's water-related revenues and expenses. Even though the City has established separate enterprise funds to facilitate the accounting for their revenue-generating departments, until FY 2008-09 there was still a mingling of expenses from the sewer operations together with those of the water department. The City's Finance Director had already noted the problems with tracking the Water Fund's expenses and revenues. For the fiscal year 2008-09 the accounting organization was changed. The sewer operation expenses previously commingled with the water expenses were entirely removed from the water fund.

3.2 Existing Water-Related Debt

The City of Rawlins has $4,047,750 in debt from earlier water projects. Table 8-1 below itemizes the water-related loans that Rawlins currently has outstanding. One of these debts, the Spruce Street Water Line, was just recently entered into the payback period requiring an annual payment of nearly $46,000.00. Because of this added debt service, Rawlins raised water fees beginning April 1, 2009. The annual water revenues must be adequate to cover the system's annual loan payments amounting totaling $250,681.29 as well as operation and maintenance expenses.

Table 8-1
Water Related Project Loans Summary

Improvement Project	Loan Balance	Annual Loan Payment	Interest Rate	Lender
Sage Creek Water Line	$2,482,560.30	$150,278.84	4.00%	WWDC
Water Storage Tanks	$851,070.00	$54,593.70	2.50%	DWSRF
Spruce Street Water Line	$714,120.00	$45,808.75	2.50%	DWSRF
Totals	$4,047,750.30	$250,681.29		

For FY 2009-10, the City has budgeted for an accelerated repayment of the two DWSRF loans for the Water Storage Tanks and the Spruce Street Water Line. At present these loans are budgeted to be paid down at 1.5 times the required amount resulting in shortening the payment period. The repayment terms for both of those loans are 20 years at 2.5% interest. The third loan, which is a WWDC loan and not budgeted for accelerated payment, is at 4% for 48 years. This loan is currently in year 19 of the payback period. The loan will cost the City more than $3.8 million dollars in interest before it is paid off. Because it has a higher interest rate, it would be financially more advantageous for the city to pay down the WWDC loan at an accelerated rate rather than to accelerate paying down the lower DWSRF loans.

3.3 Employee Expenses

Employee expenses amount to approximately 25% of the Water Fund total expenses. Personnel expenses are a significant expense for any enterprise, but Rawlins is doing a good job of keeping those expenses level with other costs. The recent changes in the departmental accounting have brought improvements in how the personnel expenses are distributed between the water and the sewer departments. Because of the FY 2008-09 changes in accounting, a direct comparison of personnel expenses before and after the accounting method change is not possible. However, for the seven years prior to those changes, personnel expenses had shown only modest increases. Expenditures on employee benefits increased at a higher rate than did other personnel-related expenses. Again, only general comparisons could be drawn because of the accounting practices change.

3.4 Other Operating & Maintenance Expenses

The water enterprise fund is divided into two separate sections for the City's budgeting, the Water Treatment Plant and Utilities. The Water Treatment Plant department operates and maintains the plant facility itself and all the system pump stations. The Water Utilities section is responsible for operating and maintaining the piping network, the storage tanks, and the residential meters. Maintenance materials for repairs are included. Major replacement or new installation projects are accounted for on a capital project basis.

Until FY 2008-09, the Utilities had also included some of the sewer expenses. An attempt to offset those expenses was made by transferring some of the sewer revenues to the water department. Beginning in FY 2008-09, the divisions were made more distinct by entirely removing the sewer-related expenses and revenues from the Water Fund. The budgeted expenses are now clearly attributable only to the water enterprise.

3.5 Administrative and Overhead Expenses

The City Finance Director has devised a formula by which an equitable portion of the city's total administrative expenses is allocated to the water, sewer and landfill enterprise funds. Approximately 22.5% of the city's total administrative costs are allocated to these enterprise funds. The city's water fund pays 41.5% of that portion. This is only 9.3 % of the city's total administrative costs.

Also the water enterprise pays its share for its use of the City's Central Shop. The central shop maintains all city-owned vehicles and rolling stock. The three enterprise funds, water, sewer and landfill, together pay for 36.3% of the total cost of City Shop. A formula has been devised that equitably allocates that cost between the three enterprise funds. The Water Fund pays for 16.5% of the total City Shop budget, leaving 19.8% to be shared between sewer and landfill.

3.6 Emergency Fund

In order to be considered self-sufficient, Wyoming Water Development recommends that an emergency water fund be established in an amount ranging from 1.5% to 2.5% of the annual operating expenses. With annual operating expenses budgeted to be approximately $2.15 million, the emergency fund should be established somewhere between $32,000.00 and $54,000.00.

Rawlins' budgeting exceeds the suggested emergency fund amount by maintaining a Contingency Fund line item within the Water Fund budget. This fund is set at $100,000.00 every year, well over the minimum recommended amount. It has not been used in recent years, thus allowing the money to be rolled over from year to year without any further contributions.

3.7 Sinking Fund

Rawlins is also accumulating another fund which they call the WWDC Reserve Fund. This fund was required under terms of previous WWDC project funding agreements. Contributions of $50,000.00 are being made to this fund annually in order to accrue a total of $1,250,000.00. As of June 30, 2009 this fund held $454,800.00. This obsolescence replacement fund was mandated with the WWDC-financed Sage Creek Pipeline project so Rawlins will be able to replace that facility at the end of its design life. This is Rawlins' only sinking fund in its water enterprise. It will be extremely challenging for the City to accumulate an adequate replacement sinking fund for the balance of its water system by the time it will likely need to replace major facilities when that becomes necessary. Outside financial assistance will be required.

4 REVENUES

4.1 User Types

The City of Rawlins currently categorizes their 3950 water customers into twelve types. Those types are: church, city government, commercial, construction water, corrals, multi-family, out-of-town, rental property, residential, sprinkler, trailer courts, and the Town of Sinclair.

The user classifications can be a useful tool for the City. The user classifications could possibly become more useful under a new rate structure. Characteristics of use are different among the different user types and they will respond differently to tiered rates if Rawlins were to implement them in the future.

4.2 Existing Rate Structure

Even though the City classifies users into twelve categories, the basic rate structure is simple. The city has two components to its water charge. The first is an availability fee which is flat rate of $14.00 per month. The second is a $2.00 per thousand "commodity charge" for water used. The availability fee is designated for debt retirement. The $2.00 per thousand gallons consumption charge is designated to cover all operation, maintenance, and other costs. The city collects no specific fees designated for obsolescence replacement.

The same flat monthly fee is charged to all water customers, with two exceptions. Users "Outside Corporate Limits" pay $2.70 per thousand gallons. Construction water users in town pay $5.00 per thousand and out of town pan $10.00 per thousand. The Town of Sinclair, which is a consecutive public system, is not required to pay the standard base $14.00 per month. Based on a negotiated agreement between the two towns, Sinclair is billed at 62.5% of the standard rate, or $1.25 per thousand gallons, for water consumption.

The other exception to the standard rate structure is the Glenn Addition, otherwise known as the "corrals." This city-owned area on the south side of Rawlins provides an area for people to keep horses in town. Corral pens are not metered. Each account is simply charged a flat monthly rate of $10.00. One master meter measures the total water usage to the corrals so the City can account for the amount of water used.

As of December 2009 the city does not have a tiered rate for the commodity portion of its water use fees.

In April 2009, Rawlins raised their base water rate to $14.00, which previously was $10.00 per month. This was done in anticipation of the need to begin making payments on their WWDC loan for the Sage Creek Project. With just under 4,000 accounts, not including City-owned accounts, the base fee now raises approximately $190,000 per year of additional revenues over the previous rate.

Rawlins water tap fees are similar to other Wyoming communities of its size. The tap fee for a standard ¾" residential service is $1,000. A 2" tap is $7,000. Unless Rawlins adopts a different philosophy about how it chooses to fund the water system there is no reason to adjust tap fees at present.

Communities can adopt a philosophy that system improvements made necessary due to increasing demands should be paid by those who are moving to the community creating the additional demand. The cost of those improvements is then recovered through tap fees. This results in water rates that are commensurate with the inflation rate over the long-term but makes tap fees rise manifold.

5 WATER ACCOUNTING

5.1 Water Measurement

Water accounting is similar to financial accounting in that it simply means tracking amounts of water as it moves through the collection, treatment, and sale cycle. Considerably less precision can be achieved with water than with money due to the variability of measurement methods and naturally occurring losses such as evaporation and leakage. Still it is a valuable tool for good water management. There are three points at which the City of Rawlins measures its water. Water accounting refers to tracking the water and comparing the amounts at each of the three stages.

Accuracy of Rawlins' water use measurements depends on readings from 4,000 residential meters. Because of this, water accounting is unlikely to balance exactly. Meters require periodic calibration and are subject to mechanical failure. In addition, there are several known water uses that are not metered including firefighting, system flushing, and system leaks, which can range from sudden, catastrophic failures with accompanying large releases of water to chronic small seeps. Systematic water accounting can help water managers become aware of and, consequently, locate chronic leak conditions and water losses within the system. Rawlins currently takes customary measures to identify and remedy most correctable system losses.

5.2 Finished Water Losses

During the most recent year for which we have data there was an inordinately high percentage of water lost from the system. According to metering information, the City's treatment facility produced over 805 million gallons of potable water during FY2008. However, during that same period point-of-use meter readings totaled only 552 million gallons billed to customers. This means that 253 million gallons, 31% of the potable water produced at the Rawlins treatment plant, was lost as non-revenue water.

Part of the disparity can be explained by incidents for which the losses are known or can be estimated. City irrigation during the summer of 2007 totaled 75,260,500 gallons according to readings kept by the water department. Other known water losses included repairs to a 6-million gallon storage tank that required draining the tank on two occasions. The sum of the estimable water losses is approximately 103 million gallons, but that still leaves unaccounted over 18% (150 million gallons) of the water production. If the 150 million gallons were revenue-generating water it would give the City an additional $210,000.

Other known water losses in 2007-2008 for which there is no reliable estimate of the quantity include over 40 leaks repaired along water mains during the year. One of those leaks occurred in a section of pipe that could not be valved off. In that situation two fire hydrants were opened for over 27 hours to relieve the water flow, releasing a large, but unmeasured, amount of water. In addition, there were the ordinary maintenance items such as system flushing and exercising of fire hydrants.

There is no practical way to fully account for all non-revenue water. Still, losses exceeding 10% in a municipal system are considered excessive. Rawlins needs to tighten its water accounting.

5.3 Raw Water Losses

Raw water losses from the system become evident by examining the raw water collected/produced as compared to finished water production at the treatment plant. The raw water quantity drawn from each of Rawlins' sources is measured. Raw water is used to irrigate the Rochelle Ranch Golf Course. The rest is used to fill Atlantic Rim Reservoir and Peaking Reservoir. Total raw water produced from all of Rawlins' sources is measured. When the water stored in the reservoirs is later withdrawn for treatment, those withdrawals are also not measured. Consequently, the City is left only with the ability to compare the total raw water produced against the total water treated at the plant. Data kept since 2003 indicates that only approximately 80% of the raw water collected annually makes it into the system as finished water. Part of that raw water goes to irrigate the golf course. In 2009, 33,846,000 gallons were used to irrigate the golf course.

Regardless, data indicates that there is significant water loss from reservoir leakage, evaporation, and perhaps other unidentified losses.

It has been known for some time that Atlantic Rim Reservoir leaks. The rate of leakage from that reservoir has been estimated at 216,000 gallons per day (WWC, 2008), or nearly 80 million gallons a year. That number represents approximately 8% of the total raw water Rawlins collects/produces from all of its sources.

Surface evaporation from the storage reservoirs and golf course irrigation are the other obvious raw water losses. Evaporation from water surfaces is commonly estimated at approximately 3 feet per year for Wyoming. Atlantic Rim Reservoir and Peaking Reservoir are approximately 45 acres, which would mean they lose 135 acre-feet of water per year, or 44 million gallons.

6 RECOMMENDATIONS

6.1 Water Accounting

The City of Rawlins needs to tighten up its water use accounting. As stated earlier system losses over 10% are considered excessive. Rawlins has a 31% loss. The first and most basic recommendation is for the City to install and regularly record reading meters on any point of use that is not currently metered.

Rawlins needs to regularly record all meter readings and centralize the storage of that data. Internal accounting of the City's own water use is strongly recommended. This means that meter readings should be taken and recorded for all of the water used by the City's various taps just like all of the other water users in the city. This not only provides a complete record of all water use, but also encourages better water management by the City. The parks and cemetery are among the largest irrigation users in Rawlins. Currently, meter readings are taken sporadically, usually at the end of the irrigation season, and not on the regular monthly schedule with the rest of the meter readings. Those readings have not traditionally been kept with the city-wide records of water use, but are instead kept by the water department. Compilation of actual water use data requires that City personnel and outside staff know of the existence of these other readings. Keeping all data in a centralized location is preferable for anyone wanting a full accounting of Rawlins' water use.

A complete accounting for the water use also requires internal or inter-departmental billing for the water used. Inter-departmental costs are already being distributed in other areas of City expense, such as the City Shop expense and City administration costs. Just as the water department is charged for their use of the City Shop and also for a share of the City's administration expenses, the other departments should be charged for their water use. The cost of producing water, potable or raw, is a real expense and should be accounted for. Doing so will bring City personnel to realize their own department's water use and the associated cost that is spread among all the other users. Recognition of the cost of water is one of the main driving forces behind water conservation and better water management.

There are at least two services where a single master meter is used to record use by several users instead of individual service meters. One of these locations where a single master meter measures the water use for the entire area is the Glenn Addition corrals. Each user is charged a flat monthly fee for water. Master metering is adequate for water accounting purposes only. While this method does provide an accounting for all the water used, it does nothing to encourage water conservation, nor does it provide a fair and equal distribution of the cost among the various corral users. Individual meters may make each customer responsible for their own use. The cost of installing meters for each corral would have to be weighed against expected benefits of metering each user.

We also recommend periodic calibration of large meters. The accuracy of readings from the water plant production meters will make the most difference when trying to account for water use. With approximately 4,000 service meters in operation, a large percentage of them would have to be inaccurate to seriously affect the totals. By their very mechanical nature, water meters typically slow down and begin to under-record usage rather than give a too-high reading.

It is also recommended that Rawlins adopt a tiered water rate structure in which the price-per-thousand-gallons would increase as usage rises. Such rates can be a useful tool to encourage water conservation. These rate structures often have minimal affect on total revenues because the increased fees for higher water usage are offset by lower water consumption.

Based on the total amount of water produced by the water treatment plant, the cost of Rawlins' produced water is $2.49 per thousand gallons, the $2,005,500 divided by the 805 million gallons produced. This should be the base commodity charge.

6.2 Water Rates

6.2.1 Water Rates Required With No Funding Assistance for Improvements Available

If Rawlins water system were to be completely self-supporting further increases would be necessary to build sinking funds for eventual facility replacement without outside financial assistance. This would cover obsolescence replacement. The city's current rate structure supports operation, maintenance and current debt payments.

As shown in Table 8-2 and 8-3 below, the city plans water system improvements totaling approximately $11.9 million dollars over the coming 30 years. Assuming the timing shown for those projects, no outside assistance and an interest rate of 4%, the City will have to be prepared to fund debt payments as shown in Table 8-2. Following Rawlins philosophy of having base rates cover debt payments, the base rates would escalate to $128 per month in 2010 and increase to approximately $190 by 2018 based on today's dollars. In addition the customers would pay the commodity charge for consumption. That rate should be set at the current cost of $2.49 per thousand gallons.

Table 8-2
Rawlins Water Master Plan
Improvements Planned 2010 thru 2040

	Project Description	Total Cost	Year Needed	Annual Loan Payment	Resulting Base Rate
1	Atlantic Rim Lining Estimate	$ 1,975,500	2010	$114,243.36	
2	Atlantic Rim Geotech Rehab	$ 2,000,000	2010	$115,660.20	
3	Atlantic Rim Pipeline	$ 3,900,000	2010	$225,537.39	$ 127.86
4	Cemetery and Prison Wells	$ 75,400	2011	$4,360.39	$ 128.95
5	Storage Tanks Maintenance	$ 2,060,000	2013	$119,130.00	$ 158.73
6	Second Transmission Line to Northeast Rawlins	$ 367,000	2013	$21,223.65	$ 164.04
7	Install 12-Inch Looping Line with PRV at 15th & Spruce	$ 386,000	2015	$28,402.56	$ 171.14
8	Install Pumps at Miller Hill	$ 395,000	2018	$29,064.79	$ 178.41
9	Install Raw Water Line For Use of Cemetery Wells	$ 657,350	2018	$48,368.96	$ 190.50
10	Study & Install WTP Screens	$ 100,000	2020	$7,358.18	
	TOTAL	**$ 11,916,250**			

6.2.2 Water Rates Required With Funding Assistance for Improvements Available

Currently, Rawlins' base rate of $14 per month is among the lowest in the state. With commodity charges added it reaches more common levels. Nearly all of Rawlins' customers are paying a $2.00 per thousand gallons commodity charge. Rawlins' water rates rank in the middle of the range of rates across Wyoming.

If the present funding mechanisms remain in place it will significantly lower Rawlins' water rates as compared to those needed to have the system totally self-supporting. Based on the assumed funding agencies involvement shown in Table 8-3 and following Rawlins' philosophy of having base rates cover debt payments, base rates would increase to $51.57 in 2010 and escalate to $75.40 in 2018. The Rural Utilities Services (RUS) division of the U.S. Department of Agriculture sets criteria for what they determine to be affordable water rates. That is 2.5% of the annual median household income (MHI). For Rawlins the official MHI is $36,600. That translates to $76.25 per month.

In addition to an increase in the base rate to cover forecast debt expenses, a tiered rate should be instituted to encourage water conservation.

Table 8-3
Rawlins Water Master Plan
Improvements Planned 2010 thru 2040

	Project Description	Total Cost	WWDC Funds @ 67%	WWDC Loan 33%	SLIB Grant 50%	Local 50%	RUS Grant 45%	RUS Loan 55%	Year Needed	Annual Loan Payment	Resulting Base Rate
1	Atlantic Rim Lining Estimate	$ 1,975,500	$ 1,323,585	$ 651,915					2010	$37,700.31	
2	Atlantic Rim Geotech Rehab	$ 2,000,000	$ 1,340,000	$ 660,000					2010	$38,167.87	
3	Atlantic Rim Pipeline	$ 3,900,000	$ 2,613,000	$1,287,000					2010	$74,427.34	$51.57
4	Cemetery and Prison Wells	$ 75,400	$ 50,518	$ 24,882					2011	$1,438.93	$51.93
5	Storage Tanks Maintenance	$ 2,060,000	$ 1,380,200	$ 679,800					2013	$39,312.90	$61.76
6	Second Transmission Line to Northeast Rawlins	$ 367,000	$ 245,890	$ 121,110					2013	$7,003.80	$63.51
7	Install 12-Inch Looping Line with PRV at 15th & Spruce	$ 386,000					$ 173,700	$212,300	2015	$14,769.20	$67.21
8	Install Pumps at Miller Hill	$ 395,000	$ 264,650	$ 130,350					2018	$7,538.15	$69.09
9	Install Raw Water Line For Use of Cemetery Wells	$ 657,350					$ 295,808	$361,543	2018	$25,151.65	$75.38
10	Study & Install WTP Screens	$ 100,000			$ 50,000	$50,000			2020		
	TOTAL	$11,916,250	$ 7,217,843	$3,555,057	$ 50,000	$50,000	$ 469,508	$573,843			

Notes:
WWDC Loans carry a 4.0% interest rate and a 30 year term
RUS loans carry a 3.375% interest rate and 20 year term
JPA loans through SLIB carry 5.06% interest and a 30 year term

6.3 Budgeting

We recommend that Rawlins adopt a practice of developing each coming year's budget based on current year's actual revenues and expenses with appropriate adjustments for anticipated changes in the coming year.

Rawlins has adopted the practice of budgeting for each coming year's water enterprise account by overestimating anticipates expenses while underestimating revenues. Also, when developing the budget, only the prior year's budget is shown on the budget work sheet, not the actual revenues and expenses. While this is helpful in assuring the developed budget is met at the end of the year, it does nothing to give the City Council and staff a realistic view of what the department has achieved in past years. Nor does it give the department managers a guideline that aids in making constant budget performance improvement.

In budgeting it is recommended that the City adopt the practice of showing all reserve funds in its budget "Beginning Balance," noting reserve funds that are committed to specific required reserves.

SECTION 9 – GIS

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

SECTION 9

Geographic Information System (GIS)

1 INTRODUCTION AND DATA

The scope of the project called for the compilation and integration of a complete Geographic Information System (GIS). This information is useful for City personnel to track and maintain a record of all facilities. The information is also useful for developing current and future computer models and can aid in future studies and reports regarding the water system.

At the beginning of the project, Olsson Associates' staff members made a site visit to Rawlins for the purpose of collecting spatial data relevant to the City's water system. Data collection was performed using Magellan Professional Mobile Mapper CE GPS units rated to submeter accuracy. Olsson staff collected approximately 200 data points across the City, including several fire hydrants, as well as major water system facilities (wells, springs, diversion structures, water treatment plants, storage tanks, pump stations, etc.). Digital photographs were taken at these major system components and were linked to their relevant GPS locations. A CD containing an ArcView 9.3 mxd file, the existing water system GIS, and a shape file containing the GPS points of the major water system facilities with hyperlinked photos is contained in Appendix E of this report.

SECTION 10 – SUMMARY AND CONCLUSIONS

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

SECTION 10

Summary and Conclusions

1 MASTER PLAN SUMMARY

This master plan has reviewed nearly all aspects of the City of Rawlins' water system including the raw water sources and their water rights, raw and finished storage, transmission, distribution, and economics. A population forecast was completed so that improvements could be recommended and prioritized. A computer model of the distribution system was generated and used to determine deficiencies in the system not always obvious to personnel or to the end user. Information from the City's current GIS (Geographic Information System) along with additional information attained during the course of this report was compiled into a GIS package to be used by City personnel and future organizations that may find the data useful. The major component of this report is to identify areas of improvement that are beneficial for all aspects of the water system. These include system improvements, operational improvements, and managerial improvements. The improvements identified in this report are summarized below.

2 SYSTEM IMPROVEMENTS

A number of improvements to the City of Rawlins' water system have been identified and discussed in this report. The improvements summarized in this section have varying degrees of importance and potential impact to the City's water system. Some are considered critical and should be pursued in the very near future. Others may offer smaller benefits or cost savings and may not be required until the future demand has been proven. These improvements have been presented and discussed on an ongoing basis with officials of the City and the WWDC. During these discussions, the projects were prioritized. This process was done in advance so that the WWDC would have adequate time to appropriate funds for applicable projects. The projects are summarized here in the order of precedence. For additional information on the projects and their associated cost estimates, refer to Sections 4 and 6.

2.1 Replace the Pipeline Between Atlantic Rim Reservoir and the Water Treatment Plant Pipeline and Construct a Booster Station to Deliver Water from the North Platte River to Atlantic Rim Reservoir

The asbestos-cement pipeline connecting the water treatment lant to Atlantic Rim Reservoir and the Sage Creek Pipeline has suffered from numerous failures in recent years. The pipeline is aging and pressure control facilities along the Sage Creek Pipeline are inadequate to prevent pressure surges that are responsible for compromising the pipeline. Additionally, the line is undersized compared to the Sage Creek Pipeline and presents a limitation on the amount of water that can flow through to the plant. Head loss through this pipeline is estimated at 68-ft for the Sage Creek Pipeline design flow rate of 3,000-GPM which is excessive. Upgrading this pipeline and reconfiguring inlet-works at the reservoir will reduce the operating pressure of the Sage Creek Springs Pipeline which will have the benefit of also reducing the back pressure imposed on the Nugget Wells which will likely increase their yield. Additional information can be found in paragraph 8.1 of Section 4.

This improvement is considered a top priority and the WWDC has already commenced the process of appropriating funds for the improvement. The WWDC has requested funds from legislation for the project and has included the improvement in its 2010 Recommended Construction Projects. The WWDC has modified the scope of the project relative to what is presented in Section 4. They have opted to also include the improvement described in paragraph 8.6 of Section 4 which is the construction of a booster station and pipeline used to store water from the North Platte River in Atlantic Rim Reservoir. The North Platte River rights will prove crucial to meeting demand for the City of Rawlins in the future and, therefore, it is desirable to have additional storage for this water supply source. Currently, Peaking Reservoir is the only facility capable of storing water from the river.

WWDC's recommended scope for this improvement project does not replace the entire length of pipe that connects the water treatment plant to Atlantic Rim Reservoir, but re-uses about 2,000-feet that is buried extremely deep (up to 35-feet deep in some places) and requires that the existing asbestos-cement pipe be lined-in-place with an appropriate insitu-form (cast in place) liner. A feasibility study will be conducted as part of the project to verify the feasibility of the booster station as well as explore alternative options. Based on WWDC's recommended scope, the replacement of the main pipeline was estimated at $3,024,484 and the construction of the booster station was estimated at $858,521 for a total of $3,883,005. The WWDC has requested money from the legislature in the amount of $3,900,000 for the project. Of this, $2,613,000 will be in grant form and the remaining $1,287,000, or 33% of the total funding package, will be a loan at 4% interest over 30 years.

2.2 Atlantic Rim Reservoir Rehabilitation

Atlantic Rim Reservoir has leaked since its completion in the early 1980s and has never been used to capacity as intended. It has been in and out of service over the years and has operated at reduced capacity while in operation. Geotechnical investigations both past and present have sought to determine the cause and any possible remedies for the leakage, but repair efforts have helped only minimally. In recent years, a two-phase Level II study was completed to investigate the leakage and present options for repairing, decommissioning, or replacing Atlantic Rim Reservoir. The study concluded that Atlantic Rim Reservoir should be decommissioned and a new reservoir be constructed. The cost was significant and prompted further review.

As a cost-effective alternative, this report proposes to install an impermeable liner in the reservoir which would mitigate all leakage. A geotechnical investigation is currently underway to assess the condition of the soils and bedrock to ensure that the foundation and embankment of the reservoir will maintain its integrity once the leakage is stopped and the soils are dried out. Also included in the scope of the proposed project is the re-working of the outlet works to allow water to be taken at different levels in the reservoir which will also provide the ability to investigate a suspected "hump" in the outlet pipeline that does not allow the reservoir to drain completely. Additional details on the project can be found in paragraph 8.3 of Section 4. Costs for the project were estimated at $1,975,482. This cost assumed that the foundation and embankment will withstand the load of the reservoir after the soils and bedrock are dried out.

The geotechnical investigation performed as part of this Master Plan project reviewed the previous studies conducted on Atlantic Rim Reservoir and their associated conclusions and has defined the work that remains to be done to fully evaluate the condition of the dam. The remaining geotechnical investigation work is estimated to cost $250,000. This remaining work is defined in a memorandum contained in Appendix E of this report. It is anticipated that this additional geotechnical work will be conducted as an amendment to the current design contract for the design and construction of the Atlantic Rim Pipeline. At the conclusion of the geotechnical investigation, any remediation work required prior to lining the reservoir will be defined along with the associated engineering.

This improvement is also considered a top priority and the WWDC has also commenced the process of appropriating funds for the rehabilitation of Atlantic Rim Reservoir. The WWDC has requested funds from legislation for the project and has included the improvement in its 2010 Recommended Construction Projects. The WWDC has modified the scope of the project relative to what is presented in Section 4. They have opted to also include appropriations for the additional geotechnical investigation which is currently underway as well as additional money for any remediation recommended in the geotechnical report. The appropriated amount for the geotechnical services is $250,000 and if repairs to the foundation or embankment are required, an additional $1,750,000 has been set aside.

The WWDC has requested money from the legislature in the amount of $4,000,000 for the project. Of this, $2,680,000 will be in grant form and the remaining $1,320,000, or 33% of the total funding package, will be a loan at 4% interest over 30 years. The funds include appropriations for the main pipeline replacement and the booster station as well as replacement/remediation of the existing line to be used as a transmission line from the booster station to Atlantic Rim Reservoir. This project comes as a substantial savings compared to decommissioning Atlantic Rim Reservoir and constructing a new reservoir, which was estimated at $16,500,000.

2.3 Investigate the Cemetery and Prison Wells for Irrigation Use and Develop a Water Source and Raw Water Storage Reservoir Operational Plan

The addition of a raw water irrigation system sourced by two non-potable wells located within City limits would reduce the demand and associated costs of the water treatment plant. The water treatment plant is currently limited to a capacity of 8 MGD and any reduced workload will extend its usefulness into the future. These wells are the abandoned Cemetery and Penitentiary wells. The wells should be evaluated to prove their usefulness. If the wells are adequate or can be rehabilitated economically, they may provide 250-GPM each. These are non-tributary water sources and would be a valuable asset to the City's water system.

The City currently uses water from three different sources to provide potable water to residents and business of Rawlins. The addition of these two wells into the system increases the systems complexity to a point where optimum usage of all available sources is crucial to the efficiency, sustainability, and reliability of the system. Additionally, the City also has three raw water storage reservoirs; however, only one (Peaking Reservoir) has been used in recent years due to operational issues of the other two. The Platte River Recovery Implementation Program will also significantly affect operations of Rawlins' system. An operational study should be completed to demonstrate how best to use all water sources and storage facilities efficiently and in a manner to maximize water quality year round. It is recommended that an operational study be completed whether the cemetery and penitentiary wells are utilized or not.

These improvements are discussed further in sections 7.7 and 8.5 of Section 4. Costs were developed for the investigation of the wells, the preparation of a Water Source and Raw Water Storage Operational Plan, and for connecting the wells to the cemetery and nearby parks. The budget for the investigation of the wells and the development of an Operational Plan is $115,000 and the total cost to connect the wells for irrigating said facilities is $712,524. The investigation of the wells and development of the operational plan should be completed by the year 2011.

2.4 Paint the Tank Farm Tanks

The interior and exterior coatings of the Tank Farm Tanks are due for replacement. The hospital tank and the Painted Hills Tank have been recently completed. The coating will protect the tanks from corrosion both on the interior and from weathering on the exterior. The improvement is further discussed in paragraph 3.1 of Section 6. The cost to repaint both of the tanks is estimated at $2,059,401. The tanks should be painted by the year 2013.

2.5 Install Second Looping Line to North East Rawlins Distribution Area

The northeastern section of Rawlins is currently fed from a 16-inch main that runs east from the Painted Hills Tank. The area resides within the low pressure zone and thus a pressure reducing valve is used to service the area. The only additional connection to the area is a single 6-inch main. In the event of a failure in the primary connection, the area would suffer significantly. This area has also been identified to be the most likely for future development which may compound the problem in the future. This area also serves a school. A secondary connection was proposed by PMPC to alleviate this problem. The improvement consists of installing an additional 12-inch main that connects the area along Inverness Boulevard. The improvement is discussed further in paragraph 3.2 in Section 6. The cost of the project is estimated at $366,757. This cost assumes that a portion of the project cost can be borne by the developer of the proposed subdivision between Higley Boulevard, and Harshman Street. The cost will be higher if the City must install the entire pipeline without cooperation from a developer. This line should be completed by the year 2013.

2.6 Install Interconnect and PRV Across Pressure Zones at Intersection of 15th Street and Spruce Street

The system modeling effort identified a low pressure condition that can occur during certain parts of the day in the eastern part of town. This improvement essentially constructs a 12-inch pipeline that serves as an interconnection between the high and low pressure zones. A pressure reducing valve is installed in this line so that in the event of a low pressure event in the low pressure zone, additional water will be supplemented from the high pressure zone. This will alleviate any excessive pressure drops in the area. The improvement is discussed further in paragraph 3.3 of

Section 6. The estimated cost of the improvement is $386,205. This improvement should be implemented by the year 2015.

2.7 Install Booster Pumps at Miller Hill Vault

The Nugget wells have decreased in production over time. Operators have restricted their use to allow the aquifer to recover. The Nugget Wells are considered the second best water source and are best used to supplement water from the Sage Creek Springs. By installing a booster station downstream of the three wells, the back pressure imposed on the wells will be reduced and will increase production. The improvement is discussed further in paragraph 8.2 of Section 4. The estimated cost for adding booster pumps to the Miller Hill Vault is estimated at $475,848. This improvement should be completed by the year 2018.

Note that upgrading the Atlantic Rim to the water treatment pipeline will reduce the operating pressure of the entire Sage Creek Pipeline. The yield of the Nugget wells should be re-evaluated after this improvement is complete to better determine the benefit of installing booster pumps in the Miller Hill Vault.

2.8 Install Raw Water Lines to Cemetery and Prison Wells

This improvement is a follow-up to the investigation of the cemetery and penitentiary wells described in paragraph 2.3 of this report. If the wells prove sufficient and are economic to bring into production, then it is recommended to construct the necessary infrastructure to provide raw water to the cemetery and nearby parks. This improvement consists of the construction of two small well houses, the installation of well pumps, pipelines connecting to the facilities to be irrigated, and raw water isolation equipment. This improvement is discussed further in paragraph 8.5 of Section 4. The estimated cost to install the required infrastructure is $712,524. This improvement should be implemented by the year 2018.

2.9 Install Screens on the Inlet of the Water Treatment Plant

The water treatment plant must backwash their diatomaceous earth (DE) filters periodically to maintain filter efficiency. During certain times of the year, particularly during high demand periods, additional backwash cycles are required to remove daphnae, shrimp, and other small aquatic inhabitants from the filters. It is recommended to install screens on the inlet works of the Plant to increase the DE filter cycle times. Further investigation should be made to determine the best approach and design of the filters. This improvement is discussed further in paragraph 7.6 of Section 4. The cost to conduct the study and install the screens will be approximately $100,000. This improvement should be implemented by the year 2020.

2.10 Construct Raw Water Pipeline and Booster Station From the North Platte River Pipeline For Irrigation

An alternative to utilizing the cemetery and penitentiary wells for irrigation purposes would be to utilize water from the North Platte River Pipeline. This improvement consists of installing a small booster station near the proposed connection to the North Platte River Pipeline and approximately 2.5 miles of pipeline. The booster station would draw water from the North Platte River Pipeline and would boost it to a pressure sufficient for irrigation at the cemetery and nearby parks and facilities. The proposed location of the booster station is near exit 215 of Interstate 80.

This improvement should be considered as an alternative or supplement to the use of the cemetery and penitentiary wells. At this time, it appears that the use of the cemetery and penitentiary wells is a more cost-effective option and therefore this improvement is not recommended at this time. The estimated cost to install the required infrastructure to irrigate the parks and cemetery with water from the North Platte River is $858,521.

3 OPERATIONAL IMPROVEMENTS

Overall the City of Rawlins does an excellent job running their system. Their priority is to use the water from Sage Creek Basin which has the highest quality and lowest cost to use. The City is using raw water from the North Platte River to irrigate the new golf course which is the cheapest means of providing irrigation water to that facility. There are only a few small recommended modifications.

After the Nugget wells were operated for a few years on a year-round basis, it was noted that the yield from the wells was declining. This was due to declining pressure in the aquifer in response to the removing water from the aquifer. The City was advised to only use the wells as needed in the summer months so that the flow rate from the wells would be highest when the water was needed. This was prior to the Platte River Recovery Implementation Program established in 1997. As indicated in Chapter 5, benchmarks were established for the consumptive use of water from the North Platte River system. The City has slightly exceeded these benchmarks over the past few years. This was largely due to the drought and trying to keep all of the raw water reservoirs as full as possible. In view of the benchmarks established during the development of the Platte River Recovery Implementation Program, a program for use of the wells should be developed in conjunction with the State Engineer's Office to make the best use of the wells. It may mean using the wells in the non-irrigation season to avoid exceeding the benchmarks established for the non-irrigations season to get the credit for the groundwater accretions to the North Platte River. The depletions and benchmarks are complicated and development of a program of usage with the State Engineer's Office would be the best way to approach this issue.

Aside from the North Platte River depletions and benchmarks, it was determined that if Peaking Reservoir is kept full at May 1 of each year, even with the record low flow from the Sage Creek Basin, the City can meet the future demand through pumping of the North Platte River. The City should try to make sure that the combined storage of Peaking and Atlantic Rim Reservoirs meets or exceeds the storage capacity of Peaking Reservoir on May 1 of each year.

A reservoir operation plan should be developed to keep the water in Rawlins Reservoir as fresh as possible. The City has been reluctant to use the water from Rawlins Reservoir due to taste and odor problems. However, a water sample taken from the reservoir showed the water quality to be equivalent to that being produced from the Sage Creek Springs. Care must be taken to avoid lowering the water level in Rawlins Reservoir to the point the fish cannot survive. This is believed to have happened once during the recent drought period.

The inlet and outlet piping at the Tank Farm tanks should be reconfigured so they do not function in parallel. The piping needs to be re-arranged so that water will flow into one tank, then into the next tank prior to going into town. This will require very little piping and help assure a good turnover in the two tanks.

The water treatment plant personnel should receive additional training on their SCADA system so the can better access the data being collected.

Consideration should be given to re-activating the penitentiary and cemetery wells in the future. This will alleviate some of the demand from the water treatment plant during the summer months and help keep the City below the benchmarks established in the Platte River Recovery Implementation Program.

4 MANAGERIAL IMPROVEMENTS

The economics and management practices of the water system were reviewed to identify practices that can be improved. The goals are to ensure that the Water Department provides fair water rates to the City subscribers while generating the revenues to operate the system in a fiscally sustainable manner including funding for preventative maintenance and future improvements.

Rawlins presently (in 2009) manages its water system finances such that the system is currently self-supporting. The City uses its base rate, which it calls an "availability fee" to finance system debt. That is currently $14.00 per month. This charge covers no water usage. In addition to the $14.00 the City charges $2.00 per thousand gallons for any water usage. Billing for water, sewer, and landfill (trash) is done on a monthly basis. Significant late penalties are charged to delinquent accounts. These results in most accounts remaining paid up. All late fees are credited to the water enterprise account rather than proportioning them between all three enterprise accounts. This generates approximately $100,000 per year that is currently available to the Water Department. As of 2009 the Rawlins water system is in sound financial shape.

While the Rawlins system is in sound financial condition, there are improvements that can be made in the approach Rawlins uses in water accounting and budgeting for the system. Those are discussed in the following sections.

4.1 Water Accounting

As discussed in Chapter 8, the City currently produces an unacceptably high amount of nonrevenue water, water that is filtered and treated by the water plant but does not go through a meter for billing or other accounted-for use such as watering of city parks. Currently the city is accounting for only 69% of its produced water, 552 million gallons of the 805 million produced. Rawlins needs to improve its water accounting practices. An acceptable system loss percentage is generally considered to be 10% or less. Rawlins is at 31%. It is recognized that the City cannot realistically get to zero nonrevenue water when uses such as fire fighting, water breaks, street cleaning, and similar non-metered uses are considered. Still, while applying best practices of accounting for produced water leaving the system, the loss should be under 10%.

Raw water losses are of less concern than is produced water because its cost to the city is significantly lower and there is less the City can do that will cost effectively reduce those losses. Leakage from the reservoirs and evaporation losses are normal. Measures are being planned to cost effectively reduce some of those losses.

4.2 Water Rates

Rawlins present system of charging for water service is generating sufficient revenues to meet present needs. Out-of town users are charged a slightly higher water use rate than are in-town users. The cost of produced water is $2.50 per thousand gallons based on city cost data. This should be the rate charged for any usage.

As discussed in Chapter 8, base rates will have to increase several-fold for Rawlins to meet financial obligations if the recommended system improvements are to be made. If the City is to make the identified improvements and the system is to remain fully self-supporting base water rates are forecast that need to be approximately $190 per month plus the $2.50 per thousand gallon water use charge in just nine years, 2018.

If the City makes the identified improvements and the present funding assistance programs are used to their fullest, base water rates are forecast that need to be $75.40 plus the $2.50 per thousand gallon water use charge by 2018.

Using U.S.D.A. guidelines for affordable water rates based on year 2000 median household income, Rawlins can charge up to $76.25 per month. This guideline rate, however, will increase after the 2010 census data is compiled because median household income has increased in the ten years since 2000.

4.3 Budgeting

Rawlins' historical practices in budgeting for the water system can be characterized as overstating forecast revenues and understating forecast expenses. Not surprisingly, this results in the City ending the year with lower than forecast expenses, more revenue "than expected" and budget surplus at the end if the year. While this bodes well with the elected officials it does not let the City base the budget on realistic forecasts.

It is recommended that each upcoming year's budget be based on the year-to-date expenses and revenues rather than on the last year's budget as is now being done. This will result in a tighter, but more realistic water department budget. The elected officials also need to be informed and understand that the budget is a set of firm guidelines, not a set of numbers that are not to be exceeded.

Also, during the budgeting process, the draft budget needs to show actual reserves in the water account. Present practice is to show as "Beginning Balance" a significantly smaller number that is sufficient to force a balanced budget. Again, as with other practices, this results in not showing the true and full financial status for the Water Department.

5 CONCLUSION

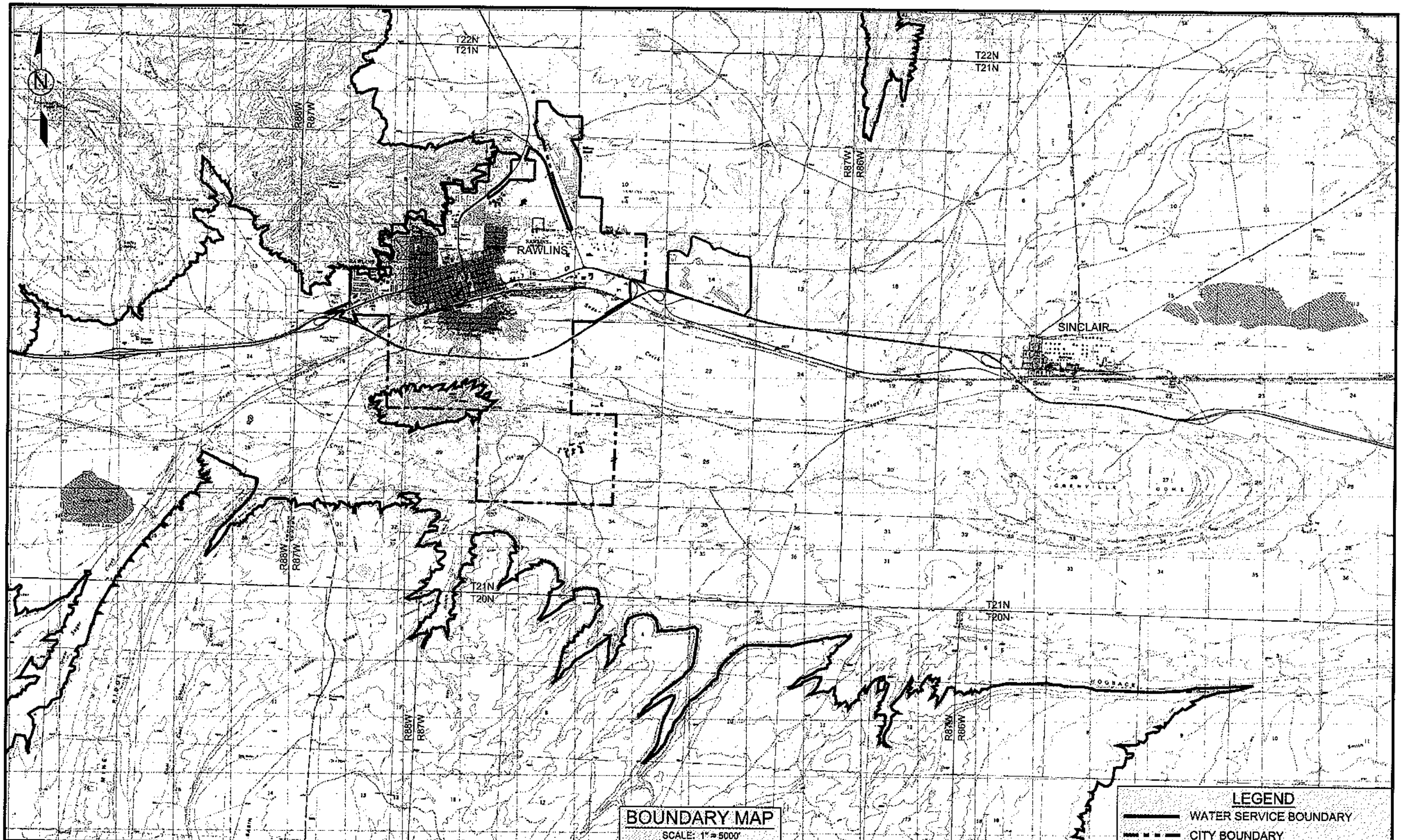
This water master plan has completed an extensive review of the components, management, and economics associated with the City of Rawlins water system. Overall, the system was found to be in great condition. City personnel offer the most experience and know the system best. Their dedication has proven crucial to the success of the operation and they are doing a great job. This report offers a third-party review and offers suggestions and improvements that will ensure the sustainability of the operation well into the future.

APPENDICES

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

APPENDIX A
PLATES

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology



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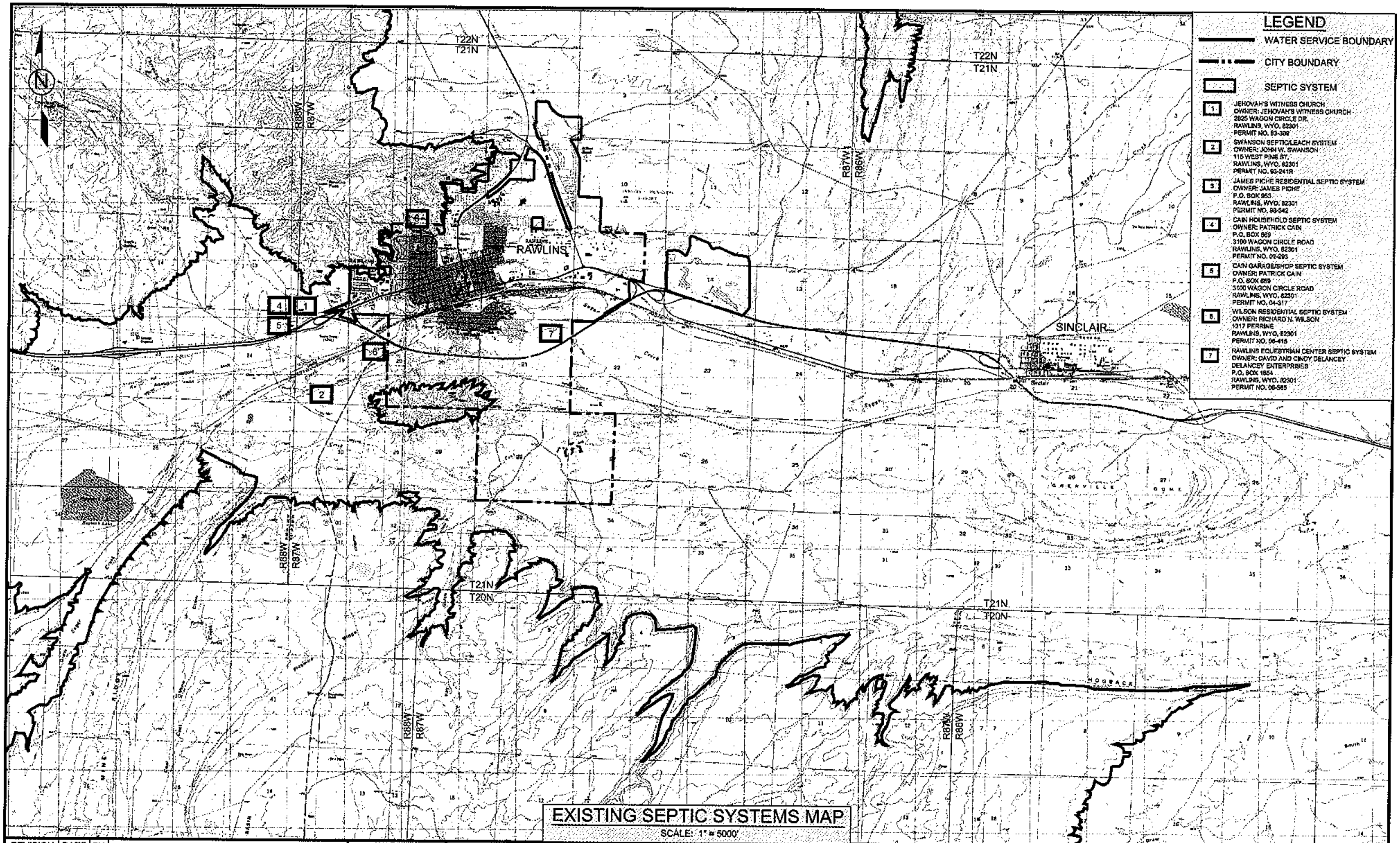
Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology
605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-0220
201 W. Lakeway, Suite 1000, Gillette, WY 82718, (307) 685-1125

CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
BOUNDARY MAP

PLATE
1



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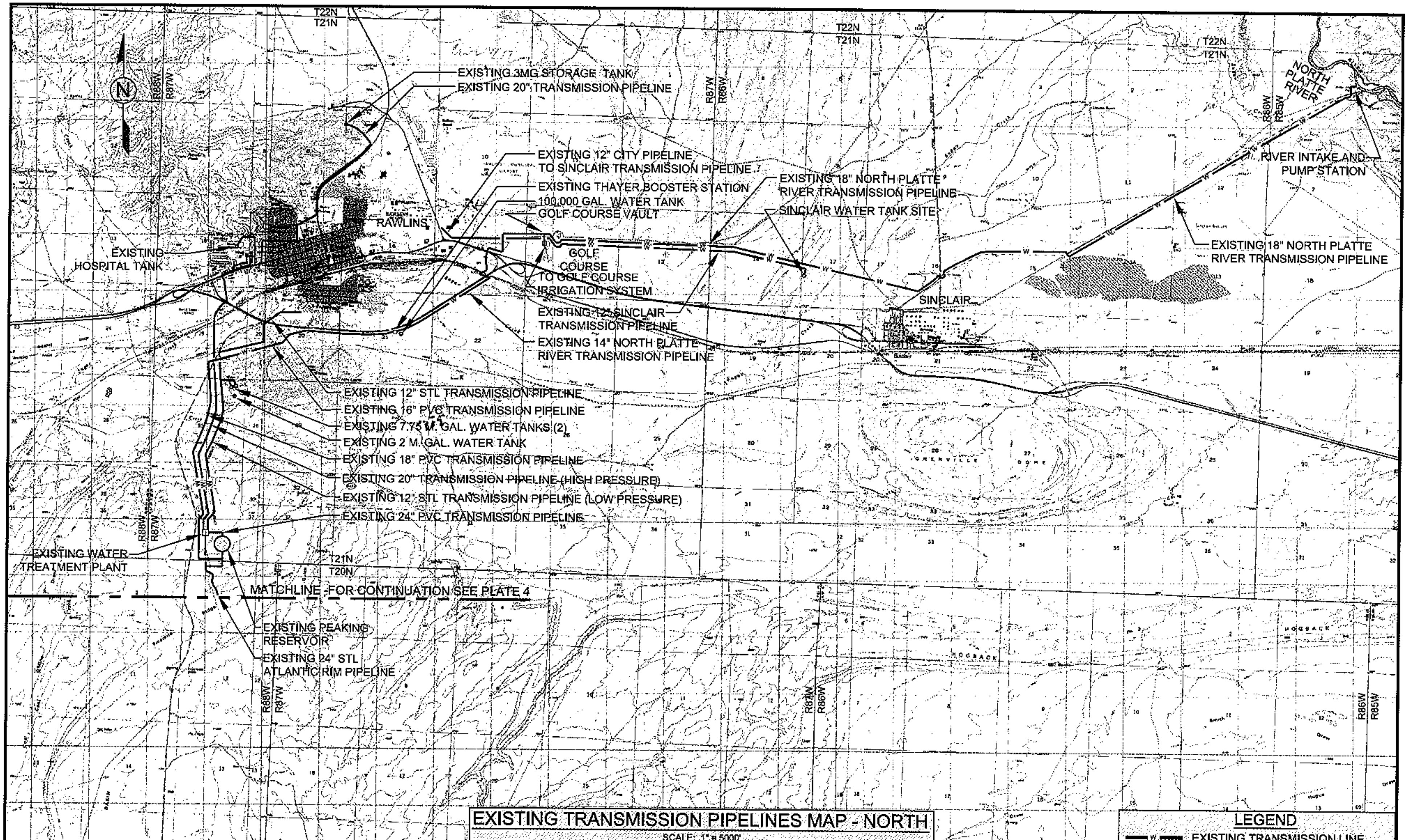
CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
EXISTING SEPTIC SYSTEMS MAP

PLATE 2



EXISTING TRANSMISSION PIPELINES MAP - NORTH

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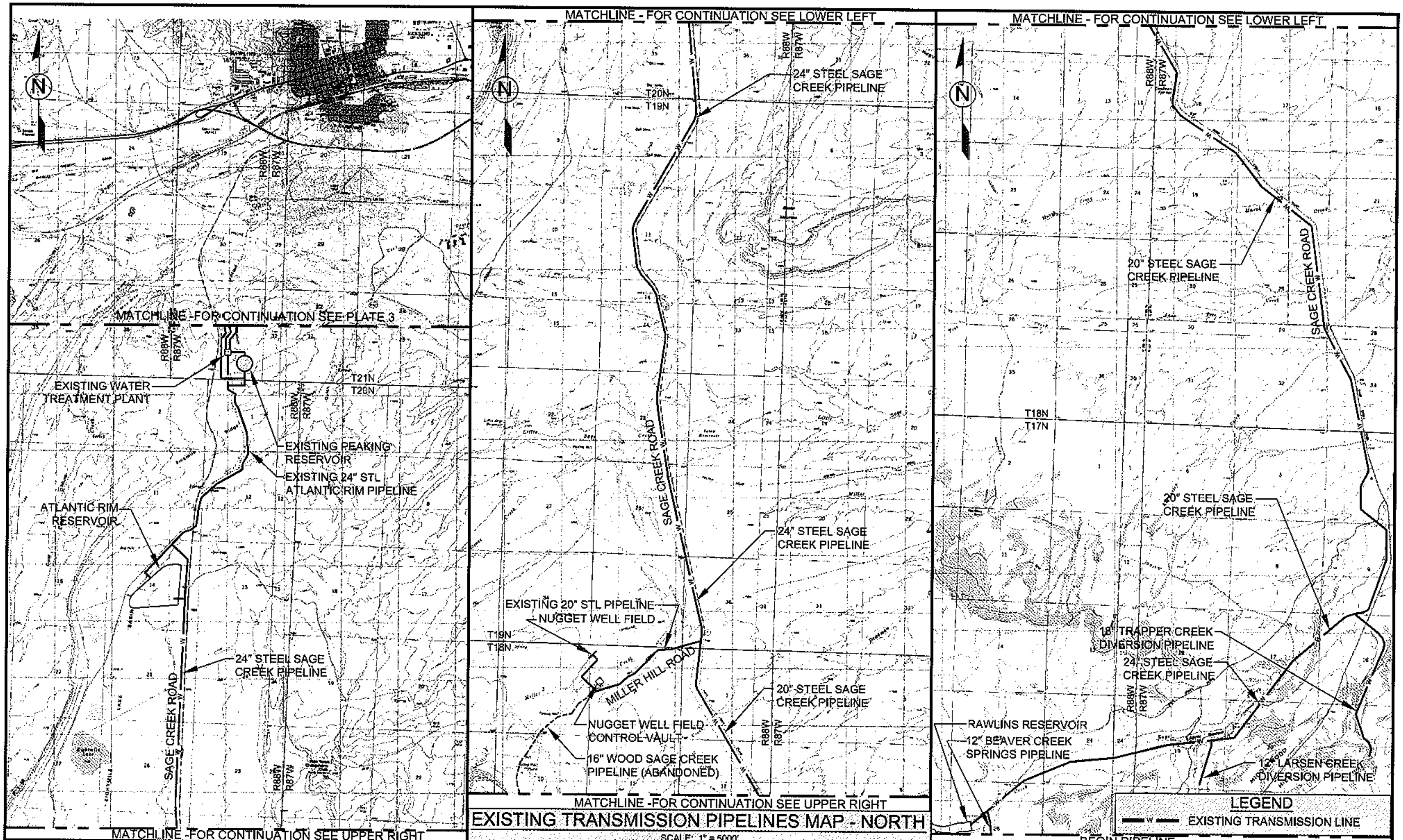
PLATE 3



EXISTING TRANSMISSION PIPELINES MAP - NORTH

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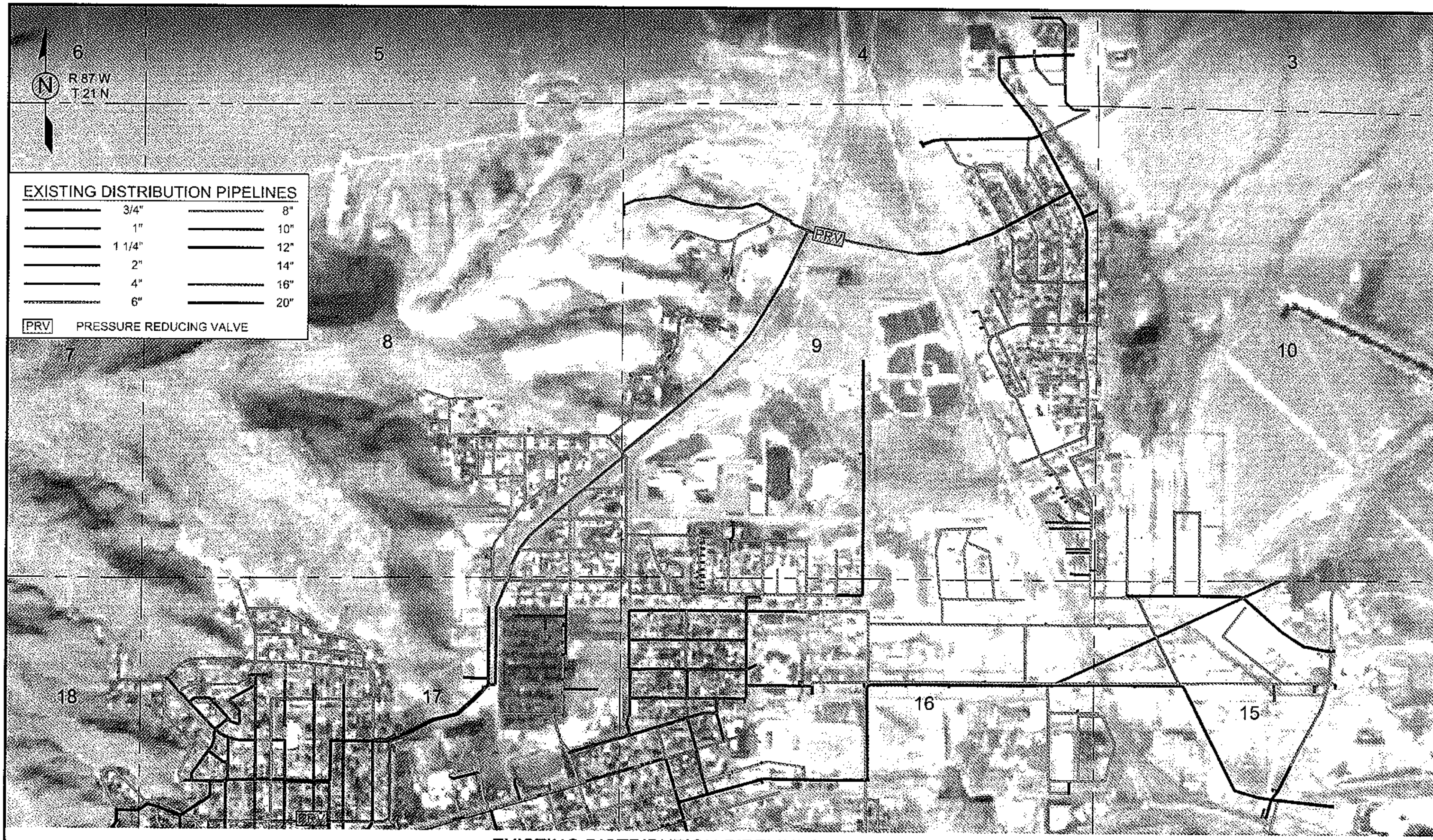
CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
EXISTING TRANSMISSION PIPELINES - SOUTH

PLATE 4



EXISTING DISTRIBUTION PIPELINES MAP - NORTH

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Wester Wetstein & Associates
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CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
EXISTING CITY DISTRIBUTION PIPELINES - NORTH

PLATE 5

EXISTING DISTRIBUTION PIPELINES MAP - SOUTH

SCALE: 1" = 1000'

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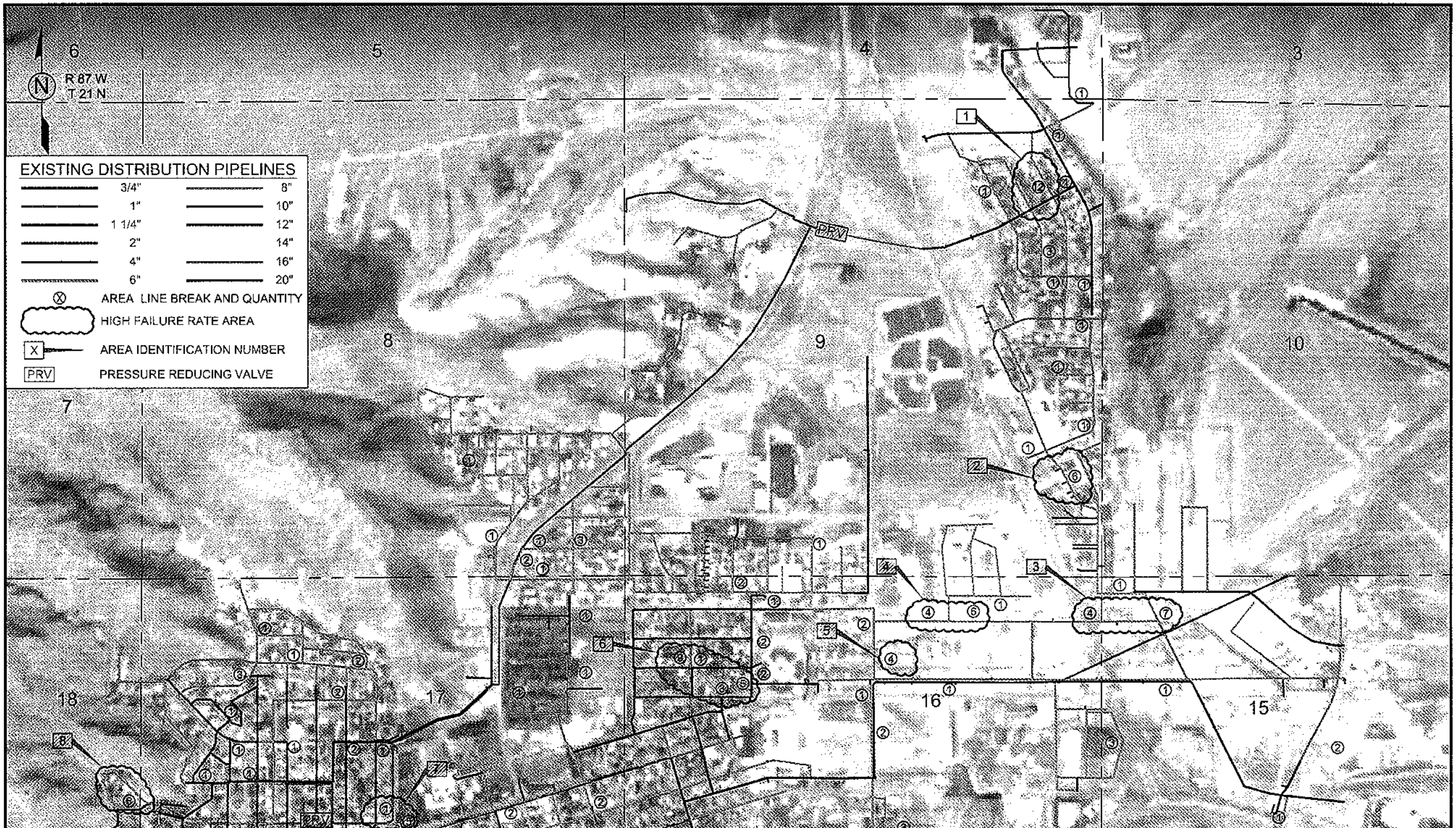
CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
EXISTING CITY DISTRIBUTION PIPELINES - SOUTH

PLATE 6



CITY WATER SYSTEM LINE BREAKS PLAN - NORTH

SCALE: 1" = 1000'

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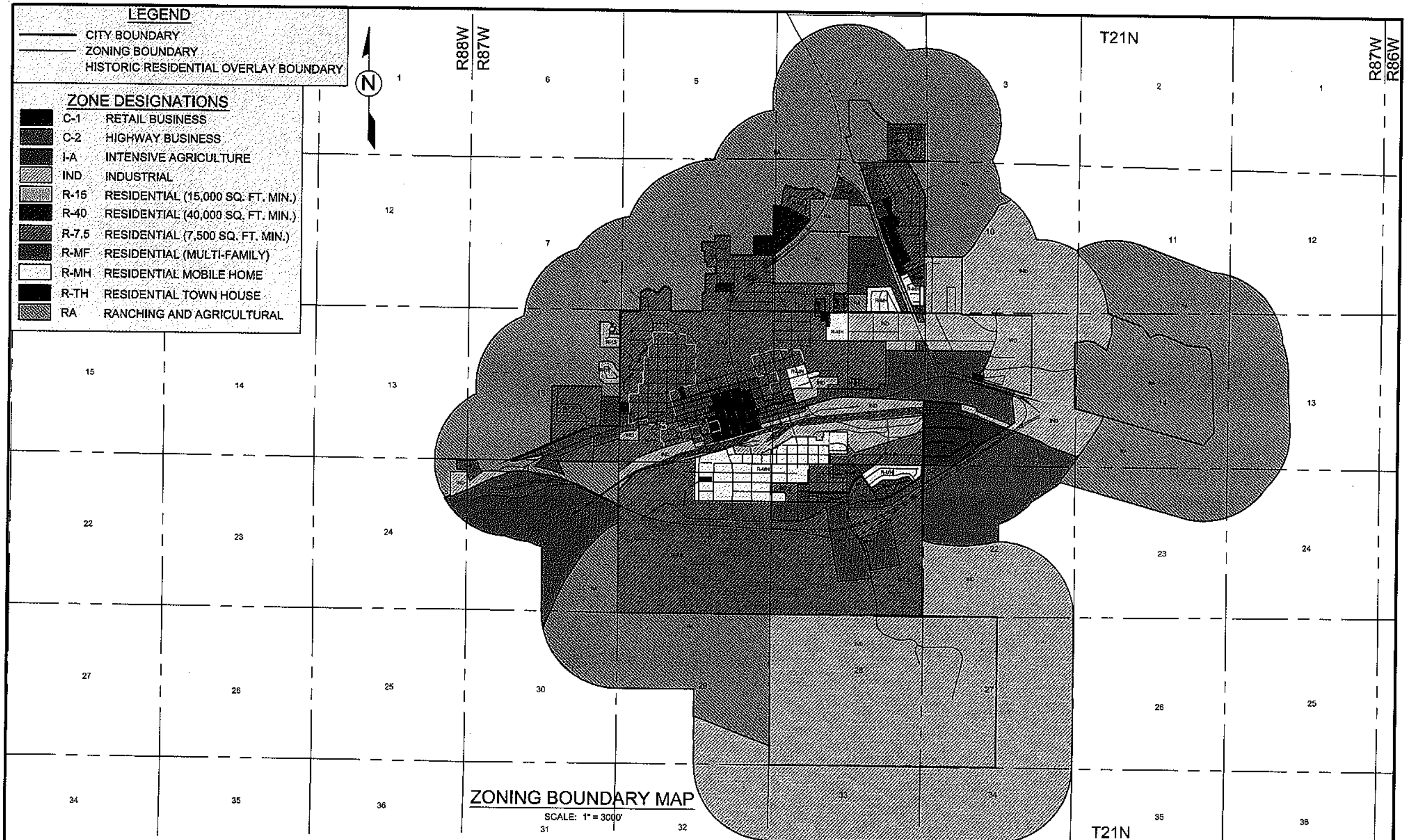
					DRAWN: DKM	JOB NO.: 7.009	605 Plaza Court, P.O. Box 2202, Laramie, WY 82073, (307) 742-0220 / 201 W. Lakeway, Suite 1000, Gillette, WY 82718, (307) 686-1125	RAWLINS WATER MASTER PLAN	7
					CK'D: LKW	SCALE: AS SHOWN		CITY WATER SYSTEM LINE BREAKS - NORTH - 2004 THRU 2008	

CITY WATER SYSTEM LINE BREAKS PLAN - SOUTH

SCALE: 1" = 1000'

REVISION	DATE	BY	DESCRIPTION	WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED: RJW	DATE: MAY, 2010	Wester Wetstein & Associates 805 Plaza Court P.O. Box 2232 Laramie, WY 82073 (307) 742-0220 201 W. Lakeway Suite 1000 Gillette, WY 82718 (307) 685-1125 Consultants in Engineering and Hydrogeology	CITY OF RAWLINS, WYOMING	PLATE
					DRAWN: DKM	JOB NO.: 7.009		RAWLINS WATER MASTER PLAN	8
					CK'D: LKW	SCALE: AS SHOWN		CITY WATER SYSTEM LINE BREAKS - SOUTH - 2004 THRU 2008	



REVISION	DATE	BY	DESCRIPTION

WARNING
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED: RJW	DATE: MAY, 2010
DRAWN: DKM	JOB NO.: 7.009
CK'D: LKW	SCALE: AS SHOWN

Wester Wetstein & Associates
Consultants in Engineering and Hydrogeology

CITY OF RAWLINS, WYOMING
RAWLINS WATER MASTER PLAN
ZONING BOUNDARY MAP

PLATE 9

APPENDIX B
RAW WATER QUALITY ANALYSIS, 2008

WYOMING DEPARTMENT OF AGRICULTURE
ANALYTICAL SERVICES
1174 Snowy Range Road
Laramie, WY 82070 Phone: (307)-742-2984
Internet: http://wyagric.state.wy.us/aslab/aslab.htm E-mail: aslab@missc.state.wy.us

ANALYTICAL REPORT

Water Supply **Irrigation, Production Agriculture**

Wester-Wetstein and Assoc.
605 Plaza Ct.
Laramie, WY 82070

Phone No: 307-742-9220

Lab Number:	71903
Date Collected:	31-Jul-2008
Date Received:	01-Aug-2008
Date Completed:	03-Sep-2008
Purchase Order No:	
WDA Invoice No	109348
Amount Due:	$ 70.00
Amount Paid:	$ 0.00

Net 30 Days, Payable to: Wyoming Department of Agriculture

Sample ID:	Rawlins WWTP Effluent
Analysis:	Rural Health

ANALYTE	UNITS	RESULT
Cations		
Calcium	mg/L	110
Magnesium	mg/L	70
Sodium	mg/L	340
Potassium	mg/L	30
Metals		
Other Analytes		
pH	pH Units	9.1
Conductivity	umhos/cm	2620

ANALYTE	UNITS	RESULT
Anions		
Carbonate	mg/L	53
Bicarbonate	mg/L	270
Chloride	mg/L	290
Fluoride	mg/L	0.5
Nitrate as N	mg/L	0.18
Nitrite as N	mg/L	<0.05
Sulfate	mg/L	710
TDSbySummation	mg/L	1700
SAR		6.2
T. Alk. as CaCO3	mg/L	310
Hardness as CaCO3	mg/L	560
Boron	mg/L	1.1

Ref.	Analyte	Method	Units	Result
1				
2				
3				
4				

Prepared By: mkw

I hereby certify that the above sample was analyzed by myself or my assistant.

Section Supervisor

State Chemist/Lab Manager

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

IRRIGATION WATER QUALITY ANALYSIS

Date Received:		01-Aug-08	Lab No:		71903
CATIONS	**mg/L**	**meq/L**	**ANIONS**	**mg/L**	**meq/L**
Calcium	110.0	5.49	Carbonate	53.0	1.77
Magnesium	70.0	5.76	Bicarbonate	270.0	4.42
Sodium	340.0	14.79	Chloride	290.0	8.18
Potassium	30.0	0.77	Fluoride	0.5	0.03
			Nitrate as N	0.2	0.01
			Nitrite as N	0.0	0.00
			Sulfate	710.0	14.78
T. CATIONS		**26.80**	**T. ANIONS**		**29.19**
Conductance		2620	Boron		1.1
TDS by Summation		1700	T Alk CaCO3		310
pH		9.1			

ANALYSIS

S A R (sodium)	**6.24**	Residual NaCO3	**0.00**
Sp Cond (salinity)	**2620**	Boron	**1.10**

CLASSIFICATION

S A R (sodium)	**2**	Residual Na_2CO_3	**1**
Sp Cond (salinity)	**4**	Boron	**3**

ERROR CHECKING

% ERROR = |(meq/L cations - meq/L anions)|*100 / (meq/L cations + meq/L anions) = 4.27 (<5%)

TDS/COND = (ROE mg/L)/(Specific Conductance) = 0.65 (0.65 TO 0.85)

IONIC = (meq/L cations + meq/L anions)/2 / (Sp. Conductance)/100 = 1.07 (0.8 TO 1.2)

OVERALL =	0.025941	MAX. OVERALL ALLOWED =	0.0531

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E-mail: aslab@state.wy.us
Phone: (307)-742-2984

CLASSIFICATION OF IRRIGATION WATER FOR AGRICULTURAL CROPS

Lab Number:	71903
Date Received:	########

The water represented by this sample number has the following characteristics based on the chemical analysis of the water you submitted.

For irrigation of agricultural crops, this water is placed in the following categories as outlined by the U.S. Salinity Laboratory

Factor	Category
Sodium Absorption Ratio (SAR):	2
Electrical Conductivity (Salinity):	4
Residual Sodium Carbonate:	1
Boron	3

The above referenced water is:

- [ ] **Suitable under most conditions**
- [ ] **Suitable with limitations**
- [X] **Unsuitable**

for irrigation of agricultural crops.

The enclosed material should give some insight into the classification of your water and any special management practices which may arise from using this water. **We strongly recommend** you have the soil to be irrigated with this water analyzed and then discuss the soil and water analysis data with the Cooperative Extension Service.

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Laramie, WY 82070
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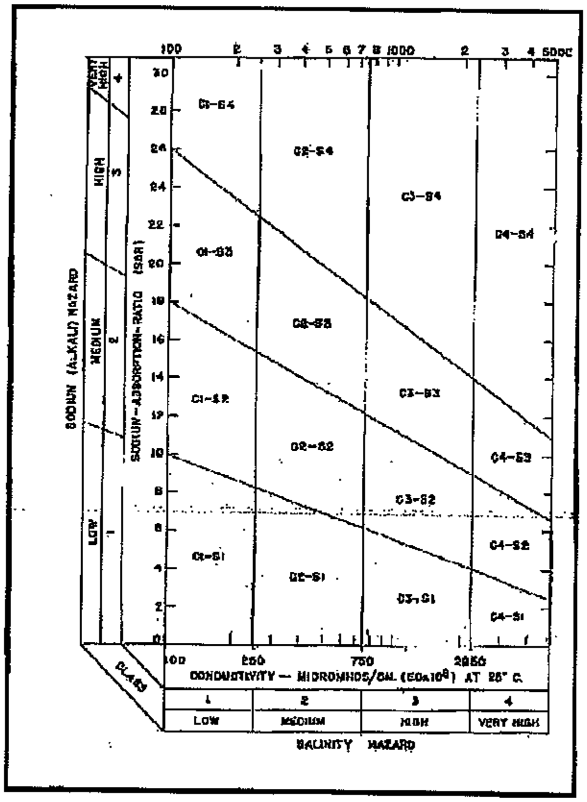
Phone: (307)-742-2984

EXPLANATION OF THE CLASSIFICATION OF IRRIGATION WATER FOR AGRICULTURAL CROPS

	Classification Number		
Parameter / Class	Suitable	Suitable with Limitations	Unsuitable
S A R (sodium)	<=1	=2	>=3
Sp Cond (salinity)	<=2	=3	>=4
Residual NaCO3	<=1	=2	>=3
Boron	<=2	=3	>=4



Based on SAR (Sodium Hazard) and Conductivity (Salinity Hazard) your water is classified below relative to the diagram.

Classification:	C4- S2

Comments

Salinity

Class C4, Very High Salinity: Not suitable for irrigation under ordinary conditions. May be used occasionally on sandy soils with excellent drainage if considerable excess water is applied for leaching and if crops with high salt tolerance are grown.Should not be used for continuous irrigation and is not suitable for use with sprinkler systems.

Alkalinity (Sodium Hazard)

Class S2, Medium Sodium: Suitable for use on sandy and loamy soils if water moves through them readily. Can cause alkali problems on heavy clay soils, under low leaching conditions, unless gypsum (or equivalent soil amendments) are present or are added to the soil.

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E-mail: aslab@missc.state.wy.us

ANALYTICAL REPORT

Water Supply

Rural Health Series

Wester-Wetstein and Assoc.
605 Plaza Ct.
Laramie, WY 82070

Phone No: 307-742-9220

Lab Number:	**71900**
Date Collected:	31-Jul-2008
Date Received:	01-Aug-2008
Date Completed:	03-Sep-2008
Purchase Order No:	
WDA Invoice No	**109348**
Amount Due:	**$ 62.00**
Amount Paid:	**$ 0.00**

Net 30 Days, Payable to: Wyoming Department of Agriculture

Sample ID:	Rawlins Springs
Analysis:	Rural Health

ANALYTE	UNITS	RESULT
Cations		
Calcium	mg/L	50
Magnesium	mg/L	4.2
Sodium	mg/L	3.2
Potassium	mg/L	3.3
Metals		
Other Analytes		
pH	pH Units	7.6
Conductivity	umhos/cm	320

ANALYTE	UNITS	RESULT
Anions		
Carbonate	mg/L	0
Bicarbonate	mg/L	180
Chloride	mg/L	2.3
Fluoride	mg/L	0.1
Nitrate as N	mg/L	0.28
Nitrite as N	mg/L	<0.05
Sulfate	mg/L	28
TDSbySummation	mg/L	180
T. Alk. as CaCO3	mg/L	150
Hardness as CaCO3	mg/L	140

Ref.	Analyte	Method	Units	Result
1				
2				
3				
4				

Prepared By: mkw RWH

I hereby certify that the above sample was analyzed by myself or my assistant.

Section Supervisor

State Chemist/Lab Manager

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

RURAL HEALTH WATER QUALITY ANALYSIS

Date Received: 01-Aug-08 | **Lab No:** 71900

CATIONS	mg/L	meq/L	ANIONS	mg/L	meq/L
Calcium	50.0	2.50	Carbonate	0.0	0.00
Magnesium	4.2	0.35	Bicarbonate	180.0	2.95
Sodium	3.2	0.14	Chloride	2.3	0.06
Potassium	3.3	0.08	Fluoride	0.1	0.01
			Nitrate as N	0.3	0.02
			Nitrite as N	0.0	0.00
			Sulfate	28.0	0.58
T. CATIONS		**3.06**	**T. ANIONS**		**3.62**

Conductance, umhos/cm	320	S A R (sodium Hazard)	0.12
TDS by Summation, mg/L	180	T Alk $CaCO_3$, mg/L	147.64012
pH, Units	7.6	Hardness as $CaCO_3$, mg/L	142
Total Coliform		Hardness as $CaCO_3$, gr/gal	8

ERROR CHECKING

% ERROR = $\frac{|(\text{meq/L cations} - \text{meq/L anions})|*100}{(\text{meq/L cations} + \text{meq/L anions})}$ = 8.36 (<5%)

TDS/COND = (ROE mg/L)/(Specific Conductance) = 0.56 (0.65 TO 0.85)

IONIC = $\frac{(\text{meq/L cations} + \text{meq/L anions})/2}{(\text{Sp. Conductance})/100}$ = 1.04 (0.8 TO 1.2)

OVERALL =	0.045003	MAX. OVERALL ALLOWED =	0.0531

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

Evaluation of Analysis - Human Consumption

Total Coliform	Not Determined	Nitrate + Nitrite as N	Suitable
Total Dissolved Solids	Suitable	**Fluoride level, EPA Std.**	Suitable
		Level for good dental health	Low
Sulfate	Suitable	Discuss Fluoride levels with your dentist.	
Hardness as $CaCO_3$	Med. Hard	Sodium	Suitable

Evaluation of Analysis - Livestock Consumption

Total Dissolved Solids	Suitable	Sulfate	Suitable

Evaluation of Analysis - Lawn & Garden Irrigation

S A R (sodium Hazard)	Suitable	Conductance, umhos/cm	Suitable

Your water, Lab No: **71900** has an overall classification for the stated purpose, as follows:

Not Evaluated	for human consumption - **Bacteria Only**
Suitable *	for human consumption - **Chemistry Only**
Suitable	for livestock consumption
Suitable under most conditions	for lawn and garden irrigation

* Based on Total Dissolved Solids, Sulfates & Nitrate + Nitrite as N - Wyoming Minimum Standard for the transfer of rural property.

WYOMING DEPARTMENT OF AGRICULTURE
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Internet: http://wyagric.state.wy.us/aslab/aslab.htm E-mail: aslab@missc.state.wy.us

ANALYTICAL REPORT

Water Supply **Rural Health Series**

Wester-Wetstein and Assoc.
605 Plaza Ct.
Laramie, WY 82070

Phone No: 307-742-9220

Lab Number:	**71901**
Date Collected:	31-Jul-2008
Date Received:	01-Aug-2008
Date Completed:	03-Sep-2008
Purchase Order No:	
WDA Invoice No	**109348**
Amount Due:	**$ 62.00**
Amount Paid:	**$ 0.00**

Net 30 Days, Payable to: Wyoming Department of Agriculture

Sample ID:	Rawlins Reservoir
Analysis:	Rural Health

ANALYTE	UNITS	RESULT
Cations		
Calcium	mg/L	30
Magnesium	mg/L	4.5
Sodium	mg/L	3.0
Potassium	mg/L	2.6
Metals		
Other Analytes		
pH	pH Units	8.8
Conductivity	umhos/cm	210

ANALYTE	UNITS	RESULT
Anions		
Carbonate	mg/L	9
Bicarbonate	mg/L	97
Chloride	mg/L	1.6
Fluoride	mg/L	0.1
Nitrate as N	mg/L	0.06
Nitrite as N	mg/L	<0.05
Sulfate	mg/L	16
TDSbySummation	mg/L	110
T. Alk. as CaCO3	mg/L	95
Hardness as CaCO3	mg/L	93

Ref.	Analyte	Method	Units	Result
1				
2				
3				
4				

Prepared By: mkw ROK

I hereby certify that the above sample was analyzed by myself or my assistant.

Section Supervisor

State Chemist/Lab Manager

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

RURAL HEALTH WATER QUALITY ANALYSIS

Date Received:	01-Aug-08		Lab No:	71901	
CATIONS	**mg/L**	**meq/L**	**ANIONS**	**mg/L**	**meq/L**
Calcium	30.0	1.50	Carbonate	9.0	0.30
Magnesium	4.5	0.37	Bicarbonate	97.0	1.59
Sodium	3.0	0.13	Chloride	1.6	0.05
Potassium	2.6	0.07	Fluoride	0.1	0.01
			Nitrate as N	0.1	0.00
			Nitrite as N	0.0	0.00
			Sulfate	16.0	0.33
T. CATIONS		**2.06**	**T. ANIONS**		**2.28**

Conductance, umhos/cm	210	S A R (sodium Hazard)	0.14
TDS by Summation, mg/L	110	T Alk $CaCO_3$, mg/L	94.576619
pH, Units	8.8	Hardness as $CaCO_3$, mg/L	93
Total Coliform		Hardness as $CaCO_3$, gr/gal	5

ERROR CHECKING

% ERROR = $\frac{|(\text{meq/L cations} - \text{meq/L anions})|*100}{(\text{meq/L cations} + \text{meq/L anions})}$ = 4.92 (<5%)

TDS/COND = (ROE mg/L)/(Specific Conductance) = 0.52 (0.65 TO 0.85)

IONIC = $\frac{(\text{meq/L cations} + \text{meq/L anions})/2}{(\text{Sp. Conductance})/100}$ = 1.03 (0.8 TO 1.2)

OVERALL =	0.024908	MAX. OVERALL ALLOWED =	0.0531

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

Evaluation of Analysis - Human Consumption

Total Coliform	Not Determined	Nitrate + Nitrite as N	Suitable
Total Dissolved Solids	Suitable	**Fluoride level, EPA Std.**	- Suitable
		Level for good dental health	- Low
Sulfate	Suitable	Discuss Fluoride levels with your dentist.	
Hardness as $CaCO_3$	Med. Hard	Sodium	Suitable

Evaluation of Analysis - Livestock Consumption

Total Dissolved Solids	Suitable	Sulfate	Suitable

Evaluation of Analysis - Lawn & Garden Irrigation

S A R (sodium Hazard)	Suitable	Conductance, umhos/cm	Suitable

Your water, Lab No: **71901** has an overall classification for the stated purpose, as follows:

Not Evaluated	for human consumption - **Bacteria Only**
Suitable *	for human consumption - **Chemistry Only**
Suitable	for livestock consumption
Suitable under most conditions	for lawn and garden irrigation

* Based on Total Dissolved Solids, Sulfates & Nitrate + Nitrite as N - Wyoming Minimum Standard for the transfer of rural property.

WYOMING DEPARTMENT OF AGRICULTURE
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E-mail: aslab@missc.state.wy.us

ANALYTICAL REPORT

Water Supply

Rural Health Series

Wester-Wetstein and Assoc.
605 Plaza Ct.
Laramie, WY 82070

Phone No: 307-742-9220

Lab Number:	**71902**
Date Collected:	31-Jul-2008
Date Received:	01-Aug-2008
Date Completed:	03-Sep-2008
Purchase Order No:	
WDA Invoice No	**109348**
Amount Due:	**$ 62.00**
Amount Paid:	**$ 0.00**

Net 30 Days, Payable to: Wyoming Department of Agriculture

Sample ID:	Atlantic Rim Reservoir
Analysis:	Rural Health

ANALYTE	UNITS	RESULT
Cations		
Calcium	mg/L	20
Magnesium	mg/L	4.9
Sodium	mg/L	8.3
Potassium	mg/L	1.3
Metals		
Other Analytes		
pH	pH Units	9.2
Conductivity	umhos/cm	200

ANALYTE	UNITS	RESULT
Anions		
Carbonate	mg/L	12
Bicarbonate	mg/L	38
Chloride	mg/L	1.8
Fluoride	mg/L	0.2
Nitrate as N	mg/L	<0.05
Nitrite as N	mg/L	<0.05
Sulfate	mg/L	42
TDSbySummation	mg/L	110
T. Alk. as CaCO3	mg/L	51
Hardness as CaCO3	mg/L	70

Ref.	Analyte	Method	Units	Result
1				
2				
3				
4				

Prepared By: mkw

I hereby certify that the above sample was analyzed by myself or my assistant.

Section Supervisor

State Chemist/Lab Manager

Wyoming Department of Agriculture
Analytical Services
1174 Snowy Range Road
Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

RURAL HEALTH WATER QUALITY ANALYSIS

Date Received:	01-Aug-08		Lab No:	71902	
CATIONS	**mg/L**	**meq/L**	**ANIONS**	**mg/L**	**meq/L**
Calcium	20.0	1.00	Carbonate	12.0	0.40
Magnesium	4.9	0.40	Bicarbonate	38.0	0.62
Sodium	8.3	0.36	Chloride	1.8	0.05
Potassium	1.3	0.03	Fluoride	0.2	0.01
			Nitrate as N	0.0	0.00
			Nitrite as N	0.0	0.00
			Sulfate	42.0	0.87
T. CATIONS		**1.80**	**T. ANIONS**		**1.96**

Conductance, umhos/cm	200	S A R (sodium Hazard)	0.43
TDS by Summation, mg/L	110	T Alk $CaCO_3$, mg/L	51.188469
pH, Units	9.2	Hardness as $CaCO_3$, mg/L	70
Total Coliform		Hardness as $CaCO_3$, gr/gal	4

ERROR CHECKING

% ERROR = $\frac{|(\text{meq/L cations} - \text{meq/L anions})|*100}{(\text{meq/L cations} + \text{meq/L anions})}$ = 4.35 (<5%)

TDS/COND = (ROE mg/L)/(Specific Conductance) = 0.55 (0.65 TO 0.85)

IONIC = $\frac{(\text{meq/L cations} + \text{meq/L anions})/2}{(\text{Sp. Conductance})/100}$ = 0.94 (0.8 TO 1.2)

OVERALL =	0.025497	MAX. OVERALL ALLOWED =	0.0531

Wyoming Department of Agriculture
Analytical Services
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E-mail: aslab@missc.state.wy.us
Internet: http://wyagric.state.wy.us/aslab/aslab.htm
Phone: (307)-742-2984

Evaluation of Analysis - Human Consumption

Total Coliform	Not Determined	Nitrate + Nitrite as N	Suitable
Total Dissolved Solids	Suitable	**Fluoride level, EPA Std.**	- Suitable
		Level for good dental health	- Low
Sulfate	Suitable	Discuss Fluoride levels with your dentist.	
Hardness as $CaCO_3$	Med. Hard	Sodium	Suitable

Evaluation of Analysis - Livestock Consumption

Total Dissolved Solids	Suitable	Sulfate	Suitable

Evaluation of Analysis - Lawn & Garden Irrigation

S A R (sodium Hazard)	Suitable	Conductance, umhos/cm	Suitable

Your water, Lab No: **71902** has an overall classification for the stated purpose, as follows:

Not Evaluated	for human consumption - **Bacteria Only**
Suitable *	for human consumption - **Chemistry Only**
Suitable	for livestock consumption
Suitable under most conditions	for lawn and garden irrigation

* Based on Total Dissolved Solids, Sulfates & Nitrate + Nitrite as N - Wyoming Minimum Standard for the transfer of rural property.