PAVILLION AREA WATER SUPPLY LEVEL II STUDY

FOR THE
WYOMING WATER DEVELOPMENT COMMISSION

January 2013

In association with:

James Gores, Associates

Westerstein & Associates

& HINCKLEY CONSULTING
PAVILLION AREA WATER SUPPLY LEVEL II STUDY

Submitted to:
STATE OF WYOMING
WATER DEVELOPMENT COMMISSION
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January 2013
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Chapter I – Introduction and Summary

Area History

The Town of Pavillion, Wyoming, is a small, rural, agricultural community in north-central Fremont County, Wyoming. The Town was established in the early 1900’s. It served as a work camp for the Department of Interior Bureau of Reclamation when the Bureau was constructing the Midvale Irrigation Project between the 1920’s and the 1950’s. Following World War II, several thousand acres of uncultivated land was offered to returning veterans by allotment drawing on the Midvale Project. Much of that land was located east of the Town of Pavillion.

The economic capabilities of most of these people who were starting a farm from raw ground left little to invest in a house and its water supply. In the area east of Pavillion water could reliably be obtained from wells, however, getting good quality water was uncertain. Most wells produce water of only marginal quality. It was also noticed that some natural gas was commonly noticed in drilling these wells. Unlike the wells in the rural area east of Town, the Town’s wells produced significantly more palatable water.

Shell Oil began development of natural gas in the area northeast of Town in the 1960’s. Shell sold the field and the Pavillion Gas Field was further developed in the late 1970’s and 1980’s by a succession of owners. In recent years, the gas field operator has applied techniques to stimulate production from the field including hydraulic fracturing (fracking). Some nearby rural residents voiced concerns that this stimulation led to a noticeable decline in the quality of the water produced from their domestic wells. The situation attracted wide-spread media attention.

Project Origin

In 2009, the Environmental Protection Agency (EPA) began researching the groundwater quality issue, and, in late August 2010, the EPA recommended that rural residents not drink water from their private wells due to groundwater contamination. In September 2010, then Governor Freudenthal directed the Wyoming Water Development Commission (WWDC) to conduct a Study to identify long-term solutions to groundwater quality issues of the domestic wells in the rural Pavillion area.

Between 2010 and 2012, the Commission-funded a Pavillion Area Water Supply Level I Study ($148,500) and an extended Level I Study ($25,000) for a total of $173,500, and a Pavillion Water Supply Level II Study for an additional $90,000. In 1995 and 1996, the WWDC also funded a $300,000 Town of Pavillion Level III Water Supply Project which constructed a water well, storage tank, and transmission line for the residents of the Town of Pavillion.

In the course of the 2010 Level I Study, the area’s geology and groundwater resources were extensively inventoried and the massive amount of data gathered by the EPA was evaluated. Through that Level I Study, it was determined that the most cost effective means of providing drinking water to the area’s widely scattered residences was through cisterns. In its 2012 session, the Wyoming Legislature appropriated $750,000 through the WWDC for the purpose of providing a long-term solution for the affected rural residents living within the study area.
designated in the Level I Study Report. It was determined that cisterns would be the most viable solution of options presented in the Level I Study Report.

**Implementation**

The State of Wyoming, through local media and a May 31, 2012 public meeting in Pavillion, notified area residents of the State’s program to install cisterns for those residents wishing to use a cistern in lieu of their private well. Residents were told that the State would accept requests for cistern systems through August 15, 2012. By that date, approximately 20 residents within the Study area requested to receive a cistern system. Under the program, the State intends to fund the installation at no cost to eligible residents who agree to the terms of a forthcoming agreement with the State. In exchange for the cistern installations, the cistern agreements will provide for access to the private wells of the rural residents by the State of Wyoming Department of Environmental Quality (DEQ) for the purpose of future groundwater-quality monitoring of these wells.

The cisterns, as envisioned, are intended to serve only domestic needs. In most cases, other water demands such as livestock watering, lawns, gardens, and the like can be supplied either through the irrigation ditch system or the existing homeowner wells.

**Focus of This Study**

This Level II Study further refines findings and costs developed in the October 2011 Pavillion Area Water Study Level I Study Final Report. Refinements include a full aquifer testing of the Town of Pavillion’s wells. The information developed from that evaluation shows that Pavillion’s present wells have sufficient water production capacity to serve both the forecast growth needs of the Town itself, and to serve as a hauled water source for those rural residents wishing to use cisterns in lieu of their private wells.

This study also further details the improvements recommended to be made to the Town of Pavillion’s water system to assure that it can meet these future service demands. Refined cost estimates and preliminary sketches depicting those recommendations are also presented. Conceptual sketches and refined cost estimates for a prototype cistern system are also presented.
Chapter II – Evaluation of the Town of Pavillion Water Supply

Supply Background and Analysis

Introduction and Background

This section of Chapter II describes the results of our investigation of the Town of Pavillion well field, including extended pump tests of Wells No. 6 and 8. This work was a follow-up of the Pavillion Area Water Supply Level I Study (James Gores and Associates, P.C., 2011). Results from the Level I investigation indicated that the Town appeared to have adequate flow to address the rural system needs. However, since none of the Town of Pavillion wells had undergone an extensive pump test it was recommended during the Level I Study that the production potential be verified by conducting pump tests on the two wells that are projected to be utilized the most by the Town of Pavillion.

The Level I Study provides extensive background on the overall project of which this chapter is a part, including the history and results of the investigations to date by the Gores consulting team and others. Chapter 3 of the Level I Study provides a description of the geology and hydrogeology of the Wind River aquifer from which the Town of Pavillion draws its municipal water supply. Table II-1 provides a summary of completion and production information for the Town of Pavillion wells, as compiled from a variety of published, unpublished, and file sources, and direct measurements taken for the Level I Study and the present Study. Thus, there is a great deal of “apples and oranges” in the table, and comparisons between wells are approximate only.

The Level I Study documents a current peak-day demand of approximately 40,000 gallons for the Town of Pavillion well field, and projects an increase of 6,800 gallons (peak day) if the system were drawn upon to supply rural residential needs in the surrounding area. Thus, the primary question for the present study is, “Can the Town of Pavillion municipal well field reliably support a 20% increase in demand?”

2012 Well Testing

As reported in the Level I Study, there has never been systematic, multi-day testing of any of the Pavillion wells. Thus, a primary objective of the present investigation was to subject select wells to sustained pumping while carefully measuring the resulting drawdown. As noted in the earlier report, about all that has been previously known about these wells is that they seem to do the job without, as far as anyone can tell, undue wear and tear on the pumps or significant depletion of the aquifer.

To investigate the production characteristics of the Town of Pavillion well field, a series of pump tests were conducted in May, 2012. The two most productive wells, Nos. 6 and 8, were selected for monitoring drawdown during five (5) days of continuous pumping. Each pumped well was paired with another Town well to serve as an observation well, in which drawdown was also monitored during the pumping period. Wells No. 7 and 1 served as observation wells for Wells No. 6 and 8, respectively. Well discharge was measured using the installed wellhead flow meters. Drawdown was logged at 1-minute intervals using down-hole pressure transducers.
<table>
<thead>
<tr>
<th>Water Right</th>
<th>No. 1</th>
<th>No. 4</th>
<th>No. 6</th>
<th>No. 7</th>
<th>No. 8</th>
</tr>
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<tbody>
<tr>
<td>SEO Permit</td>
<td>P1111W</td>
<td>P59104W</td>
<td>P70972W</td>
<td>P76991W and P73491W; can.</td>
<td>P98757W and P102274W enl</td>
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<tr>
<td>Completion (Year)</td>
<td>1950</td>
<td>1982</td>
<td>1986</td>
<td>1987</td>
<td>1995</td>
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<tr>
<td>Depth (ft)</td>
<td>495</td>
<td>510</td>
<td>506</td>
<td>515</td>
<td>517</td>
</tr>
<tr>
<td>Diameter (in)</td>
<td>8</td>
<td>8</td>
<td>8-5/8</td>
<td>7</td>
<td>6-5/8</td>
</tr>
<tr>
<td>Completion</td>
<td>6&quot; liner; torch slots 470-500</td>
<td>torch slots w/ gravel 345-510</td>
<td>screen w/ filter 478-483, 493-498</td>
<td>screen w/ filter 472-477; 505-510</td>
<td>screen w/ filter 300-305, 500-505</td>
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<td>Primary Aquifer</td>
<td>476 - 484</td>
<td>480 - 500</td>
<td>(not listed)</td>
<td>(not listed)</td>
<td>(not listed)</td>
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<td>Pump Setting (ft)</td>
<td>491 (inferred from M-M, '84)</td>
<td>488 (SOC; 458 (M-M, '84)</td>
<td>475 (SOC; 1989 report; file (nd))</td>
<td>500 (SOC; 1989 report; file, nd)</td>
<td>420 (SOC; file, nd)</td>
</tr>
<tr>
<td>Hydraulics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Permit Yield (gpm)</td>
<td>40</td>
<td>45</td>
<td>30</td>
<td>30</td>
<td>30 + 35</td>
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<tr>
<td>Measured Yield (gpm)</td>
<td>67 - 24.9 (M-M, '84); 29 (Gores, 2011)</td>
<td>46.5 - 19.5 (M-M, '85); 17 (DEQ, '10)</td>
<td>27 (M-M, '86); 27 (DEQ, '10); 29 (Gores, 2011); 28 (this study)</td>
<td>19.5 - 16.2 (M-M, '87); 27 (DEQ, '10); 27 (Gores, 2011)</td>
<td>57 (DEQ, '10); 52 (Gores, 2011)</td>
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<td>Aquifer Parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static Depth-to-Water (ft)</td>
<td>150 (SOC; 12/49); 201 (M-M, 8/84); 68 (files, 10/01); 93 (2/11); files: &quot;was&quot; 183, &quot;between 68 and 333&quot;; 44 (this study)</td>
<td>300 (SOC; 10/82); 355 (M-M, 8/84); 175 (file, nd); 216 (2/11)</td>
<td>165 (SOC; 9/86); 230 (files, 4/02); 203 (2/11); files: &quot;was 185&quot;; 196 (this study)</td>
<td>269 (SOC; 12/87); 291 (M-M, 3/87); 185 (files, 10/01); 170 (2/11); files: &quot;was 175&quot;; 169 (this study)</td>
<td>22 (SOC, 11/95); 29 (2/11); 29.5 (this study)</td>
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<tr>
<td>Approximate Transmissivity (gpd/ft)</td>
<td></td>
<td></td>
<td>250 (this study)</td>
<td>390 (this study)</td>
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</tr>
<tr>
<td>Pumping Water Level</td>
<td>450 (file, nd)</td>
<td>475 (file, nd)</td>
<td>285 (2/11); 317 (this study)</td>
<td>348 (2/11)</td>
<td>139 (2/11); 158 (this study)</td>
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<td>Approximate Specific Capacity (gpm/ft)</td>
<td>0.07</td>
<td>0.07</td>
<td>0.18 (this study)</td>
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<td>0.36</td>
</tr>
<tr>
<td>Water Quality</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Dissolved Solids (mg/L)</td>
<td>644</td>
<td>576</td>
<td></td>
<td></td>
<td>813</td>
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<td>Conductivity (umhos/cm)</td>
<td>1044 (2/11)</td>
<td>861; 877 (2/11)</td>
<td>1919 (2/11)</td>
<td>1261; 1231 (2/11)</td>
<td></td>
</tr>
<tr>
<td>Sodium (mg/L)</td>
<td>210</td>
<td>173</td>
<td>393</td>
<td>255</td>
<td></td>
</tr>
<tr>
<td>Sulphates (mg/L)</td>
<td>460</td>
<td>300</td>
<td>847</td>
<td>439</td>
<td></td>
</tr>
</tbody>
</table>

Sources: SOC = Wyoming State Engineers Office Statement of Completion; 1989 report = report in Town files; M-M, '84 and M-M '85 = Morrison and Maierle, 1984 and 1985; Pavillion Area Water Supply Level I Study (James Gores and Associates, P.C., 2011(Gores, 2011)); "files" are undated material in Town files; see text for complete references.
Prior to initiation of sustained pumping, each well pair was allowed to recover for 3 days from the effects of the general production of the well field, during which time the Town’s water needs were met exclusively by the most distant well in the well field to minimize interference. The test discharge rates were not the maximum output for the installed pumps, as flow was deliberately restricted somewhat to ensure our ability to reduce backpressure over the course of the test in order to maintain an approximately constant discharge rate.

**Wells No. 6 / 7 Test Summary:**

- **Pre-test Recovery Period:** 5/7 - 5/10/2012
- **Start of pumping:** 5/10/2012
- **Pumping duration:** 5.0 days (7173 min)
- **Recovery monitoring:** 1.1 days (1564 min)
- **Production Well:** No. 6
  - Static-water-level: 196 ft. (rising at .042 ft/hr at end of pre-test recovery)
  - Discharge rate: 20.6 gpm (average; slight variation over course of test)
  - Final Drawdown: 121 ft. (pumping water level = 317 ft.)
  - Specific Capacity at final drawdown: 0.18 gpm/ft
- **Observation Well:** No. 7
  - Static-water-level: 169 ft. (rising at .029 ft/hr at end of pre-test recovery)
  - Distance: 1030 ft.
  - Final Drawdown: 12.2 ft. (depth to water = 181 ft.)

As presented in Table II-1, Wells No. 6 and 7 are very similar in depth and completion intervals, but are remarkably different with respect to static water levels and groundwater quality. Of course, measurement of a truly “static” water level (i.e., the natural depth to water, undisturbed by any well production) in an active well field is virtually impossible. Although all the values listed in Table 1 were presumably taken in a “well OFF” condition, much of the variations are likely due to the effects of pumping other wells in the well field and of the length of time the well being measured had been off. The only two times at which simultaneous measurements have been taken were for the present investigations (2/2011 and 5/2012). In both instances the “static” water level in No. 6 was lower than in Well No. 7.

Although the pre-test water level in Well No. 6 was rising at a somewhat faster rate than the water level in Well No. 7 after three days of stabilization (rates listed above), the remaining difference of 27 ft. seems too large to disappear over time. More likely, much of this difference reflects a natural groundwater gradient between the two wells, reflecting the varying permeabilities and geometries of the individual layers and lenses that make up this aquifer. That the two wells do not share a simple, common water-bearing stratum is also demonstrated by the substantial difference in groundwater quality (discussed below).

Figure II-1 presents all of the drawdown measurements taken during this test. Both wells had been pumping the day prior to shutting down for our pre-test recovery period. The recovery from that pumping is obvious in the drawdown data for both wells. Also obvious is the hydraulic connection of the wells, as reflected in the response in Well No. 7 to the start and stop of pumping in Well No. 6. (Note that the plots for the two wells have different vertical scales; the drawdown in Well No. 7 was a much-subdued reflection of the drawdown in Well No. 6.)
Based on a simple “Jacob” plot (Figure II-2), the drawdown data from Well No. 6 indicates an aquifer transmissivity of approximately 217 gpd/ft. At the conclusion of five (5) days of continuous pumping, the pumping water level was still 161 ft. above the highest screened section and 158 ft. above the reported pump setting. The pumping rate of 21 gpm was using 42% of the available drawdown, suggesting a somewhat higher pumping rate (e.g., 30 - 35 gpm) could have been accommodated. Since the full discharge of this pump is approximately 28 gpm, the pump appears to be appropriately sized for this well.

The drawdown response in Well No. 7 to the pumping of Well No. 6 is plotted on Figure II-3. The measured drawdown can be approximated by the Theis Equation (i.e., an ideal, homogeneous, confined aquifer) using a transmissivity of 430 gpd/ft and a storage coefficient of $7 \times 10^{-5}$. These are not unreasonable values for this aquifer, but there are many combinations of aquifer properties that could produce the observed result in this multi-layered aquifer.
Pavillion Well No. 6 Drawdown
May 10-15, 2012

Transmissivity
Approx. 220 gpd/ft
Q = 21 gpm

Near well Effects and Flow Adjustments

FIGURE II-2

Pavillion Well No. 7
Constant Rate Drawdown Test
Theis Curve Match

Ideal "Theis" aquifer with:
T = 390 gpd/ft;
S = 8x10^{-5}

FIGURE II-3
Wells No. 8 / 1 Test Summary:

- Pre-test Recovery Period: 5/16 - 5/21/2012
- Start of pumping: 5/21/2012
- Pumping duration: 4.2 days (6020 min)
- Recovery monitoring: 3.9 days (5553 min)

**Production Well: No. 8**
- Static-water-level: 29.5 ft. (rising at 0.037 ft/hr at end of pre-test recovery)
- Discharge rate: 46.7 gpm (average, slight variation over course of test)
- Final Drawdown: 129 ft. (pumping water level = 158 ft.)
- Specific Capacity at final drawdown: 0.36 gpm/ft

**Observation Well: No. 1**
- Static-water-level: 44.0 ft. (rising at 0.007 ft/hr at end of pre-test recovery)
- Distance: 1190 ft.
- Final Drawdown: 8.0 ft. (depth to water = 52.1 ft.)

**FIGURE II-4**

Unlike the Well 6/7 pair, Wells Nos. 8 and 1 are not completed the same. Well No. 8 includes screened sections at 300 - 305 ft. and 500 - 505 ft. in depth, whereas Well No. 1 is open (slotted casing) only to the 470 - 500 ft. depth. As demonstrated on Figure II-4, the wells are clearly in hydraulic communication, most likely via the deeper water-bearing zone(s) which they may share. While both wells’ “static” water levels were still recovering at the beginning of the
pumping period, the difference was increasing rather than decreasing. A downward gradient between the 300 ft. and the 500 ft. zones is indicated, and groundwater is likely flowing between the two via the No. 8 wellbore when that well is off. This suggests that a portion of the groundwater withdrawn from Well No. 1 may originate in the shallower zone of Well No. 8. If so, the similarity in water quality may not reflect “native” conditions at Well No. 1.

The drawdown data from Well No. 8 (Figure II-5) indicates an aquifer transmissivity of approximately 970 gpd/ft in the immediate vicinity of the wellbore (i.e., for the first approximately 250 minutes), with a long-term effective transmissivity of approximately 690 gpd/ft. At the conclusion of five (5) days of continuous pumping, the pumping water level was still 140 ft. above the highest screened interval and 262 ft. above the reported pump setting. Based on this test, Well No. 8 should be capable of sustained production at the discharge capacity of the installed pump (47 gpm) without danger of excessive drawdown.

The test pumping rate of 47 gpm was using 48% of the available drawdown, suggesting a somewhat higher pumping rate (e.g., 70 gpm) could have been accommodated. Since the full discharge of this pump is approximately 50 gpm, it appears a somewhat higher-capacity pump could be considered.

If Well No. 8 is producing from two different water-bearing zones (i.e., at 300 and at 500 ft.), only a portion of the discharge is coming from the deep zone apparently shared with Well No. 1. Application of the aquifer storage coefficient suggested by the Well No. 6 / Well No. 7 data provides the close theoretical (ideal, “Theis” aquifer) match to the Well No. 1 data plotted on Figure II-6 if a transmissivity of 250 gpd/ft and production rate of 14.5 gpm are used. These values suggest there is a reasonably continuous water-bearing zone of modest transmissivity at the 500-ft. depth beneath the Town of Pavillion, and that the majority of the water being produced from Well No. 8 is from the upper zone.

**Summary of Pavillion’s Ability to Meet the Town’s Own Future Demands**

This testing directly demonstrated the ability of Wells No. 6 and 8 to sustain continuous production at the capacity of the installed pumps, and suggests Well No. 8 is likely capable of increased production. The obvious hydraulic connections between the wells – at least between Wells No. 6 and 7, and Wells No. 8 and 1 – demonstrates that the wells are not completed in isolated water-bearing zones. Despite the variations in “static” water levels, groundwater moves within and between the various sub-aquifers.

Although the other wells of the well field, i.e., Nos. 1, 4, and 7, were not directly tested, it is reasonable to conclude that they too have the general ability to sustain discharge at the capacities of the installed pumps. Well No. 1, for example, is reported to have been pumped continuously for a three (3) day period without drawdown of a magnitude to cause discernible problems.
Under current conditions, the set of Wells No. 6, 7 and 8 pump for an average of three (3) hours per day during peak use periods, while the set of Wells No. 1 and 4 pump for an average of six (6) hours per day (James Gores and Associates, P.C., 2011). As was noted earlier, based on the results from the recent series of pump tests, it appears that the pumps in all of the wells are properly sized with the exception of the pump in Well No. 8 which could be enlarged. The pump tests also demonstrate that the wells are capable of sustaining their current production rates for an extended period of time well beyond that of the three (3) to six (6) hour pumping period currently documented. Also, as noted, Well No. 8 is capable of producing at approximately nearly one-and-a-half (1½) times the rate of its current installed pump. Therefore, the existing wells are easily capable of satisfying the existing demands of the Town of Pavillion. If the pumping capacity of Well No. 8 were increased from 50 gpm to 70 gpm and the pumping period of Wells No. 6, 7, and 8 increased from their current peak production pumping period of three (3) hours per day to six (6) hours per day, the production capacity of the well field would increase from approximately 36,000 gallons to 62,300 gallons, or approximately a 75% increase. With the presently installed pumps, the Pavillion wells are capable of producing nearly 56,000 gallons per day if all of the wells were pumped for a six-hour (6 hr.) period. This is an increase of over 50% from their current peak production volume. This indicates that the Town of Pavillion can sustain a 50% growth in its population by doing nothing more to its existing well field other than increasing the production period from Wells No. 6, 7 and 8 from three (3) hours per day to six (6) hours per day.
Area Potable Water Demand

Because the Town of Pavillion hosts the Wind River Kindergarten to 12th Grade Schools, an anomaly exists in forecasting demand on the water system. The student and faculty population of these schools exceeds that of the Town. Population data from the 2010 census indicates the population of Pavillion is 231 people. Based on school records, the schools’ student and faculty population alone is 488, of which 319 live outside of Town. Forecasting demand on the Town’s system is further complicated by attempting to quantify how many rural area residents may eventually rely on the Town’s system as the water supply for their residential cisterns. The resulting forecast was more fully shown in Table II-2 on page II-10 below.

In the course of this investigation, an extensive analysis of the Town of Pavillion’s well field production records was conducted to determine the Town’s historical average daily water demand. In addition, the well field’s production capacity was evaluated through a series of long duration pump tests. This allows a comparison of water supply versus demand, both present and future.

The Town’s annual water production has averaged approximately 7.3 million gallons since 2005. The schools’ metered usage averages approximately 0.9 million gallons annually. School is in session for only 155 days per year; however, the school’s water usage was averaged over a full calendar year for consistency when forecasting usage. This indicates an average demand of 2,466 gallons per day (gpd) for the schools. The remainder of the water is used by Town residents, which equates to a usage of 17,534 gpd. The sum of these two values is the 20,000 gpd demand found in analyzing Town records.

Between 2005 and 2011, monthly well production averaged 613,777 gallons, which translates to 20,160 gpd. By ordinance, Town residents are not permitted to use Town water for their lawns; they must use irrigation water. Because of this, water usage throughout the year remains seasonally uniform when compared to other communities. Analysis of the Town’s water productions shows that the difference between the highest and lowest monthly usage varies from year to year. The highest month usage varies from about 30% to 100% more than the lowest.

There are no foreseeable factors that should abnormally affect Pavillion’s population growth and that of the rural area over the next 30 years. It is expected to grow at the same rate as the rest of Fremont County, which Wyoming Department of Administration and Information estimates to be 1.15 percent annually. Using 2010 census data and this projected growth rate, the population of the Town of Pavillion in the year 2040 is expected to be 326 people.

The other factor to consider when determining the future demand on the Pavillion system is the schools’ student and faculty population. In 2010, the out-of-town school faculty and student population was 319 people. The school is expected to grow at the same rate as Pavillion and Fremont County. Using these values, the out-of-town school population is predicted to be 450 in the year 2040. Again these figures are shown in Table II-2.

Using the aforementioned average daily water usage values, the current per capita usage is 80 gallons per capita per day (gpcd) for the Town and twelve (12) gpcd for out-of-town students and faculty. If the Town and the schools grow at the projected rate, the average daily water usage in
the year 2040 will be approximately 26,040 gallons. As will be discussed in Chapter III, the Town’s well field is capable of meeting this forecast demand.

**Ability of Pavillion Wells to Meet Rural Cistern Water Demands**

Assuming three (3) people per residence and 80 gallons per day per capita the estimated demand for the rural users is 240 gallons per day per residence (James Gores and Associates, P.C., 2011). This rate assumes the house water use consists only of drinking, cooking, bathing, and laundry. As described above, during the current peak production periods, if the wells are pumped for an average of six (6) hours per day, the Town’s production capacity is approximately 56,000 gallons. This is nearly 20,000 gallons above the current peak period demand. Therefore, the Town of Pavillion could presently meet the demands of approximately 83 rural cistern systems by just increasing the production period of Wells No. 6, 7 and 8 from three hours per day to six hours per day. Since, only a 20% increase in demand on the Town’s production is anticipated by the year 2040 due to supplying rural cisterns (6,800 gallons per day) (James Gores and Associates, P.C., 2011), the existing well field will be able to easily satisfy this slight increase in demand. That is shown in Table II-2.

<table>
<thead>
<tr>
<th>TABLE II-2</th>
<th>Pavillion Area Water Demand Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Daily Water Demand Forecast</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Year</strong></td>
<td><strong>Town Population</strong></td>
</tr>
<tr>
<td>2010</td>
<td>231</td>
</tr>
<tr>
<td>2020</td>
<td>259</td>
</tr>
<tr>
<td>2030</td>
<td>290</td>
</tr>
<tr>
<td>2040</td>
<td>326</td>
</tr>
</tbody>
</table>

Looking at the projected demand of the Pavillion system, the estimated average day demand for the Town of Pavillion (including the school demand) in the year 2040 is approximately 31,450 gallons (James Gores and Associates, P.C., 2011). Historically, Pavillion’s peak day demand has been approximately twice that of the average day demand, therefore, in 2040 the projected peak period demand for the Town of Pavillion proper is 62,900 gallons. In order to meet this demand, the production from Well No. 8 would need to be increased from 50 gpm to 70 gpm and the pumping period for all of the wells will need to be six (6) hours per day (estimated production of 62,300 gallons). If during this same period, the number of rural homes receiving water via a water hauling/cistern system had increased to 40, the total peak period demand would be approximately 72,500 gallons (62,900 gallons from the Town proper and 9,600 gallons from the 40 rural residential systems). In order to satisfy this demand, the production from Well No. 8 will need to be increased from 50 gpm to 70 gpm and the pumping period for the Wells No. 1, 4 and 7 could remain at six (6) hours per day and the pumping period from the two more productive wells (Nos. 6 and 8) would need to be increased from six (6) hours per day to seven-and-six-tenths (7.6) hours per day (or roughly eight (8) hours per day).
Conclusions

Under each demand forecast scenario, the Town’s present well field is able to meet demand. Under current conditions, the set of Wells No. 6, 7 and 8 pump for an average of three (3) hours per day during peak use periods, while the set of Wells No. 1 and 4 pump for an average of six (6) hours per day (James Gores and Associates, P.C., 2011). To sustain the projected 20% increase in demand (rural cistern users), with no changes in operations, the alternating sets of wells would be required to pump as follows:

- Wells No. 1 and 4 pump for the same length of time – six (6) hours, while
- Wells No. 6, 7, and 8 will be required to increase their pumping time from approximately three (3) hours per day to four-and-sixty-seven-hundredths (4.67) hours per day.

Clearly, the wells directly tested – Nos. 6 and 8 – can sustain substantially increased use. Based on the performance of these two wells, the inter-well aquifer information developed by the use of Nos. 1 and 7 as observation wells, and the historical performance reports, we are confident that the other three active wells in the well field – Nos. 1, 4, and 7 – could also support a modest increase in withdrawals.

Groundwater Quality

Table II-2 shows water quality data for seven wells for the Town of Pavillion. There are no available data for Well No. 2, which is not in use. Wells No. 3 and 5 have been abandoned. (Limited data for these wells are provided in the Pavillion Area Water Supply Level I Study (James Gores and Associates, P.C., 2011) The Town currently uses Wells Nos. 1, 4, 6, 7, and 8. Town wells data were obtained from Morrison-Maierle (1984), the State Engineer’s Office (SEO) Statements of Completion, the EPA (2009, 2010), and sampling performed for this study.

While the Town performs extensive testing throughout the distribution system (e.g., individual taps downstream of the pumping wells) in order to satisfy EPA municipal drinking water requirements, data for water directly from the Town wells is rather sparse except for the EPA monitoring study conducted in 2009 and 2010, which included Town Wells Nos. 6 and 7. The only constituents with concentrations higher than EPA primary or secondary drinking water standards are sulfate (> 250 mg/L), total dissolved solids (TDS; > 500 mg/L), iron (> 0.3 mg/L), and pH (6.5-8.5 s.u.), all of which only have secondary standards (note bold values in Table II-3). Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (e.g., skin or tooth discoloration) or aesthetic effects (e.g., color, odor, or taste) in drinking water.
The negative value for gross alpha in this analysis indicates that radionuclides in sample are not different from naturally occurring radionuclides and cosmic radiation detected by laboratory instrumentation.

0.040 higher reporting limit on GRO for Well #6 is due to lab QA/QC protocols.

Statement of Completion (from Wyoming State Engineer's Office)

EPA; 2009; "Pavillion Area Groundwater Investigation Site Inspection - Analytical Results Report".
EPA; 2010; "Pavillion Area Groundwater Investigation Expanded Site Investigation - Analytical Results Report". (Except where noted otherwise.)


Table II-3
Pavillion Wells – Water Quality
Sulfate levels greater than the secondary standard (250 mg/L) are present in all wells tested, which contributes to the high (> 500 mg/L secondary standard) TDS values in all wells tested with the exception of Well No. 6. Well No. 6 is the only well that has ever tested under 500 mg/L (495 mg/L). It should be noted that Well No. 5 was never used due to the extremely high sulfate levels (2,200 mg/L). The Well No. 7 TDS value of 1,283 mg/L was not measured, but is an approximation based on summing the concentrations of sulfate, fluoride, chloride, calcium, manganese, and sodium. However, it is reasonably close to the measured value of 1,400 mg/L (5/29/2012). Well No. 8, at the time of completion (1995), had an iron level above the secondary standard of 0.3 mg/L, but the recent test on 2/18/2011 shows the level has dropped well below the 0.3 mg/L standard. The EPA studies (2009, 2010) show iron levels in Well No. 7 approaching the 0.3 mg/L secondary standard.

There is no primary or secondary standard for sodium. However, EPA has issued a non-enforceable guidance level of 20 mg/L based on an American Heart Association recommendation. The guidance level was developed for individuals restricted to a total sodium intake of 500 mg/day and should not be extrapolated to the entire population. Table II-2 shows sodium concentrations far in excess of the EPA’s health advisory level of 20 mg/L for all samples.

The 2010 EPA study also tested Town Wells Nos. 6 and 7 for many semi-volatile compounds and petroleum hydrocarbons. In both wells, detectable levels of Bis(2-ethylhexyl)phthalate, Butylbenzylphthalate, Caprolactam (semi-volatiles) were measured. Also, in Well No. 7, a detectable level of total petroleum hydrocarbons (TPH) as diesel (DRO) was measured. In Table 9 of the EPA (2010) study, Bis(2-ethylhexyl)phthalate is listed as having an MCL of 0.006 mg/L and Butylbenzylphthalate is listed as having an RDSC (Reference Dose Screening Concentration) of 7.3 mg/L, both under the heading of Superfund Chemical Data Matrix. Detected levels in both constituents were well below their respective reference limits. EPA Table 9 shows no kind of standard for Caprolactam or TPH as diesel (DRO). None of these constituents are on the EPA list of regulated drinking water contaminants.

Diesel Range Organics (DRO) and Gasoline Range Organics (GRO) were tested for in Wells Nos. 1, 4, 6, 7 (GRO only), and 8 on 5/29/2012, all of which resulted in “non-detects”. Noticeable on Table II-3 are the different reporting limits for DRO (1.0 mg/L) and GRO (0.020 mg/L). Energy Labs personnel (pers. comm., 6/19/2012) described the analysis for each as being performed by different machines and the GRO machine can detect at a lower level, hence the lower reporting limit. The reporting limit for DRO is a “practical quantitative limit” and setting the limit at 1.0 mg/L is an issue of accuracy. Energy Labs personnel stated that with prior knowledge they can run the DRO analysis at the “minimum reporting limit” (MRL) of 0.2 mg/L, for which they would need to adjust their quality control procedures. The raw data for our analysis shows “non-detect” at the 0.2 mg/L level as well, but Energy Labs cannot retest for DRO or change our report to show results of < 0.2 mg/L due to QC measures because it is not possible to guarantee the results for that particular day. Energy Labs’ technician does not know how it is possible to obtain the 0.0231 mg/L value (an order of magnitude less than 0.2 mg/L) reported by EPA (2010) for Well No. 7, which now brings question to that value. Nevertheless, the recent testing shows no detectable levels of DRO or GRO in any of the Town wells.
Methane was initially tested for by EPA in response to community health concerns raised in 2009. EPA testing of methane in Wells Nos. 6 and 7 resulted in “non-detects” for both wells. EPA found methane at a maximum level of 0.708 mg/L in shallow groundwater from sampling monitoring wells (approximately 10-15 ft. in depth). Methane was also found in private wells at a maximum level of 0.808 mg/L. In order to evaluate the potential for an explosive hazard EPA measured methane and seven other light gases in the head space of sample jars with water collected from domestic wells. EPA detected a maximum methane level of 6,300 ppm in the water head space. EPA’s sampling method required purging the wells, which potentially removed part of the gases prior to analysis. The lower explosive limit (LEL) is 5% and the upper explosive limit (UEL) is 15%. Methane levels are not explosive when below 5% by volume in air and above 15% by volume in air. While measurements of methane were below the LEL, EPA recognized that the sampling methodology in this case does not permit an evaluation of the explosive hazard inherent with such gas-phase hydrocarbon present in the water. EPA stated that additional information would be necessary to properly assess the risk of explosion in residential plumbing. The presence of methane (and other light gases) in drinking water raises concerns that the water supply has been contaminated with petroleum products. (ATSDR, 2010)

“Methane is a simple asphyxiant (at around 87% by volume). Asphyxiants displace oxygen from air primarily in enclosed spaces. This can result in insufficient oxygen in the blood. Methane exposure can also produce symptoms of central nervous depression including nausea, headache, dizziness, confusion, fatigue, and weakness. It is unlikely these effects would be seen in Pavillion based on the current measures, as methane has practically no clinical effects at concentrations less than the Upper Explosive Limit.” (ATSDR, 2010)

Analyzed water samples collected in Wells Nos. 1, 4, and 8 on 2/18/2011 and 5/29/2012 resulted in methane levels ranging from 0.002 mg/L (Well No. 8) to 0.01 mg/L (Well No. 1). These concentrations are far below the maximum levels found by EPA, suggesting there is little reason for concern regarding methane levels. However, ATSDR (2010) noted that methane levels could fluctuate with changing conditions.

The EPA does not require the Town to test for uranium, despite it having an established MCL. As part of our 5/29/2012 analyses, uranium was tested for in Wells Nos. 1, 4, 6, 7, and 8, but each sample resulted in “non-detect”.

Bacteriological test results show the absence of iron-related and sulfate-reducing bacteria in the Town wells. Gross alpha was tested for in the 2/18/2011 sample for Well No. 8, with a result of -3 picoCuries per liter (pCi/L). The negative value indicates that radionuclides in the sample are not different from naturally occurring radionuclides and cosmic radiation detected by laboratory instrumentation. The simple answer is that the result is essentially “non-detect”.

**Transmission System Complexity**

The current mode of getting water from the wells to the storage tanks is overly complicated. Two of the wells, Nos. 1 and 4, are piped to flow to the old Stand Pipe Tank, and that flow is subsequently pumped to the Low Hill Tank. This water is pumped three times before being delivered to the customers. The remaining three wells, Nos. 6, 7, and 8, flow directly to the
Small Hill Tank where it is combined with flow pumped from the old Stand Pipe Tank. From there, all water is pumped again to the Large Hill Tank. It is this configuration that is overly complex.

In their normal operating mode, the wells are valved-off such that they directly feed the storage tanks. However, the valves can be turned on so that the wells can feed the distribution system in the event of an emergency. The Town’s well control system operates off of the Large Hill Tank. When the water level in this tank drops to a predetermined elevation, the booster pump turns on to feed this tank from the Small Hill Tank. The Small Hill Tank is supplied by Wells No. 6, 7, and 8. When the water level in this tank drops, those wells turn on. If the production from these wells cannot meet the water level drop, then the Booster Station at the Stand Pipe Tank begins pumping to replenish the Small Hill Tank. The Stand Pipe Tank is supplied by Wells No. 1 and 4. The Booster Station between the Small Hill Tank and the Large Hill Tank has a fire booster pump that can be turned on in the event of a fire emergency.

**Storage**

The Town of Pavillion currently has three water storage tanks, totaling 295,700 gallons. The original storage tank for the Town was the Stand Pipe Tank, located within Town limits. The Small Hill Tank was then constructed north of Town, followed by the Large Hill Tank. This storage capacity exceeds the current required storage capacity of 210,300 gallons, which is explained later in this chapter.

The Stand Pipe Tank has an approximate volume of 27,000 gallons. It is 10-feet in diameter and stands 49 feet tall and served for many years as the Town’s only storage. The overflow elevation is at 5510.7 feet. The Small Hill Tank was erected in 1982, and has an approximate storage volume of 43,700 gallons. It is 16-feet high and has a diameter of 22-feet. The overflow elevation for this tank is 5523.3 feet. Finally, the Large Hill Tank was constructed in 1995 on the same site as the Small Hill Tank. It has a volume of 225,000 gallons and stands 56-feet tall with a diameter of 26-feet. The Large Hill Tank’s overflow elevation is 5565.0 feet. It is this tank, with the highest elevation, that governs pressure on the Town’s system.

Municipal storage systems must meet or exceed the sum of three criteria to be considered adequately-sized. These three criteria are the average daily demand, plus fire flow storage, plus equalization storage. The fire flow storage is determined from the Insurance Services Office (ISO) guidelines while equalization storage is typically considered to be 25% of the maximum day demand. Each of these values is explained in more detail below.

**Emergency Storage**

As previously mentioned, an extensive analysis of Pavillion’s water records was conducted to determine the average daily demand of 20,000 gallons. One average day’s usage needs to be kept in storage for emergencies

**Fire Storage**

Other than the Wind River Schools, there are no significantly sized buildings within the Town of Pavillion with regard to fire flow. The Wind River Schools are equipped with a fire sprinkler
system, so ISO guidelines do not apply. The governing factor for fire flow within the Town is
the closeness of houses. Because of their proximity, a fire flow of 1,500 gpm is required for
general protection. ISO requires this flow to be available for a duration of two (2) hours, which
equates to a fire storage volume of 180,000 gallons.

Equalization Storage
The final factor in storage sizing is equalization storage. Equalization storage is considered to be
the amount of water required to supply a six hour period for the maximum day demand. After
review of Pavillion’s production data, the maximum day demand was determined to be 41,100
gallons. Because six (6) hours equates to one-quarter of a day, equalization storage is 25% of the
maximum daily demand. Thus, for the Town of Pavillion, equalization storage is 10,300 gallons.

The summation of these criteria indicates a required storage volume of 210,300 gallons for
Pavillion for the year 2012. Their current storage capacity of 295,700 gallons clearly exceeds
this value. Looking ahead 30 years to year 2042, fire flow is expected to remain the same. The
projected average daily demand is 28,200 gallons. The projected maximum day demand is
58,000 gallons which equates to equalization storage of 14,500 gallons. Using these numbers,
the required storage capacity for the Pavillion system in the year 2042 is 222,700 gallons. Even
with the recommended removal of the Stand Pipe Tank, the Small Hill Tank and Large Hill Tank
can provide this storage.

The tank level and well control system consist of an outdated electromechanical system split
between two locations, one at the Town shop and the other at the Booster Station at the Small
Hill Tank ¼-mile away. Each controller operates on its own with no signal interconnection of the
two units. To check or adjust system functions, the operator has to check both locations.
Synchronizing these two units so the tank level system functions as intended is challenging.

Transmission System
As previously mentioned, the transmission system from the wells to the storage tanks is overly
complicated. Removing the Stand Pipe Tank from service and directly tying Wells No. 1 and 4
to the hill tanks’ transmission line will reduce maintenance and streamline water delivery to the
distribution system.

The transmission system is in sound condition. The transmission line for Well No. 4 consists of
roughly 1,200 feet of 4-inch PVC line that ties into the pump house for the Stand Pipe Tank.
Well No. 1 also ties into this pump house. The line supplying water from the Stand Pipe Tank to
the Small Hill Tank is 4-inch PVC for the first 500 feet, and then enlarges to 6-inch PVC for the
remaining 1,500 feet. The transmission line from the Large Hill Tank to the distribution system
is comprised of approximately 1,700 feet of 10-inch PVC that reduces to 8-inch PVC for the
final 750 feet.

Computer modeling of the system shows the present transmission system to be capable of
delivering adequate flow under expected operating conditions for both domestic needs and fire
protection. These lines are constructed of current-day materials and are in sound condition. It is
recommended that the transmission lines from Wells No. 1 and 4 be reconfigured to feed these two wells directly to the Small Hill Tank.

**Distribution**

The majority of Pavillion’s water distribution system was upgraded to 6-inch PVC in the 1980’s. The only areas that are not 6-inch PVC are the south portion of the loop around the Wind River High School and the dead end line heading west on Center Avenue from Pine Street. Both of these sections are 8-inch PVC. Overall, the distribution system contains 14,200 feet of 6-inch water line and 2,000 feet of 8-inch water line.

Extensive water modeling of the system was conducted for the Level I Report. Modeling showed that the majority of the transmission and distribution system was capable of handling all demand, pressure, and necessary fire flow. Because of this, no upgrades to the distribution system are recommended at this time.
FIGURE II-6
Town of Pavillion Water System
Recommended System Improvements

Overall, the existing Pavillion water system is in sound shape. Nonetheless, selected improvements will make the system significantly more efficient. Those improvements include:

1. Removing the Stand Pipe Tank from service,
2. Eliminating the well pit at Well No. 1,
3. Tying Wells No. 1 and 4 directly into the Small Hill Tank,
4. Replacing the old fragmented electromechanical controls with a SCADA system, and
5. Demolishing the Stand Pipe Tank.

These recommendations are described in more detail in Chapter IV – Conceptual Designs and Cost Estimates.

Operation Improvement Recommendations

While the projected increase in production demand to supply rural cisterns can be met with no operational changes from the current situation, the Town may wish to consider adjustments to increase water quality and system efficiency:

1. As Well No. 6 provides the best quality water of the five active wells (sodium, sulfates, TDS) and appears to be the second most efficient in terms of the energy required to bring a given volume of water to the surface, preferential use of this well would improve the net quality of delivered water.

2. To the extent pumping costs are an issue; Well No. 8 is clearly the least expensive well due to both its higher productivity (less drawdown per unit of discharge) and its higher static water level (the starting point for drawdown). In terms of raw energy, for example, to deliver 30 gpm of water into the system from Well No. 1 costs nearly 4 times as much as to deliver 30 gpm of water into the system from Well No. 8.

Recommended upgrades for the Pavillion system include retiring the small (27,000 gallons) Stand Pipe Tank near Well No. 1 and rerouting the piping from Wells No. 1 and 4 so that all of the wells in the Pavillion system pump to the Small Hill Tank (43,700 gallons). This modification would negate the need to keep the current operational grouping for the wells (i.e., Wells No. 1 and 4 as one operation group and Wells No. 6, 7 and 8 as the other). The recommended operation of the wells could then be redesigned to improve the water quality and efficiency of the Pavillion system.

Provide Highest Quality of Water

Based on purely a water quality approach, the two wells that should be utilized the most are Well No. 6 and Well No. 4. To meet the current average day demand (20,000 gallons), these two wells would need to be operated for approximately 7¼ hours per day. To meet the additional projected demand from the rural cistern system (6,800 gallons per day), Well No. 6 and Well No. 4 would need to pump 9¼ hours per day. Well No. 8, which is the most efficient and produces water with the highest quality of the three remaining wells (Wells No. 1, 7 and 8) should be called upon to
augment Wells No. 6 and 4 in order to meet the demands as they increase through the peak demand period.

If the Town of Pavillion wishes to limit well production to near the current production period (approximately three (3) to six (6) hours), yet try to improve the overall quality of water produced, Wells No. 6, 4 and 8 should be operated together. During an average day, these pumps would be required to operate for a period of approximately 3½ hours to meet the Town of Pavillion needs and approximately 4½ hours to meet the average day needs of Pavillion and the rural cistern users. If these wells are not capable of satisfying the demands within this 4½ hour time period, then Well No. 1 and Well No. 7 should be called upon. It is recommended that these two wells be alternated in that Well No. 1 augments the flow of the three main wells (Wells No. 4, 6, and 8) one day and then the next day the additional demand needs will be met by the production from Well No. 7.

**Most Efficient System**

From an efficiency standpoint, Well No. 8 should be the primary source of water for the Pavillion system. This well alone could meet the average day demand of the Town of Pavillion proper, and, as was mentioned previously, due to both its higher productivity (less drawdown per unit of discharge) and its higher static water level (the starting point for drawdown) is the most efficient well in the Pavillion system. Operating Well No. 8 as the primary water supply source would require that this well be operated for approximately 6½ hours each day. In order to meet the additional demand (6,800 gallons per day) from the rural cistern system, Well No. 8 would need to pump for approximately 8½ hours each day. To meet the current peak period demand, including the cistern system, Wells No. 4 and 6 will need to be operated, in conjunction with Well No. 8. These three wells would need to operate for an eight (8) hour period to meet the peak period demand.

Under this scenario, Wells No. 1 and 7 would remain as back-up wells and would be required to be operated on a weekly basis to insure their operational status in the event they are called upon to replace one of the other wells.

**Recommended Operational Procedure**

Although both scenarios (best quality and most efficient) present advantages for the Town of Pavillion, the operational scenario that will provide the best quality of water does pose two potentially negative issues. The first is a degradation of the water quality during the peak use periods. If the residents become familiar with the quality of water provided by Wells No. 4 and 6 during most of the year, they could find the change of water quality objectionable when the other wells are brought on line during the peak demand period. The other drawback to this operating scheme is that the most efficient well in the system is not being fully taken advantage of. This would mean that the Town of Pavillion would be paying more to produce their water.

The recommended well field operational scheme would be a combination of the two previously described scenarios. We would recommend that Well No. 8 be the primary pump. Because the Town of Pavillion is used to a three (3) to six (6) hour pumping period, we recommend trying to maintain a similar pumping period by alternating the use of Wells No. 4 and 6 with that of Well No. 8. A typical average day (including estimated rural cistern use) would have both Wells No. 8
and 4 pumping when the tank level reaches the low level set point. These two pumps would be required to pump approximately 6½ hours to satisfy the average day demand. The next time the well field is called upon, Well No. 8 and Well No. 6 will be called upon to meet the demand. Again, on an average day, the pumping period for these two wells will be 5½ hours. At the conclusion of this pumping period, the lead pump would switch back to Well No. 4 from Well No. 6. During the peak demand period (including the rural cistern system) all three wells (No. 8, No. 4 and No. 6) will be required to operate where the lag pump will be called upon if the No. 8 pump and the lead pump cannot keep up with the system demand. These three pumps will be required to operate for a period of eight (8) hours during the peak period.

This operational scenario does not incorporate, on a consistent basis, the use of Wells No. 1 and 7, because of their poor water quality in comparison to the other wells. It is recommended that the Town of Pavillion develop a maintenance scheme where these wells are either manually operated once a week for a short period of time (less than one hour) or are programmed to be automatically turned on and pumped for this short maintenance period. Wells No. 1 and 7 would be standby or backup wells that would be called upon if one of the other wells is down due to a maintenance issue. The weekly pumping will insure that the pumps in these standby or backup wells will be functional when called upon.

References

EPA 2009

EPA 2010


ATSDR, 2010

Chapter III – Selection of Water Supply for Cistern System

Town of Pavillion’s Ability to Meet Cistern Supply Demands

Chapter 2 provides a detailed description of the production capacity of the Town of Pavillion’s present well field. That production capacity, based on the pump testing that was performed during this study, is 36,000 gallons per day (gpd) at present and could be increased to 63,000 gpd. The forecast demand within the Town of Pavillion itself, including the school, is estimated to be 31,400 gallons per day by the year 2040. It warrants restating that the school population exceeds that of the Town itself while school is in session. The school is the Town’s largest water customer, expected to use 5,400 gallons per day by 2040, while the Town residents are forecasted to require 26,000 gallons per day by 2040.

In 2012, approximately 20 rural area residences had expressed interest in being served by cistern system’s that are to be installed by the State of Wyoming. Assuming that rural residential cistern use grows at the same rate as is expected for the county-wide population, that number would grow to some 28 users by the year 2040. The demand for those 28 users, based on 80 gallons per person per day (gpcd) is 6,800 gallons per day. It is recognized that the per capita usage with hauled water will likely be some unknown amount less than 80 gallons. Still, with a water production capacity of 63,000 gpd and a forecast total demand of 31,400 gpd it is obvious that the Town of Pavillion can meet the forecast demand of cistern users without injury to the Town’s own forecasted needs.

Pavillon Water Loading Station

Typically, when there is a need to provide bulk water, a nearby community responds to the need by offering potable water through a water loading station. Up to this point in time, the Town of Pavillion has not had a water loading station because few area residents haul water to meet their domestic needs. The planned State funded cistern installations will soon be in place as well as a water loading station.

Water loading stations can be very simple or quite complex. A fairly simple water loading station can serve the small number of rural Pavillion residents that are expected to install cistern systems. It is recommended that this station be installed with the equipment necessary to make water loading available 24 hours a day, 7 days a week. This can be accomplished by installing a simple water loading station with a frost proof swinging discharge arm able to accommodate different styles and heights of vehicle-mounted water tanks. The station would also include a fee collection system for the users to pay for the water at the site and a stable paved loading pad sloped to drain spilled water away from the loading area. The fee collection system is the most expensive piece of equipment in the water facility.

City of Lander

By comparison, the City of Lander is approximately 35 miles from the planned delivery area. This distance alone is a cost constraint to delivering water. Just the additional mileage to the service area makes providing water from the City of Lander’s fill station a less desirable option.
Lander charges $5.68 per 1,000 gallons of water. The City of Lander can easily meet the year 2040 forecast demand of 6,800 gallons per day.

City of Riverton
The City of Riverton is approximately 27 miles from the planned delivery area. As with Lander, the haul distance from Riverton also excludes it as an economical option. Riverton charges only $2.00 per 1,000 gallons of water, a cost saving rate as compared to Lander. If one assumes equal per mile charges for the water hauled from either Lander or Riverton it is obvious that using Riverton would be a preferable choice over Lander in both water charges and haul costs. Table 3-1 gives an estimate of costs associated with delivering 6,000 gallons of water from each city.

Town of Pavillion
While both Riverton and Lander have water loading stations, the Town of Pavillion’s close proximity (approximately from 5 to 10 miles) to area cistern users is a more favorable location to supply the water to those area residents who use cisterns to meet their domestic water need. The Town’s close proximity to area cistern users provides the shortest haul distance from a public water supply to the delivery destination. Hauling the potable water to its destination is the most costly part of providing drinking water to cistern systems regardless of the type of vehicle being used for the purpose.

Hauling Water

Two methods of delivering water to the individual cisterns were evaluated.

1. Property owners hauling their own water using a 450-gallon pickup style haul tank and,
2. The cistern owners contracting with a water haul service that can get delivery of up to 3,000 gallons of water in one trip.

The annual cost of a hauled water supply is dependent on each homeowner’s water consumption. The costs associated with the homeowners hauling their own water equates to approximately $2,000.00 annually. Contracted water delivery is estimated to cost approximately $125 per 3,000 gallon load. Depending on water consumption, water haul costs are estimated to be $3,000.00 annually. On an out-of-pocket cost analysis, a homeowner hauling their own water is most economical. When adding in the economic value of that owner’s driving time, the economic advantage is less distinct. This decision will have to be made by the cistern owners on an individual basis. A detailed breakdown of alternate water hauling costs is given in Table 3-1 below.
Table III-1

Rural Pavillion Estimated Annual Water Hauling Costs - Per User
Delivery of 6,000 gallons

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<tr>
<td>Quoted Commercial Rate of $125 per 3,000 Gal. Load</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Cost</td>
<td>2</td>
<td>Load</td>
<td>$125</td>
<td>$250</td>
</tr>
<tr>
<td><strong>Annual Cost</strong></td>
<td>12</td>
<td></td>
<td>$250</td>
<td>$3,000</td>
</tr>
<tr>
<td><strong>District Operated Haul Option</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6,000 Gal. Haul Truck with Driver</td>
<td>2</td>
<td>Hr.</td>
<td>$100</td>
<td>$200</td>
</tr>
<tr>
<td>Water Cost</td>
<td>6</td>
<td>K. Gal</td>
<td>$4</td>
<td>$24</td>
</tr>
<tr>
<td>Monthly Cost</td>
<td></td>
<td></td>
<td></td>
<td>$224</td>
</tr>
<tr>
<td><strong>Annual Cost</strong></td>
<td>12</td>
<td>Load</td>
<td>$224</td>
<td>$2,688</td>
</tr>
</tbody>
</table>

Assumptions:
- Water use is 80 gpcd, 30 days/mo.
- Average of 2.5 people per residence
- Pickup mounted water tank costing $420 will last 10 years
- Water price is $4.00/thousand gal.
- No value is assigned to the time the homeowner is hauling water
Chapter IV – CONCEPTUAL DESIGNS AND COST ESTIMATES

Town of Pavillion Needed Improvements Conceptual Design and Cost Estimate

Through the work in the Pavillion Area Water Supply Level I Study, The Town of Pavillion’s water system was found to be in sound condition. That report, though, noted some deficiencies that warranted being addressed. The evaluation made through this Level II Study further refined those findings, and improvements will make the system significantly more efficient. Below are the recommended improvements listed in the order of their priority.

1. Remove the Stand Pipe Tank from service and pump Wells No. 1 and 4 directly to the Small Hill Tank. This would eliminate having to pump the water a second time from the Stand Pipe Tank to the Small Hill Tank. It would eliminate the Well No. 1 pump house and would allow all disinfection to be done at the Small Hill Tank booster station.

2. Take the Stand Pipe Tank out of service requiring replumbing of Well No. 1. This will consist of installing approximately 120 feet of 4-inch PVC pipe. In conjunction with this improvement, the Well No. 1 pit needs to be eliminated. This well pit has been a noted deficiency in several DEQ inspection reports. It is recommended that the well house be removed, the well casing extended and fitted with a pitless adapter, and the well pit filled. This would bring this well to current-day standards.

   The existing pump in Well No. 1 was installed in 1999. That pump and its column pipe will be removed to allow extending the well casing and installing the pitless adapter. It is recommended that this pump and its cable be replaced with a new pump and cable while all of this equipment is out of the well for this operation. The new pump needs to be efficiently matched the change in high water level of the Small Hill Tank. Further, it is recommended that an air line be installed to allow future water level sensing in the well.

3. Tie Well No. 4 to the Small Hill Tank transmission line. This will require abandoning the 4-inch transmission line from this well to Well No. 1 and the Stand Pipe Tank. A 6-inch PVC line can then be run directly north from Well No. 4 for approximately 50 feet and be connected to the present 8-inch PVC transmission line with a tee. A 6-inch line was chosen due to the availability of 6-inch fittings.

   Well No. 4 is producing only 17 gpm at present. It is suspected that the pump installed in 1996 is worn and that replacing it may restore its original production of about 30 gpm.

4. Replace the old electromechanical control system with a current SCADA system, allowing the operator to select the usage of individual wells and water level set points for both tanks. It is recommended that the replacement system be a modern PCL controller with radio telemetry configuration and a single controller located at the Town shop or another central location best suited to the Town’s needs. This would significantly improve the Town’s ability to manage the system water production for quality and quantity, anticipate well maintenance needs, and record and report water production.
5. Remove/demolish the Stand Pipe Tank.

The cost estimate presented here details the construction and non-construction costs associated with these recommended system improvements.

### PRELIMINARY OPINION OF PROBABLE PROJECT COSTS

**Town of Pavillion Water System Improvements**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobilization, bonds, and insurance</td>
<td>1</td>
<td>LS</td>
<td>$10,000.00</td>
<td>$10,000</td>
</tr>
<tr>
<td>2</td>
<td>Pull Well No. 1 pump, well house demo, and extend casing</td>
<td>1</td>
<td>LS</td>
<td>$10,000.00</td>
<td>$10,000</td>
</tr>
<tr>
<td>3</td>
<td>Install new Well No. 1 pump</td>
<td>1</td>
<td>EA</td>
<td>$5,000.00</td>
<td>$5,000</td>
</tr>
<tr>
<td>4</td>
<td>Backfill well pit, extend well casing</td>
<td>1</td>
<td>LS</td>
<td>$4,000.00</td>
<td>$4,000</td>
</tr>
<tr>
<td>5</td>
<td>Install pitless adapter</td>
<td>1</td>
<td>LS</td>
<td>$8,000.00</td>
<td>$8,000</td>
</tr>
<tr>
<td>6</td>
<td>Connect Well No. 1 to transmission line</td>
<td>120</td>
<td>LF</td>
<td>$90.00</td>
<td>$10,800</td>
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<td>7</td>
<td>Booster station demolition</td>
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<td>LS</td>
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</tr>
<tr>
<td>8</td>
<td>Pull Well No. 4 pump and install new pump</td>
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<td>LS</td>
<td>$5,000.00</td>
<td>$5,000</td>
</tr>
<tr>
<td>9</td>
<td>Tie Well No. 4 to transmission line</td>
<td>50</td>
<td>LF</td>
<td>$90.00</td>
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<td>10</td>
<td>Install SCADA system and start-up</td>
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<td>11</td>
<td>Site restoration and seeding</td>
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<td>LS</td>
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**Subtotal for Well Work**

$135,300

### Standpipe Tank Removal

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<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
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<td>11</td>
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<td>$1,600.00</td>
<td>$1,600</td>
</tr>
<tr>
<td>12</td>
<td>Remove and salvage Standpipe Tank</td>
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<td>LS</td>
<td>$20,000.00</td>
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**Subtotal for Standpipe Tank Removal**

$21,600

**Subtotal of All Construction Costs**

$156,900

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<th>Unit Cost</th>
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</tr>
</thead>
<tbody>
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<td>13</td>
<td>Contingencies</td>
<td>15%</td>
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<td></td>
<td>$23,535</td>
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**Total Estimated Construction Costs**

$180,435

<table>
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<th>Item</th>
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<th>Unit</th>
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</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Engineering Design</td>
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<td></td>
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<tr>
<td>15</td>
<td>Engineering Construction Monitoring</td>
<td>10%</td>
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<td></td>
<td>$18,044</td>
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</tbody>
</table>

**Total Non Construction Costs**

$36,087

**TOTAL ESTIMATED PROJECT COST**

$217,000
Water Loading Station Conceptual Design and Cost Estimate

Water loading stations can range from simple to sophisticated. The more featured the unit, the greater its cost. It is expected that this loading station will predominately serve the sparsely populated rural Pavillion area. It is recommended that the station’s design be commensurate with its expected service demands; that it be economical, yet serviceable. For this project it is recommended that water loading station will be located in the Town of Pavillion. Further, at a location that minimizes conflict with other in-town traffic Its location is yet to be selected. The location must allow the station to be directly connected to one of the Town’s water mains. It is recommended that the location be easily accessible to large and small water haul units alike.

To demonstrate the type of water loading station envisioned for Pavillion the below are photos of water haul stations at Riverton, Worland and Thermopolis are shown as examples.

Riverton, WY

Thermopolis, WY

Worland, WY
The tank fill line needs to be an articulating swing arm having a pivoting head to enable filling different styles and heights of truck mounted tanks. The discharge line will also be fitted with a French drain or properly connected to the sanitary sewer to drain residual water from the line to prevent freezing. The vehicle approach to the station, as recommended, will be paved and having a reinforced concrete pad on which vehicles will park while filling. This filling pad would also include a drain to collect and dispose of spilled water that would otherwise create a hazard and nuisance, especially during freezing weather. The figures below show the conceptual configuration of the water loading station.

Figure IV-1
Conceptual Water Loading Station
The water loading station needs to be continuously available, accessible, and operational to allow rural residents to get water at any time. To accommodate this it is recommended that the station be lighted at night and be installed with a coin/bill type fee collection unit to ensure the facility is available beyond working hours and on weekends. The fee collection mechanism and base of the feed line may be housed in a small heated structure to prevent freezing and provide ease of maintenance.

The cost of the water loading station is estimated to be $65,000 including land acquisition, site grading, paving, all equipment and its associated installation. That cost estimate is given below.
## PRELIMINARY OPINION OF PROBABLE PROJECT COSTS

**Project:** Pavillion Water Loading Station  
**Date:** 10/24/12  
**Updated from:** 2/24/12  
**Project No:** 05-13-0012  
**Estimate By:** JAMES GORES & ASSOC.  
**J. Gores**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bonds, Mobilization and Insurance</td>
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<td>LS</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
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<tr>
<td>2</td>
<td>Site Grading</td>
<td>1</td>
<td>LS</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
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<tr>
<td>3</td>
<td>Base and 8&quot; Concrete Pad</td>
<td>1280</td>
<td>SF</td>
<td>$7.00</td>
<td>$8,960.00</td>
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<tr>
<td>4</td>
<td>Paved Entrance/Exit Access Ramp and Base</td>
<td>1000</td>
<td>SF</td>
<td>$7.00</td>
<td>$7,000.00</td>
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<tr>
<td>5</td>
<td>4&quot; Water Line - for Feed</td>
<td>100</td>
<td>LF</td>
<td>$40.00</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>6</td>
<td>4&quot; Tee and Gate Valve</td>
<td>1</td>
<td>EA</td>
<td>$1,050.00</td>
<td>$1,050.00</td>
</tr>
<tr>
<td>7</td>
<td>Tank Fill Stand Pipe with Panic Shut-off, Etc.</td>
<td>1</td>
<td>LS</td>
<td>$3,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>8</td>
<td>Fee Collection Unit and Meter</td>
<td>1</td>
<td>LS</td>
<td>$8,260.00</td>
<td>$8,260.00</td>
</tr>
<tr>
<td>9</td>
<td>Property Acquisition</td>
<td>1</td>
<td>LOT</td>
<td>$7,500.00</td>
<td>$7,500.00</td>
</tr>
</tbody>
</table>

Subtotal of Construction Costs: $46,770.00

Contingencies: 15% $7,015.50

**Total Construction Costs:** $53,785.50

**Non Construction Costs**

- Engineering Design 10% $5,400.00
- Engineering Construction Monitoring 10% $5,400.00
- Legal and Administrative

**Total Non Construction Costs:** $10,800.00

**TOTAL ESTIMATED PROJECT COST:** $64,600.00
Chapter V – Financing Plan

Town of Pavillion’s Cost of Produced Water

The Town of Pavillion in fiscal year 2011-2012 spent $36,205 to operate and maintain the water system while the Town’s water system revenue was $51,074. At first glance, it appears that the Town water system is self-supporting and may even have a comfortable revenue surplus.

Under the present accounting system, however, the Town is not setting aside funds specifically reserved for water system emergencies or for system obsolescence replacement. When those costs are considered, the financial solvency of the water system changes appreciably. This is due almost entirely to the Town’s small customer base of only 131 customers (taps). It is from this small number of customers that all of the revenue for operation, maintenance, and eventual system replacement needs to come for the system to be fully self-supporting. The present value of the Town’s water system is estimated to be $2,979,575. Assuming a system life of 65 years, each year the Town needs to put into savings $50,000 to cover the system as it wears out and becomes obsolete. Without those funds being set aside, the Town’s water system is not financially self-sustaining. This will result in one of two options: the Town will either have to rely on grants or secure loans to fund replacement of parts of the system as they wear out.

In the Table VI below, the reader will note that there is no accumulated interest revenue accounted for in the funds being held for future repairs. This is deliberately done to reflect the trend over the last several years in which the rate of inflation has essentially been equal to the interest rates offered on bank savings. The two rates cancel one another out. Thus, the financial benefit of interest paid on savings is consumed by increases in costs of construction.

Derivation of Equitable Water Sales Charges by the Town of Pavillion

Present In-Town Water Charges

Residential Rates
The Town of Pavillion currently charges $31.00 per month for residential service which includes 4,000 gallons of use. The Town charges a flat rate of $5.00 per thousand gallons over the 4,000 gallons included in the base rate. Town records show that the average water bill is $35.70, indicating that most residential customers meet their household needs with little more than the 4,000 gallons included in their base rate. They achieve this low usage rate largely because the Town has a ditch system that provides summer irrigation water for lawns and gardens. Additionally, residents are prohibited by ordinance from watering from the Town system.

Commercial Rates
The Town’s commercial rate is little different; $38.00 per month, again with a 4,000 gallon base consumption and a flat rate charge of $5.00 per thousand gallons thereafter. There are 13 commercial accounts in the Town. The largest is the school, followed by a restaurant, a tavern, the post office, a store (not open in 2012), churches, and others.
Neither commercial nor residential rates are structured on a tiered system. The Town has a ditch system which supplies irrigation water. By Town ordinance, residents are prohibited from using potable water for irrigation. For that reason alone, while a tiered rate may achieve some water conservation in Pavillion, it is questionable whether the resulting savings would be significant.

**Determination of Recommended Water Rates**

**In-Town Residential Rates**

In evaluating the water system, it was noted that there were no designated water obsolescence or emergency funds. In order to have self-supporting systems, these funds need to be identified and tracked. During the development of the proposed rate schedule, these funds were taken into account. James Gores and Associates evaluated three different rate schedules, assuming the system’s life spanning 50 to 80 years. Since the majority of the Town’s system is considered relatively new, it was decided that this age range was appropriate. Based on the assumption that the system will need to be replaced in 50, 65, or 80 years, the resulting in-town base rates would be $61.60, $52.70 and $46.80 respectively. The base rate still allows up to 4,000 gallons of consumption, the same as the present rate.

The major reason for the increase in the rates is accounting for the obsolescence and emergency fund. These are real costs and vital components to the long-term financing of any system. These funds enable a municipality to fix water leaks or replace system components without having to find outside funding. The suggested rate schedule also has tiers for consumption over 4,000 gallons. These are broken down to 4,001-10,000 gallons, 10,001 to 15,000 gallons, and 15,001 gallons and over. This tiered rate system increases the charge per thousand gallons as consumption increases. This promotes water conservation. A detailed breakdown of the proposed rate schedule is shown in Table 5-1.

**Commercial Rates**

The derived commercial rates are based on the Town’s existing commercial rates. They are higher than in-town residential rates. The proposed commercial rates are $74.04, $63.71, and $57.07 for the 50, 65 and 80 year design life respectfully. Pavillion has only 13 commercial users.

**Out of Town Rates**

The recommended rates for out-of-town user are the same as the commercial rates. The reason these rates are the same is both commercial and out-of-town users typically require the same additional maintenance and Wyoming law allows for such a surcharge.

**Bulk Water Charges**

The proposed rate for the proposed bulk water station was determined to be $2.00 per 500 gallons ($4.00/thousand). This rate is forecast to cover the cost of water plus the operation and maintenance of the bulk water station. At the time of this report it was assumed the property owners which requested cisterns from the state would be the primary users of the station. This assumption is only for the rate analysis purposes. It is believed the bulk water
model may be used by several additional users. In order that the rates be conservative and not rely on those additional users, the assumed number of users was set at 20 users.

**Table V-1**

**Pavillion Water Rate Calculations**

<table>
<thead>
<tr>
<th></th>
<th>80 years</th>
<th>65 years</th>
<th>50 years</th>
<th>Number of Customers 2009</th>
</tr>
</thead>
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<tr>
<td>Annual Emergency Fund</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
<td>Residential 107</td>
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<td>Annual Sinking Fund</td>
<td>$37,244.69</td>
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<td>O&amp;M With No Replacement Costs</td>
<td>$36,205.00</td>
<td>$36,205.00</td>
<td>$36,205.00</td>
<td>Out of Town 5</td>
</tr>
<tr>
<td>Total Annual Fixed Costs</td>
<td>$78,449.69</td>
<td>$87,044.62</td>
<td>$100,796.50</td>
<td>Total 125</td>
</tr>
<tr>
<td>Total Monthly Fixed Costs</td>
<td>$6,537.47</td>
<td>$7,253.72</td>
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</tr>
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<td>Monthly Fixed Costs Per Customer</td>
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<tr>
<td>Commercial</td>
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<td>$63.71</td>
<td>$74.04</td>
<td></td>
</tr>
<tr>
<td>Out of Town</td>
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<td>$63.71</td>
<td>$74.04</td>
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<tr>
<td>Monthly Rate</td>
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</tr>
<tr>
<td>Residential</td>
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<td></td>
</tr>
<tr>
<td>Base Rate first 4,000 gals</td>
<td>$46.80</td>
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<tr>
<td>4,001-10,000 gals</td>
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<td>$1.50</td>
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</tr>
<tr>
<td>10,001-15,000 gals</td>
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<td>$2.00</td>
<td></td>
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<tr>
<td>over 15,001 gals</td>
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<td>$2.50</td>
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</tr>
<tr>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Rate first 4,000 gals</td>
<td>$57.07</td>
<td>$63.71</td>
<td>$74.04</td>
<td></td>
</tr>
<tr>
<td>4,001-10,000 gals</td>
<td>$1.50</td>
<td>$1.50</td>
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<tr>
<td>10,001-15,000 gals</td>
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<tr>
<td>over 15,001 gals</td>
<td>$2.50</td>
<td>$2.50</td>
<td>$2.50</td>
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<tr>
<td>Out of Town</td>
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</tr>
<tr>
<td>Base Rate first 4,000 gals</td>
<td>$57.07</td>
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<td>4,001-10,000 gals</td>
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<td>10,001-15,000 gals</td>
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<tr>
<td>over 15,001 gals</td>
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<td>$2.50</td>
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<tr>
<td>Bulk Water</td>
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</tr>
<tr>
<td>500 gals</td>
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<td>Revenues-Monthly</td>
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<tr>
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<tr>
<td>Difference Revenue - Expenses</td>
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<td>$373.65</td>
<td></td>
</tr>
</tbody>
</table>

The expected design life in the table above is defined as the amount of time one expects the system to last with regular preventative maintenance. For instance, in an 80-year design life, it is assumed that the entire system will be slowly replaced over 80 years. The table denotes
the correlation between the longer expected design lives and the lower the expected water rates. In contrast to the longest design life, the shorter design lives will have higher rates, but the Town will need to accumulate the emergency and obsolescence funds faster by paying more into them every month. This is a decision for the Town to determine what is best for the residents. Common practice is for the obsolescence and emergency funds to actually comprise between 50-65% of the base rates, depending on the design life chosen. Adding these funds into the rates assures that when a problem arises the Town has the financial capabilities to fix it without having to find alternative funding sources.

In order to determine the water rates in Table V-1, four assumptions were made.
1. First, the value of the system was estimated by using replacement costs for the transmission and distribution lines, the storage tanks, and the well.
2. Second, the population projections were taken from the State of Wyoming and the 2010 Census.
3. Third, since the population projections are somewhat in dispute, the current population of the town was used to determine the obsolescence and emergency rates. This assumption will give the rates a buffer as opposed to a high population forecast.
4. Fourth, daily O&M costs were determined using figures from 2011. Records were unavailable over a period of 5-7 years to refine better numbers and trending.

### Financing Recommended Improvements

<table>
<thead>
<tr>
<th>TABLE OF FINANCING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town of Pavillion Water System Improvements</td>
</tr>
<tr>
<td>20 Year Project Financing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Total Cost</th>
<th>67% WWDC Grant</th>
<th>33% WWDC Loan</th>
<th>SLIB Grant</th>
<th>SLIB Loan</th>
<th>Annual Loan Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WWDC Eligible Items</td>
<td>$217,000</td>
<td>$144,522</td>
<td>$72,478</td>
<td>$-</td>
<td>$-</td>
<td>$ (4,985)</td>
</tr>
<tr>
<td>2</td>
<td>Legal and Administrative</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>3</td>
<td>Total WWDC Eligible Costs</td>
<td>$217,000</td>
<td>$144,522</td>
<td>$72,478</td>
<td>$-</td>
<td>$-</td>
<td>$ (4,985)</td>
</tr>
<tr>
<td>4</td>
<td>Subtotal WWDC Ineligible Items</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>5</td>
<td>Total Project</td>
<td>$217,000</td>
<td>$144,522</td>
<td>$72,478</td>
<td>$-</td>
<td>$-</td>
<td>$ (5,333)</td>
</tr>
</tbody>
</table>

The Probable Opinion of Project Costs for recommended improvements to the Town of Pavillion’s system that are eligible for WWDC funding is $217,000. It is assumed that 2/3 of this cost will be eligible for and receive a WWDC grant, leaving a 1/3 portion, $72,478, for which the Town would need to secure additional funding. The Town plans to secure this funding through the State Land and Investment Board administered programs or other agencies.

Other funding sources available for water system improvements include those administered by the State Land and Investment Board including Mineral Royalty Grants, Drinking Water State Revolving Fund, and County Consensus Funds. In addition, funding is available through USDA Rural Utility Services.