From: <dschwenke@jdshydro.com>
To: <Bboyd@smtpgate.dphe.state.co.us>
Date: 6/24/2009 4:36 PM
Subject: Town of Cheyenne Wells - Green Project Reserve Question
Attachments: DW Green Reserve Business Case Distribution Line.doc

Barry,

Hopefully you receive this e-mail (I thought that I would try this method to get you information) that way I can attach documents if you need anything changed.

I reviewed the Green Project Reserve documents and found the numbers you are inquiring about. Lets go ahead and change the percent to 6.5% so that it exactly corresponds with the documented distribution vs. proposed replaced lines to one decimal point.

I have attached the document in word format with the revision if you want to insert it into the project reserve package we sent last week.

Let me know if you have any other questions.

Doug

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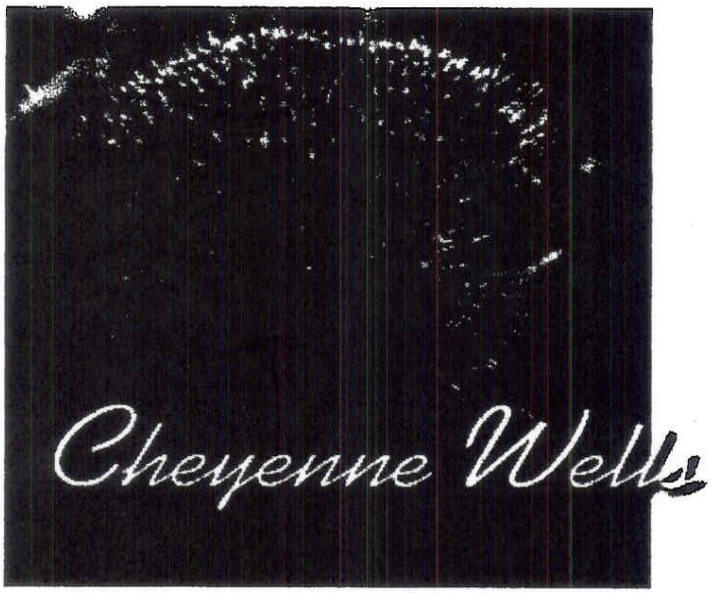
Town of Cheyenne Wells
Cheyenne Wells, CO

Water System Improvements
Business Case for Green Project Reserve Funds

101.13

June 2009



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Town of Cheyenne Wells
Water System Improvements
Green Project Reserve – Business Case Report
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The Town of Cheyenne Wells Water System Improvement Project No. 080006D recently prioritized as an American Recovery and Reinvestment Act initiative, eligible for $1,732,517 in principal forgiveness. Of the $1.732 million, $1.077 has been proposed as eligible as a Green Project Reserve. This memorandum report has been prepared to provide further detailed information as requested by the Colorado Department of Health and Environment Water Quality Control Division Financial Solutions Unit.

Project Background

Of the three main components which comprise the proposed project, two are considered eligible for Green Project Reserve funding. These two project components are:

1) Replacement of existing distribution lines.
2) Replacement of existing touch read meter system with a fixed base automated meter read system.

The third component of the project which is not considered eligible for Green Reserve Funding is the replacement of an existing 10" transmission line with a 24" replacement line for the purpose of increasing chlorine contact time for three municipal wells.

The estimated cost of the proposed loan is $1,732,517 as mentioned above (total project cost $1,800,500 including the engineering planning, distribution modeling, and reuse planning studies, as depicted in the ARRA loan application).

- **History of Water Accountability**

  The majority of water lines constructed within the commercial and residential portions of town were installed in the late 1920's and early 1930's. Early pipe materials consisted mostly of cast iron pipe, and were not cement mortar lined. Generally, these pipe sizes were mostly 4" and smaller. As the town grew through the 1940's and 1950's pipe materials changed from cast iron pipe to mostly galvanized. Little planning was put into the distribution system layout as it rapidly grew, and laterals were installed using whatever pipe sizes and materials were available. Large quantities of 1¼" galvanized lines were utilized as mains off of the old 4" and 6" lines through main street to provide water service to the growing residential districts. In addition, almost all existing water services are made from galvanized pipe installed in the 1960's. In the past 20 years the town has attempted to be as proactive as possible in addressing the poor condition of the distribution system (and as finances have allowed). Over the past 20 years the town has successfully undertaken the following water improvement projects addressing water accountability and distribution:

  1) 8" loop around the southern edge of town
  2) 8" line replacement down main street
  3) 8" line replacement down Hwy. 385 (via an EIAF grant and in conjunction with CDOT paving project in 2004).
  4) Meter replacement program 2003 – 2005.
  5) Water main / service repair program (basically these lines are repaired as they fail).

  However, even given these proactive steps the town has taken over the years, water accountability percentages are still not as impressive as they should be, given the amount of money and work put into the system. As mentioned in #4, the town embarked on a meter replacement program after implementing a water accountability study in 2002. From 2003 to 2005 the Town replaced all old meters and installed new meters at previously unmetered locations. From **Table A** below the initial influence of the meter program can be seen as water accountability improved from its inception in 2003 to its completion in 2005 (from -21.56% in 2002 to -15.14% in 2005). However, in 2006 and 2007 water accountability again plummeted to -25.04% and 28.47% (both of which were not

considered dry years either). Since 2006 attention has now turned to the very old, outdated, corroded, and undersized lines located in the central parts of town. The Town has had to undertake extensive repair work in these parts of town (as shown in the repair logs depicted in Appendix C) in order to repair numerous line and service breaks. Also, samples of pipe pulled from these locations show signs of the corroded condition of these old pipes. The majority of old CIP pipe in town is thin walled, corroded, tuberculated, and pocked with numerous amounts of holes. It is very likely that the old pipe located throughout town is responsible for up to 11% of the unaccounted water loss experienced annually.

Table A. Accountability (Well Production vs. Billed Usage)

Year	Well Production (gal)	Billed Usage (gal)	Difference (gal)	% Difference (%)
1998	143,853,199	128,943,321	-14,909,878	-10.36%
1999	151,012,198	115,760,711	-35,251,487	-23.34%
2000	161,037,700	132,748,083	-28,289,617	-17.57%
2001	149,341,399	120,087,080	-29,254,319	-19.59%
2002	167,660,200	131,513,440	-36,146,760	-21.56%
2003	141,036,208	113,424,109	-27,612,099	-19.58%
2004	116,575,228	96,856,665	-19,718,563	-16.91%
2005	131,013,465	111,173,823	-19,839,642	-15.14%
2006	150,542,151	112,841,090	-37,701,061	-25.04%
2007	150,986,213	108,003,240	-42,982,973	-28.47%
2008	135,542,295	113,710,000	-21,832,295	-16.11%
TOTALS	**1,598,600,256**	**1,285,061,562**	**-313,538,694**	
AVG.	145,327,296	116,823,778	-28,503,518	-19.42%

Another cause of unaccounted for water is assumed to be the meter read system. Currently the Town employs a touch read meter system installed in the late 1990's to early 2000's. While the touch read meter system is a definite improvement over manually read water meters, it still incorporates enough human error in data collection, data entry, missed meters during reading, and other points of error that some amount of annual unaccounted for water can be attributed. The Town water staff estimates that as much as 2% of annual unaccounted for water losses can be attributed to the touch read meter system. Also, though the touch read meter system can be considered partially automated, the staff still must spend at least a week of manpower driving around town reading meters (including fleet gas usage, maintenance, and labor hours). Overall, the touch read meter reading system can be considered inefficient and partially ineffective as an automated meter reading process.

Thus, in the interest of water and energy efficiency the town would like to consider the improvement of both the water distribution system and meter reading system as Green Project Reserve Components.

Green Reserve Components

- **Component #1 – Replacement of existing distribution lines**

1. Identification / Project Description – this component proposes to replace undersized, outdated, and corroded distribution mains (plus associated services) with new 6" C-900 DR21 pvc lines. A brief description of the proposed line replacements are summarized below:

   - North 1st Street West: Replace existing conglomerate 1¼" iron pipe, 1¼" galvanized pipe, and 4" CIP pipe with 685 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.

- North 5th Street West: Replace 4" segment of CIP pipe with 325 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.
- West 2nd Street North: Replace existing 2" galvanized and 1 ¼" galvanized with 935 LF of 6" DR21PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.
- North 3rd Street East and East 2nd Street North: replace existing 4" OD steel pipe with 1,460 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, hydrant tie-ins, and shut downs.
- East 1st Street North and South: Replace existing 1¼" galvanized pipe with 760 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.
- East 4th Street North: Replace existing 1¼" galvanized pipe with 390 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.
- East 5th Street South: Replace existing 1¼" galvanized pipe with 390 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, and shut downs.
- East 7th Street North: Replace existing 1¼" galvanized pipe with 1,220 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, hydrant tie-ins, and shut downs.
- Fairgrounds Distribution line: Replace existing 4" cast iron pipe with 1,320 LF of 6" DR21 PVC pipe. This item will include all associated valving, service conversions, tie-ins, hydrant tie-ins, and shut downs.

Line replacements for distribution systems are **not considered categorically eligible** and require a **business case** to be considered for Green Project Reserve funding.

2. Classification – there are portions of the line replacement which could be considered for both Energy Efficiency and Water Efficiency. Obviously replacing lines which are old, of poor quality, and possibly porous will promote water efficiency by retaining and maintaining water distribution flows and pressures. In addition, improving the wall roughness coefficients and upsizing the diameter of the lines to be replaced will improve pumping efficiencies as well (thus reducing electrical energy consumption).

3. Justification – as mentioned above, distribution line replacements are not considered categorically justifiable. Therefore a business case must be developed for justification of Green Reserve Funding. The following sections are formatted to follow the proposed CDPHE worksheet as provided by the Financial Solutions Division. The worksheet is attached as Appendix A with this letter report.

Specific Segment Data:

A. North 1st Street West

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Cast Iron Pipe	150 LF	1930's	83	0.0065 gpm/LF
1.25" Galvanized	150 LF	1960's	120	0.0010 gpm/LF
4.00" Cast Iron Pipe	150 LF	1930's	83	0.0065 gpm/LF
0.75" Galvanized (Services)	60 LF	1960's	120	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	683 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	40 LF	New	135	0.00 gpm/LF

B. North 5th Street West

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
4.00" Cast Iron Pipe	170 LF	1930's	83	0.0065 gpm/LF
0.75" Galvanized (Services)	60 LF	1960's	120	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	683 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	40 LF	New	135	0.00 gpm/LF

C. West 2nd Street North

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Galvanized	560 LF	1940's	110	0.0010 gpm/LF
2.00" Galvanized	331 LF	1940's	110	0.0010 gpm/LF
0.75" Galvanized (Services)	60 LF	1940's	110	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	1031 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	110 LF	New	135	0.00 gpm/LF

D. North 3rd Street East / East 2nd Street North

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
4.00" Cast Iron Pipe	1050 LF	1930's	83	0.0065 gpm/LF
0.75" Galvanized (Services)	240 LF	1940's	110	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	1457 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	225 LF	New	135	0.00 gpm/LF

E. East 1st Street North and South

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Galvanized	768 LF	1940's	110	0.0010 gpm/LF
0.75" Galvanized (Services)	615 LF	1940's	110	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	768 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	615 LF	New	135	0.00 gpm/LF

F. East 4th Street North

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Galvanized	390 LF	1940's	110	0.0010 gpm/LF
0.75" Galvanized (Services)	115 LF	1940's	110	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	390 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	125 LF	New	135	0.00 gpm/LF

G. East 5th Street South

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Galvanized	390 LF	1940's	110	0.0010 gpm/LF
0.75" Galvanized (Services)	120 LF	1940's	110	0.00001 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	390 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	120 LF	New	135	0.00 gpm/LF

H. East 7th Street North

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
1.25" Galvanized	740 LF	1960's	120	0.0010 gpm/LF
0.75" Galvanized (Services)	190 LF	1960's	120	0.0010 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	1220 LF	New	150	0.00 gpm/LF
0.75" Copper (Services)	200 LF	New	135	0.00 gpm/LF

I. Fairgrounds Line Replacement

Replacement Line Data:

Pipe Size and Type	Length Replace.	Age	C-Value	Leak Rate
4.00" Cast Iron Pipe	1320 LF	1930's	83	0.0065 gpm/LF

New Line Data:

Pipe Size and Type	Length	Age	C-Value	Leak Rate
6.00" DR 21 PVC	1320 LF	New	150	0.00 gpm/LF

	Replacement Length		Annual Head Loss	Annual Est. Water Loss
Totals:	4" CIP to be replaced	1,640 LF	13 ft	9,190,116 gal.
	2" Galv.	331 LF	28 ft	173,974 gal.
	1 ¼" Galv.	3,000 LF	2,349 ft	1,575,749 gal.
	1 ¼" CIP	150 LF	207 ft	512,460 gal.
	¾" Services	1,580 LF	82 ft	8,304 gal.
		6,699 LF	**2,678 ft**	**11,406,603 gal.**
	New 6" DR21 PVC	7,787 LF	2 ft	0 gal.
	New ¾" Copper	1,457 LF	54 ft	0 gal.
		9,262 LF	**56 ft**	**0 gal.**

Financial Advantages of Replacing Proposed Lines in the Distribution System

As this letter report indicates above, there are significant water efficiency and energy efficiency savings in replacing old, outdated, undersized, corroded, and leaky with the Cheyenne Wells Distribution system. The line replacements indicated above represent the areas within the system that are to be replaced, with accompanying approximated data values. In order to quantify these efficiencies, it is estimated that the savings will be realized financially in five distinct areas:

1) Recovery in revenues from lost billings
2) Recovery in costs from estimated line breaks
3) Recovery in chemical costs (chlorinating lost water)
4) Recovery in pumping costs (the cost of pumping excess "lost" water)
5) Recovery in energy efficiency costs (reducing the energy it takes to pump water through old pipes by replacing with smoother pipes).

Financial data and technical calculations substantiating these financial assessments can be found in the appendices, and are noted throughout the business case memorandum.

1) Recovery in revenues from lost billings –
Table 2 in Appendix B provides a break down of accounted for vs. unaccounted for water recorded by the Town of Cheyenne Wells water staff in 2008. In 2008 the Town of Cheyenne Wells pumped approximately 135,542,295 gallons of water into its distribution system. Of that volume, 113,710,000 gallons were billed by the town (according to the Sensus Touchread and billing software). Additionally, another 2,793,933 million gallons were accounted for through miscellaneous metered usage (i.e. use at the fire station, tank overflows, hydrant flushings, and for park irrigation) resulting in 19,038,362 gallons in total unaccounted for water (or 14.05% of the total water produced). It should be noted that prior to 2008, meters located at the fire station and parks had not been read. However, since the total unaccounted for water was greater in 2007 and 2006, the 2008 estimates will be conservative in determining lost billings for the system.

Through distribution system evaluations by the town and assessments of existing pipe sizes, materials, and ages, the water staff estimates that approximately 11% of the total water pumped by the system is lost to distribution leaks and breaks. Of that 11%, approximately 70% of those leaks (or 8% of the total water pumped) can be located at the lines proposed for replacement above. To corroborate the estimates made by the Town, theoretical leakage rates were assigned to each length of pipe depending upon original pipe materials, size, age, and observed conditions. The leakage rates were developed from multiple case studies of aged distribution systems constructed in the early 1930's. Of particular concern with Cheyenne Wells' distribution system is the amount of old cast iron pipe present, which supposedly was not lined with cement (which had become prevalent in the late 1930's). This old CIP pipe has been dug up on numerous occasions in town during repairs, and usually found to be

highly corroded, tuberculated, and pocked with numerous holes. These lines were thus assigned very high leakage rates per lineal foot (0.0065 gpm/LF). A large amount of galvanized lines are employed throughout the town and are generally found to be in a bit better condition than the CIP lines. However, they too have experienced numerous breaks, are relatively old (built in the 1940's-1960's) and have relatively high leakage rates as well (0.001 gpm/LF). All existing services are generally galvanized and built in the 1940's through 1960's. Though the Town has had to complete numerous repairs to the service lines, they generally do not experience very high flowrates and have been assigned lower leakage rates compared to the distribution mains (0.00001 gpm/LF). As seen above, it is estimated that approximately 11,406,603 gallons of water were lost at the proposed replacement line locations in 2008, or around 8.43% of the total water produced. This stands to corroborate the estimates made by the Town's water staff and will be used as a conservative estimate of annual lost water due to leaks located in the proposed replacement zones.

In determining an average billing rate for use in quantifying an annual lost billing amount, an average three tiered monthly rate was developed from the total rate structure shown in Appendix D. The average tiered rate structure is shown in Part I of the Financial Calculation Section of Appendix B. From Part I it is estimated that $2,162 are lost monthly in billings, or **$25,948.81** annually.

2) Recovery in costs from Line Breaks –
A detailed breakdown of line and service breaks in the proposed replacement areas are shown in Appendix C. The breakdown depicts documented line and service break repairs dating back to 1999 and includes number of repairs per year, cost of repairs per year, and number of customers affected. A summary of the line break information can be found in Table 4 of Appendix B. From Table 4 an average annual estimate of line break projections for the proposed replacement areas is developed. From the table it is estimated that three service breaks per year and one main break per year can be expected annually if the proposed line replacements are not undertaken. The total cost of repairs annually (for both service and line breaks) is estimated at **$11,843.50**, resulting in an estimated 33 affected customers over an average of 3 days total.

3) Recovery in chemical costs (chlorination of lost water) –
Even though the estimated amount of water lost through leakages at the proposed replacement locations never make it to the end customer, it is still chlorinated at the point of collection (i.e. the raw water pump stations). Therefore, if the Town is able to replace the lines at the locations proposed above, it can be assumed that it will save in the chemical costs of disinfecting the raw water which would ultimately not have to be pumped. The town water staff estimates that it costs $0.00176 / gal to chlorinate raw water. Using this unit cost as shown in Part III of the Financial Calculation Section of Appendix B against the estimated annually water loss at the proposed replacement locations, a total of **$2,017.07** can be saved annually.

4) Recovery in pumping lost water costs –
Assuming that replacing the proposed lines listed above mitigates the amount of leakage estimated, the five groundwater pumps active in the existing collection system will not need to pump the extra 11,406,603. This will save in pumping costs alone in the raw water collection field. In estimating the costs required to pump the additional lost water the following data points had to be developed (this calculation is shown in Part IV. of the Financial Calculations Section of Appendix B):

Average Pumping Rate – since it is not known exactly which pumps were directly responsible for pumping the "extra" lost water over the course of the year, an average pumping rate was developed for the collection field. This estimate was made by simply

dividing the number of gallons pumped over the course of 2008, then dividing by 365 days and converting to gallons per minute. The estimated average pumping rate for 2008 was then determined to be 276 gpm.

Time to pump excess water – the number of "lost" water gallons were divided by the average pumping rate determined above. The time to pump the lost water was estimated to be 691 hours.

Power estimate – as mentioned above, it is not known which of the five wells would have been predominantly responsible for pumping the "lost" water, so an average power output was calculated from the five wells. By averaging the nameplate horsepower of each well, overall system average was estimated at 84 Hp.

Cost to pump "lost" water – the average power required to pump the "lost" water was multiplied by the time required to pump the "lost" water and by the estimated unit cost (currently around $0.08 kWh as provided by KC Electric). The resulting annual savings is estimated to be around **$3,462** per year.

5) Recovery in energy efficiency costs (reducing the energy it takes to pump water through old pipes by replacing with smoother pipes).
As mentioned above, the existing lines proposed for replacement are extremely old, corroded, tuberculated, and most likely pitted. The distribution system existing around the downtown area was built in the 1930's and aside from the line run down main street in the 1980's, is made up of old 4" CIP pipe or 1¼" galvanized pipe. The 4" CIP pipe is not cement lined, which would have helped with its longevity. However, the samples of cast iron pipe pulled by the water staff during other line breaks have indicated that it is extremely thin walled, corroded, tuberculated, pitted, and in many instances, worn all the way through. This leads to extremely high friction losses, as indicated in the C-Values developed in the tables shown above and in Appendix B. C-Values for all CIP pipe being replaced were assigned a rating of 83 (which is extremely conservative, and could have been lowered to 65). All galvanized lines were essentially constructed in the 1940's through 1960's and are for the most part in better condition than CIP lines. Thus, these lines were assigned C-Values of 110. The big issue with the galvanized lines is that they are significantly undersized for the applications which they serve (for the most part they are 1¼" serving as mains in many locations), as well as their propensity to leak. The head losses incurred at these locations are mostly due to small pipe diameters.

In estimating friction losses through existing and new lines, the Hazen-Williams equation was used on a comparative basis. C-Values were selected according to comparisons with similarly constructed and aged pipes. Flowrates through select pipes were estimated according to Town experience and field testing. Flowrates through services were assumed to be extremely low and according to average residential demand. Though periodic irrigation demand would put flowrates through services as high as 15 gpm, an average flowrate of 3 gpm was selected. For mains, flowrates obviously fluctuate dramatically and seasonally, ranging anywhere from 0 gpm (mostly at night) to as high as 1,460 gpm during fire flow conditions. An average of 50 gpm was selected for flows through all mains considering nighttime and high season demands as the two extremes.

Using the C-Values, pipe diameters, flowrates, and pipe lengths shown in the above tables (and Table 1 in Appendix B) friction losses for all replacement and new pipe lengths were developed. In looking at the results above, friction losses in the new pipe lines and services were significantly reduced in the model. This should translate into significant annual energy savings in pumping all water through these lines. In order to estimate the difference in input energy to the well pumps, horsepower requirements for pumping against the additional

friction head were estimated. In order to accomplish this system wide, an average collection system wire-to-wire pump efficiency had to be established, and is shown in Part V of the Financial Calculation Section. Individual wire-to-wire efficiencies are shown in the table with an overall corresponding system wire-to-wire efficiency (estimated to be approximately 75%, which is consistent with the age of pumps currently employed in the Cheyenne Wells system). By using the assumed average pumping rate (determined in Part IV), known static TDH (364'), assumed system wire-to-wire efficiency, and calculated dynamic head loss due to friction of both lines (replaced and new), the annual horsepower required to overcome these head losses can be estimated.

Annually, 245 more horsepower are required to overcome friction losses in the old pipe vs. the proposed pvc and copper piping. This translates into an annual savings of **$19,223** in energy efficiency.

Overall

Combining all savings listed above, it is estimated that the Town can save approximately **$62,500** annually by implementing the proposed improvements. Projecting these savings over a 20-year period at an annual interest rate of 6%, it is estimated that the 20-year return on these savings will be **$712,000.** This is very close to the overall construction cost of the component itself (from the ARRA loan application, this component was estimated to be $611,000 raw construction and materials costs, plus $116,090 in contingencies - including Davis-Bacon wages and Buy American clauses), totaling $727,090.

- **Component #2 – Fixed Base Automated Meter Read System**

1. Identification / Project Description – this component proposes to replace the existing Sensus Touchread meter system with a fixed base automated meter read system. The new meter read system will completely automate the meter and billing system so that no human interface is needed between the meter reading to billing cycle. The work will include the following:

   A) Replace all 623 domestic (including residential, commercial, and recreational) Touchread endpoint devices at every meter and replace with an "Advanced Metering Infrastructure" (AMI) endpoint device, which will automatically send water use signals out to the receiving station. This work will also include supplying 27 spare endpoint devices for a total of 650 endpoint devices delivered to the site.
   B) Install the Fixed Base meter information receiving and transmitting station. This will include a propagation study to be conducted by the supplier in order to determine the number of antennae required for sufficient coverage and transmission. Currently, only one antennae is assumed to be required at the existing storage tank site. However, more may be required pending the results of the propagation study. The antennae itself will be responsible for receiving all signals from the AMI endpoint devices in the field and transmitting the data to the data collection hardware and software.
   C) Provide and install the back-end data collection software and platform hardware for interface with the user and existing billing software. This hardware and software must able to store and backup meter reading data, provide efficient interface with the water staff end users, and communicate directly with the existing billing software.

This upgrade from a touchread meter reading system to automated is probably considered to be **categorically ineligible** for Green Project Reserve Funding, thus requiring a business case (new automated meter reading systems need to be installed where there was no previous meter system in order to be considered categorically eligible).

2. Classification – the installation of an automated meter reading system can be considered a Green Reserve **Water Efficiency** and **Energy Efficiency** project.

3. Justification – as mentioned above, in 2008 the Town experienced approximately 19,038,362 gallons in lost or unaccounted for water (or 14% of all water produced). Of this amount, 11% is estimated to be lost through leaks (8% estimated to be lost through the lines proposed for replacement). The Town estimates that another 2% of all water is assumed to be "lost" through accounting. These losses in volume appear to occur through human error in the touch read meter reading process. An automated meter reading process would cut down these losses to virtually zero. On top of the reduction in unaccounted for water losses, the Town's water staff would experience increased efficiencies in staff operations, fleet gas use, and fleet O&M costs by converting the metering and billing of systems to an automated process.

   a. Water efficiency – Appendix E summarizes the savings recovered by going to a fully automated meter reading system in terms of lost billings. If 2% of all water produced is lost in meter accounting errors and data transfer problems with the touch read meter system, then approximately 2,710,846 gallons in 2008 were unbilled due to these issues. Using the same average rate structure prepared in the distribution system business case, an annual budget recovery of **$5,824.37** could be expected per year.
   b. Energy Efficiency – Going to an automated meter reading system would also result in improved staff and fleet efficiencies in the form of reduced labor, gas, and O&M costs. Town staff estimates that it spends 26 hours per month driving around town reading meters using the Touchread System. Using an average hourly rate of $25.00 per hour, plus $61.00 per month in gas and $5.00 per month in O&M costs, the Town should experience a savings of $716.00 per month, or **$8,592** annually.

4. Associated Cost – the estimated raw cost of providing and installing the fixed base automated meter read system as described above is approximately $294,000. Including contingencies, O&P, Davis-Bacon wage allotments, and Buy-American contingencies, the estimated component cost is **$349,937**. As mentioned above, the entire proposed loan request is for $1,732,517 (total project cost is $1,800,500 including all relevant studies, modeling, etc.). Annual savings estimated by converting the meter reading system over to an automated meter reading system totals at **$14,416.37** per year. The 20-year return on these annual savings at an interest rate of 6% would be **$165,400.** If the life span of the equipment can be stretched to 40-years, the return could be almost as much as the estimated cost of construction.

Appendix A

COLORADO STATE REVOLVING FUND PROGRAM
AMERICAN RECOVERY AND REINVESTMENT ACT
20% GREEN RESERVE BUSINESS CASE FORM
DISTRIBUTION LINE REPLACEMENT/REHABILITATION

Name of Applicant and Project: Town of Cheyenne Wells

Name of Person Preparing Form: Douglas E. Schwenke, P.E. w/ JDS-Hydro Consultants, Inc. (District Engineer for the Town of Cheyenne Wells)

Phone Number and e-mail Address: Dannie McMillan, Town of Cheyenne Wells (719) 767-5865; mcmillan@rebeltec.net

Name of Consulting Engineer: Douglas E. Schwenke, P.E. w/ JDS-Hydro Consultants, Inc.

Phone Number and e-mail Address: (719) 227-0072; dschwenke@jdshydro.com

Brief project description: Distribution line replacement.

Green Infrastructure Costs

For green project reserve funding, a business case is required for distribution line replacement projects in order to demonstrate water efficiency. Please provide the following information regarding the project:

Identify the problem in the existing facility and provide information documenting water loss (at minimum, system-wide, and more specific localized data if available):

See attached letter report.

1. Proposed linear feet of pipe replacement: **1,640** LF of 4" CIP; **331** LF of 2" Galvanized; **3,000** LF of 1¼" Galvanized; **150** LF of 1 ¼" Iron; **1,580** LF of ¾" Galvanized Services

2. Total length of distribution lines utilized by the utility: **103,000 LF (19.5 miles)** miles

3. Percent of lines being replaced: **7.0** %

4. Total cost of project: $**1,800,500 Total** ($1,732,517 prioritized as ARRA principal forgiveness)

5. Minimum pressure maintained in the distribution system. **40 (static); 30 (residual)** psi

6. Type of current pipe material to be replaced: 4" **CIP(not cement lined); 2" Galvanized; 1¼" Galvanized; 1¼" Iron; ¾" Galvanized Services**

7. Age of current pipe to be replaced: **1930's (all CIP pipe); 1940's (Galvanized pipe located near main street); 1960's (Galvanized pipe on west side)**

8. Current pipe to be replaced C-values: **64** – all CIP from 1930's; **75** – all galvanized pipe from 1940's; **90** – all galvanized pipe from 1960's

9. Current pipe to be replaced diameter: **4"** CIP(not cement lined); **2"** Galvanized; **1¼"** Galvanized; **1¼"** Iron; **¾"** Galvanized Services

10. Type of proposed pipe material: **DR 21 PVC (Distribution Mains); Type K Soft Copper (Service Replacement from new Mains to meters only)**

11. Proposed pipe C-values: **150** – for PVC pipe; **135** – for Copper pipe

12. Proposed Pipe Diameter: **Inside Diameter = 6.09", Outside Diameter = 6.90" (Distribution Mains); ¾" and 1" Service Replacements**

13. Water Volumes and Total amount of unaccounted for water through distribution losses, including line breaks

Water Volumes	Gallons per year
A. Total water produced and/or purchased from another water system (2008)	135,542,295
B. Total water sold (2008)	113,710,000
C. Total water loss (A – B)	21,832,295
D. Gallons of water attributed to:	
Hydrant flushing	200,000
Storage tank overflow	42,000
Water treatment plant use	N/A
Wastewater treatment plant use	N/A
Fire Department use	634,969
Other	1,916,964
E. Total gallons accounted for (Sum of D)	2,793,933
F. Total gallons unaccounted for (C – E) including line breaks	19,038,362
G. Percent of unaccounted for water (%)	14.05%

Please provide a discussion of how the quantity of unaccounted for water through distribution system losses was quantified. Provide information such as the number of metered connections, unmetered connections, # of gallons billed, estimated quantity of water through unmetered connections, etc. Please attach backup documentation such as billing information, operational records, etc. **Unaccounted for water (2008) was calculated by taking meter readings from all 5 production wells, then subtracting billed water from metered water production. Metered miscellaneous water was then calculated (i.e. hydrant flushing, storage tank overflow, fire department use, and park irrigation). Resulting in a total unaccounted for volume and percentage (listed above). The Town's water staff estimates that of the 14.05% of unaccounted losses totaled for 2008, 11% can be attributed for system wide water losses. Of the 11% of the system wide water losses, roughly 8% can be directly traced back to the lines being proposed for replacement as part of this project. Appendix A, Table 1 depicts a line by line inventory of lines to be replaced. As part of the inventory, water loss estimates are developed per linear foot of pipe (water loss rates per linear foot are dependent upon pipe age and material – and were developed through researching case studies of various other water loss studies for aged pipe, particularly in systems constructed in the 1920's and 1930's). From the inventory, it was estimated that roughly 11,421,000 gallons were lost through the proposed replacement lines, or 8.43%.**

14. Estimated quantity of water saved by replacing the distribution lines. Provide a description. **See Table 1 and Table 3, Appendix B. It is estimated that by replacing the distribution and service lines proposed in this project, roughly 8%, or 11,421,000 gallons can be saved annually on average. This is assuming minimal leakage out of the new pvc water lines.**

15. Provide an estimated amount of lost billings due to the amount of lost water in the portion of distribution lines to be replaced. This should include billing rate information in the analysis. **It is estimated that the Town loses an average of $25,858.14 annually to unbilled water. See Part I of the financial breakdown page in Appendix A. The Table shows an average rate estimate taking into account all rate structures in the town in order to take in consideration all affected rate. A list of all rate structures of the Town is provided in Appendix D.**

16. Estimated amount of breaks per year of pipe scheduled to be replaced for this project: **3 Service Breaks and 1 Main Break per Year (Table 4, App. A)**

17. Estimated number of affected service connections per line break event per year: **5 Customers per Service Break and 28 Customers per Main Break**

18. Estimated duration of water service interruption for repair: **1.5 days per service break and 1.5 days per main break**

19. Estimate the average total cost per line break repair. Provide a description as necessary. **$6,445.31 spent on repairing service breaks per year and $5,398.18 spent on repairing main breaks per year (this cost includes labor, parts, materials, asphalt, patching, flushing, etc.). See Table 4, Appendix A, Part II in the Financial Calculations Section, and Appendix C.**

20. Technical Component – Energy Efficiency
    a. If energy efficiency is relevant to project qualification as Green, please provide any available documentation regarding expected increases in energy efficiency. **It is anticipated that the reduction in head loss due to reduction in friction by replacing the aged pipes will result in greater pump efficiency and reduced input power. The majority of pipes proposed for replacement were installed between the 1930's and 1960's. All cast iron pipe being replaced was installed in the 1930's was not cement lined, thus resulting in extremely low C-values (conservatively estimated at 83). These lines are also extremely thin walled, resulting in extensive line breaks and leakage. Also, all galvanized mains and services are for the most part undersized and corroded, The C-Values for these lines will most likely fall in the 110 range. For the most part, system pressures are maintained via gravity from the elevated storage tanks. However, it estimated that system pressures are partially maintained by the well pumps, which pump into the system with residual water going up into the tank. A conservative estimate is that the well pumps use 15% of their pump time maintaining system pressures. A detailed calculation**

quantifying how much the Town will recoup in energy efficiency by replacing the old and undersized lines proposed in this project is shown in Part V. of the Financial Calculation Section in Appendix B.

b. Please provide the total annual operating costs for water treatment. This should include energy costs including pumping costs and chemical costs.
$ **19,086 in pumping costs and 2,013.14 in chemical costs**

21. Financial Component
    a. Please provide a detailed breakdown of cost and water savings from the project based on technical analysis of benefits, and an assessment of these savings comprise a substantial part of the financial justification. **The total overall savings provided by the project is comprised of five areas of savings: (recouped billings, line break savings, chlorination savings, savings from pumping lost water, and energy efficiency savings). These breakdowns are shown in Appendix B, Financial Calculations.**

    b. Estimated amount of savings per year as a result of distribution line replacement. For example, if the system determines that 5% of the total water produced can be saved as a result of the distribution line replacement project, then that percentage can be multiplied by the total annual costs to treat the water produced at the plant to determine the savings. $ **62,248 annually, or 714,000 over 20-years at a 6% rate of return.**

Appendix B

Replacement Line Inventory

Table 1

Segment			Material	Age (year)	Length (ft)	C-Value	Friction Loss (ft)	Estimated Leakage Rate (gpm/LF)	Estimated Leakage Total Gal/Yr.
North 1st Street West									
Services Replaced:	0.75	in	Galvanized	1960's	60	120	2.76	0.00001	315
Size of Line Replaced:	1.25	in	Iron Pipe	1930's	150	83	207.05	0.0065	512,460
Size of Line Replaced:	1.25	in	Galvanized	1960's	150	120	104.68	0.001	78,840
Size of Line Replaced:	4.00	in	Cast Iron	1930's	150	83	0.72	0.0065	512,460
TOTAL:					**510**		**315.21**		**1,104,075**
Replacement Services:	0.75	in	Copper	New	40	135	1.48	0	0
Replacement Line:	6.00	in	PVC	New	683	150	0.15	0	0
TOTAL:					**723**		**1.63**		**0**
North 5th Street West									
Services Replaced:	0.75	in	Galvanized	1960's	180	120	8.28	0.00001	946
Size of Line Replaced:	4.00	in	Cast Iron	1930's	170	83	0.82	0.0065	580,788
TOTAL:					**350**		**9.10**		**581,734**
Replacement Services:	0.75	in	Copper	New	30	135	1.11	0	0
Replacement Line:	6.00	in	PVC	New	528	150	0.12	0	0
TOTAL:					**558**		**1.23**		**0**
West 2nd Street North									
Services Replaced:	0.75	in	Galvanized	1940's	60	110	3.24	0.00001	315
Size of Line Replaced:	1.25	in	Galvanized	1940's	560	110	459.07	0.001	294,336
Size of Line Replaced:	2.00	in	Galvanized	1940's	331	110	27.57	0.001	173,974
TOTAL:					**951**		**489.88**		**468,625**
Replacement Services:	0.75	in	Copper	New	110	135	4.07	0	0
Replacement Line:	6.00	in	PVC	New	1031	150	0.23	0	0
TOTAL:					**1141**		**4.30**		**0**
North 3rd Street East / East 2nd Street North									
Services Replaced:	0.75	in	Galvanized	1940's	240	110	12.97	0.00001	1,261
Size of Line Replaced:	4.00	in	Cast Iron	1930's	1050	83	5.05	0.0065	3,587,220
TOTAL:					**1290**		**18.02**		**3,588,481**
Replacement Services:	0.75	in	Copper	New	225	135	8.32	0	0
Replacement Line:	6.00	in	PVC	New	1457	150	0.33	0	0
TOTAL:					**1682**		**8.65**		**0**
East 1st Street North and South									
Services Replaced:	0.75	in	Galvanized	1940's	615	110	33.23	0.00001	3,232
Size of Line Replaced:	1.25	in	Galvanized	1940's	768	110	629.58	0.001	403,661
TOTAL:					**1383**		**662.81**		**406,893**
Replacement Services:	0.75	in	Copper	New	615	135	22.75	0	0
Replacement Line:	6.00	in	PVC	New	768	150	0.17	0	0
TOTAL:					**1383**		**22.92**		**0**
East 4th Street North									
Services Replaced:	0.75	in	Galvanized	1940's	115	110	6.21	0.00001	604
Size of Line Replaced:	1.25	in	Galvanized	1940's	390	110	319.71	0.001	204,984
TOTAL:					**505**		**325.92**		**205,588**
Replacement Services:	0.75	in	Copper	New	125	135	4.62	0	0
Replacement Line:	6.00	in	PVC	New	390	150	0.09	0	0
TOTAL:					**515**		**4.71**		0

East 5th Street South									
Services Replaced:	0.75	in	Galvanized	1940's	120	110	6.48	0.00001	631
Size of Line Replaced:	1.25	in	Galvanized	1940's	390	110	319.71	0.001	204,984
TOTAL:					**510**		**326.19**		205,615
Replacement Services:	0.75	in	Copper	New	130	135	4.81	0	0
Replacement Line:	6.00	in	PVC	New	390	150	0.09	0	0
TOTAL:					**1030**		**4.90**		**0**
East 7th Street North									
Services Replaced:	0.75	in	Galvanized	1960's	190	120	8.74	0.00001	999
Size of Line Replaced:	1.25	in	Galvanized	1960's	740	120	516.43	0.001	388,944
TOTAL:					**930**		**525.17**		389,943
Replacement Services:	0.75	in	Copper	New	200	135	7.40	0	0
Replacement Line:	6.00	in	PVC	New	1220	150	0.27	0	0
TOTAL:					**1420**		**7.67**		**0**
Fairgrounds Line Replacement									
Size of Line Replaced:	4.00	in	Cast Iron	1930's	1320	83	6.35	0.0065	4,509,648
TOTAL:					**1320**		**6.35**		4,509,648
Replacement Line:	6.00	in	PVC	New	1320	150	0.30	0	0
TOTAL:					**1320**		**0.30**		**0**

TOTALS:

Replacements	Length	Head Loss	Estimated Annual Water Loss
4" CIP	1640 ft	13 ft	9,190,116 gallons
2" GALVANIZED	331 ft	28 ft	173,974 gallons
1 -1/4" GALVANIZED	2998 ft	2,349 ft	1,575,749 gallons
1-1/4" IRON PIPE	150 ft	207 ft	512,460 gallons
3/4" GALVANIZED SERVICES	1580 ft	82 ft	8,304 gallons
TOTALS:	**6699 ft**	**2678.6613 ft**	**11,460,603 gallons**
New	**Length**	**Head Loss**	**Estimated Annual Water Loss**
6" DR21 PVC	7787 ft	1.74 ft	0 gallons
3/4" COPPER SERVICES	1475 ft	54.57 ft	0 gallons
TOTALS:	**9262 ft**	**56.31 ft**	0 gallons

Overall System Information

Average System Flowrate: 50 gpm
Average Service Flowrate: 3 gpm

Minimum System Pressure: 40 psi (Static)
Minimum System Pressure: 30 psi (Residual)

Water Use Inventory

Table 2 - Water Volumes - 2008	
A. Total Water produced	135,542,295
B. Total Water Sold	113,710,000
C. Total Water loss (A-B)	21,832,295
D. Gallons of water attributed to	
Hydrant Flushing	200,000
Storage Tank Overflow	42,000
Water Treatment Plant Use	0
Wastewater Treatment Plant Use	0
Fire Department Use	634,969
Other (Parks)	1,916,964
E. Total Gallons accounted for	2,793,933
F. Total gallons unaccounted for including line breaks.	19,038,362
G. Percent of unaccounted water	14.05%

Table 3 - Leak Volume Estimate - 2008	
I. Estimated losses through leaks (%)	11%
J. Volume through leaks (gal)	14,909,652
K. Volume of lost water at line replacement locations	11,460,603
L. Estimated percent of losses at replacement locations	8%

Table 4 - Line Break Inventory - Since 1999
(For documented line break information see Appendix C)
* Note: All documented line breaks occurred in the proposed replacement areas

Year	Cost	Customers Affected	Duration
1999			
2 Service Line Breaks	$5,348.70	3	1.5 day each
2 Main Line Breaks	$11,554.08	47	3 days each
2000			
5 Service Line Breaks	$12,029.07	5	1 day each
1 Main Line Break	$2,395.00	19	1 day
2001			
4 Service Line Breaks	$10,656.57	7	2 days each
2002			
5 Service Line Breaks	$9,357.44	6	2 days each
2003			
3 Service Line Breaks	$5,597.84	4	1.5 days each
2004			
2 Service Line Breaks	$2,787.94	3	1 day each

2005			
4 Service Line Breaks	$5,094.57	6	1 day each
2006			
3 Service Line Breaks	$6,051.83	5	2 days each
2 Main Line Repairs	$2,245.50	19	1 day each
2007			
4 Service Line Breaks	$4,602.72	6	1 day each
2008			
3 Service Line Breaks	$2,926.40	4	1 day each
Projected Breaks per year			
3 Service Breaks per Year	$6,445.31	5	1.5 days each
1 Main Repair per Year	$5,398.19	28	1.5 days each

CLIENT: Cheyenne Wells
PROJECT: Green Project Reserve
DETAIL: Bus. Case Calcs

JOB NO.: 101.13
DATE: 6/15/2009

Financial Calculations

Part I. Unbilled Water

Volume of Lost Water to Leaks at proposed line replacement locations (2008) (Item K in Water Use Inventory)		11,460,603 gallons per year 955,050 gallons per month
Average User Rate from Town Billing (See Appendix D)	$72.25	20,300 Minimum Charge
	$1.55	79,700 per 1,000
	$2.30	99,999,999 per 1,000
Estimated Lost Billing per Month		$2,162.40
	per Year	**$25,948.81 Annually**

Part II. Line Break Savings

3 Service Breaks per Year	$6,445.31
1 Main Repair per Year (See Table 4)	$5,398.19
Estimated Line Break Cost Repairs per Year	**$11,843.50 Annually**

Part III. Chlorination

Estimated Cost to Chlorinate Raw Water (Cost provided by Town)	$0.0002 per Gallon pumped
Extra Gallons pumped per year lost to leakage (Item K in Water Use Inventory)	11,460,603 gallons per year
Estimated Total Cost to Chlorinate Lost Water	**$2,017.07 Annually**

Part IV. Pumping Lost Water

Annual Average Water Use: (From Water Use Table		145,327,296	Gallons
Average Annual Pump Rate:		276	GPM
Time required to pump excess water		11,460,603	Gallons
		41,449	minutes
		691	hours
Average Power per Pump:			
	North Well =	150	Hp
	Snyder #1 =	60	Hp
	Snyder #2 =	75	Hp
	Doty =	60	Hp
	Feyh =	75	Hp
	Average =	84	Hp
	Power Cost =	$0.08	$/kWh
Average Cost to Pump Lost Water per Year:		**$ 3,462**	**Annually**

Part V. Energy Savings Calculations

Average System Horsepower:		84	Hp (From Part IV. Above)
Average Annual Pump Rate:		276	GPM (from Part IV. Above)
Static System TDH:		364	ft
Average Pump Wire-to-Wire Efficiency:			
	North Well =	75%	
	Snyder #1 =	83%	
	Snyder #2 =	63%	
	Doty =	75%	
	Feyh =	80%	
	Average =	75%	
Dynamic Head Contributed by Replacment Lines: (See Totals in Replacement Line Inv.):		2,679	ft
Required Input Hp to Pump through replacement lines:		283	Hp
Annual Average Power Cost:		$ 147,635	
15% of pump power used for system press.		$ 22,145	

Dynamic Head Contributed by New 6" DR 21 PVC Lines: (See Totals in Replacement Line Inv.):	56 ft	
Required Input Hp to Pump through replacement lines:	39 Hp	
Annual Average Power Cost:	$ 20,394	
15% of pump power used for system press.	$ 3,059	ANNUALLY
ANNUAL PUMP SAVINGS	**$ 19,086**	

ANNUAL REPLACEMENT VALUE:	**$62,357**
20-Year Return	**$715,200**

Appendix C

Town of Cheyenne Wells, water repairs completed in the effected areas of the proposed water improvements.

1999

2 service lines effecting three customers total cost $5348.70
2 main line repairs effecting forty seven customers total cost $11,554.08

2000

5 Service lines effecting five customers total cost $12,029.07
1 main line repair effecting nineteen customers total cost $2,395

2001

4 Service lines effecting seven customers total cost $10,656.57

2002

5 Service lines effecting six customers total cost $9,357.44

2003

3 Services lines effecting four customers total cost $5,597.84

2004

2 Service lines effecting three customers total cost $2,787.94

2005

4 Service lines effecting six customers total cost $5,094.57

2006

3 Service lines effecting five customers total cost $6,051.83
2 Main line repair effecting nineteen customers total cost $2,245.50

2007

4 Service lines effecting six customers total $4,602.72

2008

3 Service lines effecting four customers total cost $2926.40

Appendix D

WaterWorks
A Utility Billing Software

Town of Cheyenne Wells

Rate List

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Water Rate	Inside City Limits		1
16.50000	Minimum Charge	3,000	
1.05000	Per 1000 for next	26,999	
1.15000	Per 1000 for next	19,999	
1.30000	Per 1000 for next	49,999	
2.30000	Per 1000 for next	99,999,999	
0.00000	Per 1000 for next		

Water Rate	Outside City Limits		2
22.50000	Minimum Charge	4,000	
2.05000	Per 1000 for next	95,999	
2.30000	Per 1000 for next	99,999,999	
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		

Water Rate	Large Consumers		3
200.00000	Minimum Charge	100,000	
1.30000	Per 1000 for next	399,999	
2.05000	Per 1000 for next	499,999	
2.30000	Per 1000 for next	99,999,999	
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		

Water Rate	2 Trailers		4
33.00000	Minimum Charge	6,000	
1.05000	Per 1000 for next	26,999	
1.15000	Per 1000 for next	19,999	
1.30000	Per 1000 for next	49,999	

WaterWorks
A Utility Billing Software

Town of Cheyenne Wells

Rate List

Printed 4/9/2009 @ 9:53

2.30000	Per 1000 for next	99,999,999	
0.00000	Per 1000 for next		

Water Rate — **3 Trailers** — 5

49.50000	Minimum Charge	9,000
1.05000	Per 1000 for next	26,999
1.15000	Per 1000 for next	19,999
1.30000	Per 1000 for next	49,999
2.30000	Per 1000 for next	99,999,999
0.00000	Per 1000 for next	

Water Rate — **4 Trailers** — 6

66.00000	Minimum Charge	12,000
1.05000	Per 1000 for next	26,999
1.15000	Per 1000 for next	19,999
1.30000	Per 1000 for next	49,999
2.30000	Per 1000 for next	99,999,999
0.00000	Per 1000 for next	

Water Rate — **8 Trailers** — 7

132.00000	Minimum Charge	24,000
1.05000	Per 1000 for next	26,999
1.15000	Per 1000 for next	19,999
1.30000	Per 1000 for next	49,999
2.30000	Per 1000 for next	99,999,999
0.00000	Per 1000 for next	

Water Rate — **2 Out Of City User** — 8

45.00000	Minimum Charge	8,000

2.05000	Per 1000 for next	95,999	
2.30000	Per 1000 for next	999,999,999	
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		

Water Rate **3 Out Of City User** 9

67.50000	Minimum Charge	12,000	
2.05000	Per 1000 for next	95,999	
2.30000	Per 1000 for next	99,999,999	
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		

Water Rate **Outside City 4 User** 10

90.00000	Minimum Charge	16,000	
2.05000	Per 1000 for next	95,999	
2.30000	Per 1000 for next	999,999	
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		
0.00000	Per 1000 for next		

Water Rate **Meters Shut Off** 11

0.00000	Minimum Charge	999,999,999	
0.00000	Per 1000 for next	999,999,999	
0.00000	Per 1000 for next	999,999,999	
0.00000	Per 1000 for next	999,999,999	
0.00000	Per 1000 for next	999,999,999	
	Per 1000 for next		

WaterWorks
A Utility Billing Software

Town of Cheyenne Wells

Rate List

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Water Rate		**Courthouse**		12
	60.00000	Minimum Charge	80,000	
	1.05000	Per 1000 for next	500,000	
	1.15000	Per 1000 for next	1,000,000	
	1.30000	Per 1000 for next	100,000,000	
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
Water Rate		**Meter Off Minium**		13
	10.00000	Minimum Charge	999,999,999	
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
Water Rate		**Freshwater**		16
	16.50000	Minimum Charge	3,000	
	2.00000	Per 1000 for next	999,999,999	
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
	0.00000	Per 1000 for next		
Trash Rate		**Trash Rate A**		14
	0.00000	Flat Rate		

WaterWorks
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Town of Cheyenne Wells

Rate List

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Other2 Rate	**Fire Dues Rate A**		15
0.00000	Flat Rate		
Sales Tax Rate	**0.0% Sales Tax**		17
0.00000	Flat Rate		

Appendix E

CLIENT: Chey. Wells
PROJECT: Green Project Reserve
DETAIL: Bus. Case Calcs

JOB NO.: 101.13
DATE: 6/15/2009

Meter Reader Justification

Meter Reading Costs for Touch Read System

1) Estimated time Monthly Reading Meters =	26	hours
2) Labor Costs (Meter Reader per Hour) =	$25.00	per hour
3) Estimated Gas Spent on Driving to Meters per Month =	$61.00	per month
4) Estimated Monthly Repairs =	$5.00	per Month
	$716.00	per Month
	$8,592	Annually

Meter Inaccuracies due to Human Error:

Total Water Used 2008:	135,542,295	gallons
Total Water Billed 2008:	113,710,000	gallons
Total Unbilled but Accounted for Water 2008:	2,793,933	gallons
Total Unaccounted for Water (2008):	19,038,362	gallons
% Unacounted for Water (2008):	14.05%	
Amount Unaccount. Water attrib. to leaks:	14,909,652	
% Unaccounted for Water attributed to leaks:	11.00%	
% Unaccounted for Water attibuted to Poor Metering Activities:	2.00%	
Amount Unaccount. Water attrib. to meters:	2,710,846	gallons / year
	225,904	gallons / month

Annual Lost Billings in Meter Inaccuracies:
Town Billing (See Appendix D)

$72.25	20,300	Minimum Charge
$1.55	79,700	per 1,000
$2.30	99,999,999	per 1,000
Estimated Lost Billing per Month	$485.36	
per Year	$5,824.37	Annually

Total Annual Savings by Replacing Meter Read System: $14,416.37 Annually

20-Year Return $165,400

JDS-HYDRO CONSULTANTS, INC.

April 27, 2009

Carolyn Schachterle, Unit Manager
Financial Solutions Unit
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, Colorado 80246

RE: Business Case Substantiating Water Efficiency Improvements in regards to line replacement

Dear Ms. Schachterle,

One of the components of the proposed improvements to the water system includes providing approximately 8,250 LF of 6" water pipe for the purpose of improving water efficiency, accountability, and service pressures within the Town of Cheyenne Wells water distribution system. The proposed improvements include replacing approximately 7,000 LF of old and undersized pipe, the majority of which exist in the oldest segments of town. These lines include old, galvanized 1¼", 2", and 4" size pipe which serve as main distribution lines through parts of the commercial and residential districts of town. The existing water staff has not attempted to remove and replace these lines as they represent some of the most difficult and expensive portions of line to replace. The remaining segments of 6" lines represent areas where it is imperative to complete loops to provide sufficient fire flows and pressures for affected residents and businesses. Without the implementation of these loops present and future residents and businesses in these areas could not be assured safe fire fighting capabilities in the event of a fire. Completion to these loops is imperative to the future business and economic development of the Town.

The town initiated a meter replacement program in 2002 where the staff embarked on replacing old existing meters and researching customers that had not been previously metered. The intent of this program was to try and reduce the span between recorded well production and billed usage, which had grown as high as 23.34% in 1999 (see Table 1 below). Since 2002 accountability improved steadily until 2006, where it jumped up again above 20% (10% to 20% accountability is average for community water systems). With the entire water system having rotated and installed new meters it is likely that some of the older piping in town is beginning to experience continued, and possibly, exacerbated leakage.

Replacement of the existing lines, as well as implementation of the proposed loops could save the town thousands of gallons in lost water annually, as well as improved efficiency in water delivery. Rough preliminary calculations estimate that approximately 1,000,000 to 2,000,000 gallons of water could be saved annually through the replacement of old pipe and improved efficiencies. This in turn translates into a cost savings of anywhere between $10,000 to $50,000 annually when taking into account reduced pumping costs and recoup of lost revenues. These numbers will improve even more with the inclusion of the proposed fixed based meter system as part of this project.

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Table 1: Water Accountability – Well Production vs. Billed Usage

Year	Well Production (gal)	Billed Usage (gal)	Difference (gal)	% Diff. (%)
1998	143,853,199	128,943,321	(14,909,878)	-10.36%
1999	151,012,198	115,760,711	(35,251,487)	-23.34%
2000	161,037,700	132,748,083	(28,289,617)	-17.57%
2001	149,341,399	120,087,080	(29,254,319)	-19.59%
2002	167,660,200	131,513,440	(36,146,760)	-21.56%
2003	141,036,208	113,424,109	(27,612,099)	-19.58%
2004	116,575,228	96,856,665	(19,718,563)	-16.91%
2005	131,013,465	111,173,823	(19,839,642)	-15.14%
2006	150,542,151	112,841,090	(37,701,061)	-25.04%
2007	150,986,213	108,003,240	(42,982,973)	-28.47%
2008	135,542,295	113,710,000	(21,832,295)	-16.11%

Thus, it can be anticipated that by incorporating the line replacement into the overall "green initiative" of the project the overall efficiency of the water distribution system can be significantly enhanced. Substantial operating and maintenance costs savings can be anticipated by the Town, along with improvements to service pressures, fire flows, and water accountability. These improvements will also lay the foundation towards residential and business development for a community which sorely needs.

We would recommend that CDPHE consider the proposed line replacement program as a water efficiency element to the overall "green initiative" program.

Respectfully,
JDS-Hydro Consultants, Inc.

Douglas E. Schwenke, P.E.
(c/o the Town of Cheyenne Wells)

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