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# Table of Contents

1.0 **Introduction** .................................................................................................................. 1-1
   1.1 History and Project Background ...................................................................................... 1-1
   1.2 Authorization and Purpose ........................................................................................... 1-2

2.0 **Existing Well Evaluation and Testing** ........................................................................ 2-1
   2.1 Well A2 Assessment ....................................................................................................... 2-1
      2.1.1 Well A2 Well Video Survey ..................................................................................... 2-1
      2.1.2 Well A2 Existing Pumping Equipment ..................................................................... 2-2
      2.1.3 Well A2 Aquifer Testing .......................................................................................... 2-2
      2.1.4 Well A2 Water Quality ............................................................................................ 2-3
      2.1.5 Well A2 Water Supply Improvement Alternatives ..................................................... 2-3
   2.2 Well A3 Assessment ....................................................................................................... 2-4
      2.2.1 Well A3 Video Survey ............................................................................................. 2-4
      2.2.2 Well A3 Pumping Equipment .................................................................................... 2-4
      2.2.3 Well A3 Aquifer Testing .......................................................................................... 2-5
      2.2.4 Well A3 Water Quality ............................................................................................ 2-6
      2.2.5 Well A3 Water Supply Improvement Alternatives ..................................................... 2-6
   2.3 Well A4 Assessment ....................................................................................................... 2-7
      2.3.1 Well A4 Video Survey ............................................................................................. 2-7
      2.3.2 Well A4 Existing Pumping Equipment ..................................................................... 2-8
      2.3.3 Well A4 Aquifer Testing .......................................................................................... 2-8
      2.3.4 Well A4 Water Quality ............................................................................................ 2-9
      2.3.5 Well A4 Water Supply Improvement Alternatives ..................................................... 2-9

3.0 **Hydrogeologic Investigation and Well Siting** ............................................................. 3-1
   3.1 Geologic and Hydrogeologic Setting .............................................................................. 3-1
   3.2 Potential Test Hole and Test Well Sites .......................................................................... 3-3
   3.3 Test Hole Drilling .......................................................................................................... 3-4

4.0 **1-Anderson Test Well Drilling** .................................................................................... 4-1
   4.1 Drilling Conditions and Well Completion ...................................................................... 4-1
   4.2 Geologic and Hydrogeologic Conditions ...................................................................... 4-1
   4.3 Well Development ........................................................................................................ 4-2
   4.4 Hydrogeologic Evaluation of the High Plains Aquifer .................................................... 4-2
      4.4.1 Stepped Rate Testing ............................................................................................... 4-3
      4.4.2 Constant Rate Testing ............................................................................................ 4-3
      4.4.3 Projected Development Impact ............................................................................... 4-4
   4.5 Water Quality ................................................................................................................ 4-4
   4.6 Video Survey .................................................................................................................. 4-5
   4.7 Recommendations ......................................................................................................... 4-5

5.0 **Additional Water Quality Testing** ............................................................................... 5-1
6.0 Development Alternatives, Conceptual Designs, and Cost Estimates ..........6-1
6.1 Existing Well Improvements ...................................................................................... 6-1
6.1.1 Well A2 ............................................................................................................. 6-1
6.1.2 Well A3 ............................................................................................................. 6-2
6.1.3 Well A4 ............................................................................................................. 6-3
6.2 1-Anderson Test Well and Transmission Line Connection ................................6-3
6.3 Isolated Transmission Line ...................................................................................... 6-5
6.4 Water Treatment ..................................................................................................... 6-6

7.0 Financing Analysis of Recommended Improvements ............................................. 7-1

8.0 Permitting and Environmental Issues ........................................................................ 8-1

9.0 Recommendations ................................................................................................... 9-1

10.0 References ............................................................................................................. 10-1

Tables

Table 2.1 Existing Production Well Completion Details and Observations ....................2-11
Table 2.2 Existing Production Well Pumping Equipment ..............................................2-11
Table 2.3 Burns Existing Production Well Stepped Rate Test Summaries ......................2-12
Table 2.4 Burns Existing Production Well Constant Rate Test Summaries ....................2-12
Table 2.5 High Plains Aquifer Water Quality Summary, Burns Existing Production Wells ....2-13
Table 3.1 Potential Test Hole/Test Well Drill Sites ......................................................3-6
Table 4.1 1-Anderson Test Well Stepped Rate Test Summary .........................................4-6
Table 4.2 1-Anderson Test Well Constant Rate Test Summary .......................................4-6
Table 4.3 High Plains Aquifer Water Quality Summary, 1-Anderson Test Well ...............4-7
Table 5.1 High Plains Aquifer Water Quality Summary, Burns Area Wells ....................5-2
Table 6.1 Well A2 Pump Replacement Costs ...............................................................6-8
Table 6.2 Well A2 Replacement Costs ........................................................................6-9
Table 6.3 Well A3 Replacement Costs ........................................................................6-10
Table 6.4 Well A4 Rehabilitation Costs ......................................................................6-11
Table 6.5 Well A4 Replacement Costs ........................................................................6-12
Table 6.6 Costs for 1-Anderson Test Well Pumping Equipment and Transmission Line ......6-13
Table 6.7 Costs for Isolated Transmission Line ............................................................6-13
Table 7.1 Summary of Anticipated Annual Operating Costs with Recommended Alternatives. 7-2
Table 7.2 Construction Cost Summary and Financial Analysis .....................................7-2
Figures

Figure 2.1  Geologic Map and Production Well Locations .............................................. 2-14
Figure 2.2  Well A2 Stepped Rate Test ................................................................. 2-15
Figure 2.3  Well A2 Specific Capacity Curve ........................................................... 2-16
Figure 2.4  Well A2 Constant Rate Test ................................................................. 2-17
Figure 2.5  Well A3 Stepped Rate Test ................................................................. 2-18
Figure 2.6  Well A3 Specific Capacity Curve ........................................................... 2-19
Figure 2.7  Well A3 Constant Rate Test ................................................................. 2-20
Figure 2.8  Well A4 Stepped Rate Test ................................................................. 2-21
Figure 2.9  Well A4 Specific Capacity Curve ........................................................... 2-22
Figure 2.10 Well A4 Constant Rate Test ............................................................... 2-23

Figure 3.1  Test Hole and Well Locations Map ..................................................... 3-7
Figure 3.2  1-Anderson Test Hole Completion ....................................................... 3-8
Figure 3.3  2-Anderson Test Hole Completion ....................................................... 3-9
Figure 3.4  6-Phillips Test Hole Completion ............................................................ 3-9

Figure 4.1  1-Anderson Test Well Completion ....................................................... 4-8
Figure 4.2  1-Anderson Test Well Stepped Rate Test ............................................ 4-9
Figure 4.3  1-Anderson Test Well Specific Capacity Curve .................................... 4-10
Figure 4.4  1-Anderson Test Well Constant Rate Test ......................................... 4-11
Figure 4.5  1-Anderson Test Well Constant Rate Test Recovery .......................... 4-12
Figure 4.6  1-Anderson Test Well Testing, Observation Well Water Level Elevations 4-13

Figure 5.1  Burns Area Water Quality Sample Locations ....................................... 5-3

Figure 6.1  New Production Well and Isolated Transmission Main ........................... 6-14
Figure 6.2  1-Anderson Test Well Site Conceptual Layout ..................................... 6-15

Appendices

Appendix A  State of Wyoming Approved Permits
Appendix B  Existing Well Analytical Reports
Appendix C  Analytically Modeled Theis Drawdown for 1-Anderson Test Wells
Appendix D  1-Anderson Test Well Water Quality Analytical Results
Appendix E  June 2012 Well Water Quality Testing Memo
Appendix F  2013 Sampling Water Quality Analytical Reports
Appendix G  Pump Sizing Spreadsheets
Appendix H  1-Anderson Test Well Transmission Line Alignment Photos
Appendix I  Isolated Transmission Line Alignment Maps
Appendix J  Electrical Operating Cost Spreadsheets
Project Notebook

A. Well A2
   a. Pumping Equipment Inventory
   b. Pumping Equipment Improvements
   c. Aquifer Testing Data
   d. Aquifer Testing Analysis
   e. Well Video
B. Well A3
   a. Pumping Equipment Inventory
   b. Pumping Equipment Improvements
   c. Aquifer Testing Data
   d. Aquifer Testing Analysis
   e. Well Video
C. Well A4
   a. Pumping Equipment Inventory
   b. Pumping Equipment Improvements
   c. 1994 DC Drilling Well Rehabilitation Notes
   d. Aquifer Testing Data
   e. Aquifer Testing Analysis
   f. Well Video
D. Test Hole Drilling Logs and Sandstone Sieve Analyses
E. 1-Anderson Test Well
   a. Well Completion History
   b. Lithologic Log
   c. Drilling Penetration Rates
   d. Geophysical Logs
   e. Well Construction Materials
   f. Well Development Records
   g. Aquifer Testing Data
   h. Aquifer Testing Analysis
   i. Well Video
F. Sargent Drilling Company Final Pay Request for 1-Anderson Test Well
1.0 Introduction

In 2011 with authorization from the Wyoming State Legislature, the Wyoming Water Development Commission (WWDC) retained Lidstone and Associates, Inc. (LA), to complete a Level II project for the Town of Burns (Town), the project sponsor. LA teamed with AVI, p.c., (AVI) to complete the evaluation of the Town’s existing high capacity wells, and the construction of a new Arikaree Formation production well in the High Plains Aquifer.

LA completed a Level I Master Plan evaluation of the Town water system in 2011 (Lidstone, 2011). Based on results of that study, it was determined that the Town needed to obtain additional and supplementary water to account for future growth in the water system service area, to provide adequate source redundancy in case of well failure, and to help meet fire flows. The Master Plan study projected that the Town needs to supply approximately 325 gallons per minute (gpm) to meet the peak summertime demands in 2040. Based on available water use data, the Town's four existing Arikaree Formation wells are capable of meeting that demand. Their capability of meeting that demand was demonstrated in July 2007, when during one day that month, the four wells together yielded 458 gpm. However, all the wells were operated continuously to meet that peak summer demand. Had either one of the Town's highest capacity wells (Well A2 or A4) failed, the Town would not have had sufficient water to meet demand. Given the ages and histories of Wells A2 and A4 that were originally constructed in 1956 and 1977, respectively, the Town needed a new high capacity well to provide water source redundancy.

1.1 History and Project Background

The Town's water system is supplied with potable water from four Arikaree Formation wells located within the Town limits. Wells A2 and A4 each yield 200 gpm to the water system, while Wells A5 and A6 each yield 30 gpm. These four wells are directly connected to the water distribution system. Well A3 is owned by the Town and is used to water athletic fields adjacent to the school located on the southeast side of Town. Well A3 is not connected to the distribution system. A 200,000-gallon water tank is located in the eastern portion of the Town near Well A6 that provides the operating pressure, storage for peak demand periods, and fire flow demands for the water system. Water from the distribution system is used for residential and commercial purposes as well as fire suppression. The distribution system is looped throughout Town. The elementary and high schools are the largest commercial water user. The other commercial users in Burns are smaller businesses and it is thought their water use is comparable to residential use. A SCADA system (Supervisory Control and Data Acquisition) is used to control the operation of the wells and the water system.

The Level I Master Plan study was the first comprehensive survey of the Town’s water system. The study was completed in January 2011 with funding from the WWDC. The results of that investigation highlighted two significant needs:

1. Increase the storage capacity of the water system to meet future growth and fire suppression requirements.

2. Develop additional water supply and provide redundancy via well improvements and/or a new water supply well.
To address storage capacity, a new 200,000-gallon elevated storage tank was completed in 2012 with Level III WWDC funding assistance. With the completion of the tank near Well A2, the Town has increased water storage capacity and can supply the required fire flow needs of the Laramie County public school in Burns.

Preliminary investigation suggested that Wells A2 and A4 are nearing the end of their design life, but still have serviceable life remaining. Wells A2 and A4 historically yielded more than their 200 gpm operating capacity, but Well A4 produced considerable sand at higher pumping rates, particularly above 650 gpm. The preliminary findings of the Level I study suggested that Well A3 was also capable of yielding additional water supplies to the Town. The Level II investigation determined the amount of additional water that could be obtained from these wells based on their actual physical condition and yield characteristics. Increasing the yields of the existing wells would alleviate some of the supply issues facing the Town, but would not eliminate issues of source redundancy and potential well failure. It was determined that the completion of a new large capacity production well would address both of these issues.

During the Level I study, it was discovered that Well A5 had only a temporary permit with the Wyoming State Engineer’s Office (SEO). LA collaborated with the Town and the SEO to restart the permitting process. As a result of that process, the SEO granted the Town a water right in February 2012 for Well A5 under Permit No. U.W. 197348.

1.2 Authorization and Purpose

This Level II feasibility study was undertaken to increase the Town’s available water supply in order to accommodate future growth of the system, meet fire flows, and provide source redundancy. The purposes of this project were to:

- Evaluate the feasibility of increasing the pumping rates of A2, A3, and A4, and to identify the pumping rates that these wells could reasonably sustain.
- Identify potential drilling sites for an Arikaree Formation (High Plains Aquifer) test well in close proximity to the Town.
- Complete a new high capacity test production well in the High Plains Aquifer.
- Develop designs for pumping system improvements and to provide transmission and water treatment system alternatives, as required.
- Prepare conceptual designs, cost estimates, financing and economic analysis of sufficient detail to move the recommended improvements toward a WWDC Level III construction phase.
- In addition a supplementary water quality assessment was conducted to address concerns with regional nitrate and the Town’s wells gross alpha concentration.
2.0 Existing Well Evaluation and Testing

In collaboration with Sargent Drilling (Sargent) of Broken Bow, Nebraska, LA evaluated the physical condition and water yielding character of Wells A2, A3, and A4. The locations of these and the other Town wells relative to the local bedrock geology are shown on Figure 2.1. Since Wells A5 and A6 produce less than 30 gpm of water and are not as old, they were not included in the detailed inspection and evaluation. The evaluation of each well involved removing, inspecting, and cataloging the existing pumping equipment; video surveying of the well casing and screen; stepped and constant rate testing of the High Plains Aquifer using a test pump; collecting and analyzing water quality samples; and resetting the existing pumping equipment. For the aquifer tests, LA acquired a WYPDES permit and signed consents from Boyd Frye for discharge from Wells A2 and A4, and from Stephen Birt for discharge from Well A3. A copy of the discharge permit (Permit No. WYG720281) is included in Appendix A. Based on the condition of the pumping equipment in each well the Town opted at its own expense to pay for certain equipment improvements prior to pump reinstallation. Details on these respective improvements are included in the Project Notebook.

During August 2012 and February 2013, LA obtained additional water quality samples from Burns existing wells, the new test well, and several local domestic wells. The samples were collected to obtain additional water quality data related to the concentrations of nitrate in the High Plains Aquifer, and to assess gross alpha concentrations that were approaching or exceeding U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs). Because of concerns regarding laboratory analytical protocol and past sampling and laboratory errors, samples were split between two EPA-certified laboratories: Energy Labs, Casper, Wyoming (Energy) and Intermountain Labs, Sheridan, Wyoming (IML). Results of this analytical effort are summarized in Section 5.

2.1 Well A2 Assessment

Evaluation of Well A2 was completed in October 2011. Well A2 was originally constructed around 1956, but the details of the existing pumping equipment and completion of this reportedly 200-foot deep, 12-inch diameter well were unknown beyond information contained in the SEO records. At the time of this investigation, the well was producing 200 gpm directly to the water system. Original reports, field notes, and details of the investigation are included in the Project Notebook.

2.1.1 Well A2 Well Video Survey

The video survey of Well A2 revealed a number of previously unknown details about the completion of this well as noted in Table 2.1. The well is a telescoped completion. While the well is completed with 16-inch diameter casing at the surface, the casing diameter reduces to 12 inches at a depth of approximately 8 feet. The well is completed with a combination of blank and perforated steel casing. Blank casing extends from surface to a depth of 146 feet, and vertically slotted casing extends from 146 to 184+ feet.

The following conditions were also observed from the video:

- The interval from 146 to 152 feet appears to be the most productive as the water column below this point was more turbid.
- Approximately 40% of the perforations appeared to be partially or completely blocked by encrustations. Both the blank and perforated casing below water level exhibited evidence of corrosion.
Gravel pack was visible through the slotted casing.

The well was measured to be 190.5 feet deep.

The PVC pump shroud had fallen to the bottom of the well. The top of the shroud was visible at a depth of 184 feet. Because the camera was lowered to the well bottom through the shroud, the condition of the well casing below this depth could not be viewed.

### 2.1.2 Well A2 Existing Pumping Equipment

The pumping equipment in Well A2 was generally in good condition, as noted in Table 2.2. The pump was originally set at a depth of 181 feet. The pump, electrical cable, and transducer all appeared to be in good condition. Following the aquifer tests, Sargent reinstalled this existing equipment, along with a new pump shroud. The pump drop pipe and pump attachment were corroded and showed signs of encrustation, but did not exhibit deep pitting underneath the tubercles. Sargent cleaned the pipe and exchanged three pipe sections located above water level with three from below water level. They also replaced the pump attachment, installed a new check valve in the drop pipe at water level, and removed 10 feet of drop pipe to keep the pump above the PVC pump shroud at the well bottom. The pump was reset to a depth of 168 feet.

### 2.1.3 Well A2 Aquifer Testing

Following removal of the pumping equipment and completion of the well video, Sargent installed a test pump in the well. A stepped rate test was completed on October 4, 2011. LA and Sargent completed the stepped rate test with discharge rates of 170, 299, 402, and 490 gpm. The steps were generally completed for 60 minutes each, and the discharge rate was increased at the end of each step. Figure 2.2 graphically summarizes the drawdown associated with each pumping rate, and Figure 2.3 illustrates the specific capacity curve of the well. Results of the stepped rate test are summarized in Table 2.3.

The results of the stepped rate test of Well A2 demonstrate that:

- This well yields water efficiently despite its age and apparent screen blockages. During the test, the specific capacity of the well diminished between successive steps from 24.7 to 20.3 gpm/ft of drawdown. Maximum drawdown over the course of the test was 24 feet.

- The maximum yield point of the well was not established from the test. As shown on Figure 2.3, the slope of the discharge vs. drawdown plot for the test did not change, suggesting that the well could yield additional groundwater beyond the 490 gpm at which it was tested.

- Sand production from the Arikaree Formation generally increased with each step. Fine-grained sand concentrations started at 6.3 mg/L, decreased to 3.9 mg/L on the second step, and increased to 21 and 46 mg/L on the 402 and 490 gpm steps, respectively.

The constant rate test was completed on October 5, 2011. Based on the stepped rate test data, a target rate of 400 gpm was selected for the constant rate test. The constant rate test was run for eight hours at a discharge rate of 394 gpm. The specific capacity of the well dropped from 23.5 gpm/ft after 40 minutes to 19.8 gpm/ft after eight hours. Total drawdown after eight hours of pumping was 19.9 feet. Figure 2.4 graphically summarizes the drawdown associated with the test. Results of the constant rate test are summarized in Table 2.4.

The results and recommendations developed from the constant rate test are summarized as follows:
• The well should be able to sustain production rates of up to 400 gpm for long pumping periods. Higher pumping rates from this well are possible because the test did not reveal any adverse boundary conditions in the High Plains Aquifer.

• Pumping this well at higher discharge rates increases the production of fine grained Arikaree Formation sand from the well. Sand production diminished during the constant rate test, but remained high. LA measured sand production to be 72 mg/L after one hour pumping, 54 mg/L after two hours pumping, and 26 mg/L after eight hours of pumping.

• The hydrogeologic parameters associated with the High Plains Aquifer at this location are typical of fractured sandstone. Transmissivity and hydraulic conductivity values of 40,800 gallons per day per foot (gpd/ft) and 329 gallons per day per square foot (gpd/ft²), respectively, were calculated based upon the drawdown versus time data.

2.1.4 Well A2 Water Quality
LA collected and submitted samples of groundwater from this well to Energy on October 5, 2011, and to IML on August 9, 2012. Results of the analyses are summarized in Table 2.5. The full analytical results of these sampling events are included in Appendix B. The water quality samples exhibited low concentrations of total dissolved solids (TDS). Calcium and magnesium are the principal cations in the groundwater, while bicarbonate is the predominant anion.

Analysis of the water quality of this well identified several constituents of concern. The water contains arsenic and uranium at concentrations at 0.003 mg/L and 0.0125 mg/L. Both of these concentrations are below the current MCLs for these constituents. Nitrate concentrations are elevated at 6.8 mg/L, approximately 70% of the 10 mg/L MCL. Despite concentrations of radium below detection, Energy reported a gross alpha concentration of 20.1 pCi/L, which is above the MCL when factoring in uranium. For QA/QC purposes, a second water quality sample was collected in August 2012 and analyzed by IML. Based on the results of that sampling, the gross alpha concentrations may actually be closer to 6 pCi/L. The results of further sampling and analyses of the radionuclide parameters are presented in Section 5.

2.1.5 Well A2 Water Supply Improvement Alternatives
Based on the evaluation work completed, the Town has several options it could pursue to increase the yield of Well A2, although with some associated risks. The status quo option is keep the well as it is currently operated. The well currently yields 200 gpm while producing a modest amount of fine-grained sand. The status quo option costs the Town nothing, but does nothing to improve yield or affect the long term viability of the well.

The Town has the following short term and long term options to maintain the viability of this well:

1. Increase the production rate of Well A2 to 400 gpm. This change in production would be accomplished by exchanging the current pumping equipment with a variable frequency drive, pump, and motor. This option will require approval from the SEO since this well has an adjudicated water right of only 275 gpm. With this equipment, the Town could produce more water for either short or long periods of time. This option would compensate for lost production from another well or provide additional water during peak demand periods. Increasing the groundwater production of this well comes with costs associated with additional sand production. Pumping at 400 gpm may increase sand production rates from approximately 6 mg/L to 25-30 mg/L. Sand separating equipment would be required to remove the majority of the sand before entering the distribution system and water storage.
tanks. Sand removal efficiency ranges between 90 to 100%. Increasing both the water and sand production rates from this well will accelerate potential pump failure/replacement, and well failure as the sand can cut and erode the vertical slots in the perforated casing.

2. **Drill a replacement well and abandon the current well.** Well A2 was originally drilled as a replacement for Well A1 which was subsequently abandoned and lies beneath the storage tank completed onsite in 2012. Given the productivity of Well A2, LA anticipates that a 10-inch diameter replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production for the Town.

The costs and approach associated with these alternatives are presented in Section 6.

### 2.2 Well A3 Assessment

LA and Sargent completed an evaluation of Well A3 in September 2011 to determine whether it would be appropriate to connect the well to the Town water system and thereby increase the Town’s water supply. Well A3 currently supplies irrigation water to two athletic fields near the school. Based on SEO records, Well A3 was originally completed in July 1990 with 6-inch diameter PVC casing to a depth of 250 feet. Details of the pumping equipment in the well were unknown prior to this investigation. LA completed a limited step test on the well in August 2009 to estimate the approximate yield of the well, and submitted water samples for analysis. Results of the testing indicated that the well may be capable of sustaining a yield of 100 gpm or more, but the analytical data raised concerns regarding the groundwater quality of the well, particularly with regard to lead, nitrate, uranium, and gross alpha (Lidstone, 2011). Original reports, field notes, and details of the investigation are included in the Project Notebook.

#### 2.2.1 Well A3 Video Survey

The video survey of Well A3 revealed several details of the completion of this well as noted in Table 2.1. The video indicated the well is completed with bell end PVC casing and slotted screen to a depth of approximately 237 feet, and has approximately 13 feet of fill material in the bottom of the well. Two screened intervals are present at depths of 114-154 and 174-234 feet. The screen appears to have been field cut as the slot lengths are variable. The cuts had been made in five vertical columns through these depth intervals. Gravel pack was visible through the slots and appeared to be entering the well through some of the slots.

The following conditions were also noted:

- The screen and casing appeared to be in very good physical condition with one significant exception noted below. The slots did not appear to be encrusted or blocked in any way.
- There is a 2-foot long vertical crack along one of the columns of slots in the lower screened interval. The crack extends from 193-195 feet. The width of the crack appeared to be approximately two to three times the width of the field cut slots.
- The well is not plumb, and there is some evidence of pipe rub from the pump column pipe.

#### 2.2.2 Well A3 Pumping Equipment

Inspection of the pumping equipment in Well A3 revealed that it had deteriorated to the point that Sargent recommended replacement, as noted in Table 2.2. The pump was originally set at a depth of 220 feet. The original pump was a Goulds 90L15 that was manufactured in October 1989. Sargent
found metal pieces in the pump from the check valve and from the collets that hold the impellers in place, and noticed the pump shaft had a lot of side play. The up thrust bearing on the motor was worn down to the point where it required replacement. Sargent recommended replacing the pump and motor along with the wire and column pipe due to the lack of a ground on the pump wire, and deterioration of the column pipe threads.

The Town approved and paid for complete replacement of the pump, motor, column pipe, and wire as recommended by Sargent. Following the aquifer tests, Sargent installed the new pumping equipment, including a Goulds 80GS75 pump and 7.5 hp Franklin motor. Due to the crack in the lower screened interval, the pump was installed to a depth of 169 feet, or approximately 14 feet above the fracture and between the screened intervals. Details on the equipment that was installed are noted in Table 2.2, and are included in the Project Notebook.

### 2.2.3 Well A3 Aquifer Testing

Following removal of the pumping equipment and completion of the well video, Sargent installed a test pump in the well. Due to the fracture in the lower screened interval, and Sargent’s concern with potentially losing their pump, the test pump intake was placed above the fracture at a depth of 185 feet. The stepped rate test was completed on September 27, 2011 with discharge rates of 45, 94, and 111 gpm. The first two steps were generally completed for 60 minutes each, and the discharge rate was increased at the end of each step. The final step was terminated after 40 minutes due to cavitation. Figure 2.5 graphically summarizes the drawdown associated with each pumping rate, and Figure 2.6 illustrates the specific capacity curve of the well. Results of the stepped rate test are also summarized in Table 2.3.

Based on the results of the stepped rate test, the following observations can be made of Well A3:

- This well does not yield water efficiently. During the step test, the specific capacity of the well diminished between successive steps from 3.1 to 1.6 gpm/ft. Maximum drawdown over the course of the test was approximately 70 feet. This inefficiency is at least partly due to the manner in which this well is screened and completed.

- The maximum yield point of the well from the 185-foot pump setting is approximately 90 gpm. As shown on Figure 2.6, the slope of the discharge vs. drawdown plot for the test changes dramatically after the 94 gpm step, indicating that the well cannot provide the water demanded by the pump beyond this point. It is possible that a higher yield could be obtained from a deeper pump setting.

- Sand production from the Arikaree Formation diminished greatly after the first step. Fine-grained sand concentrations during the first step were very high but could not be quantitatively measured due to the large quantity of sand produced. The extreme sand production during the first step was due to the location of the pump intake adjacent to screen. Sand concentrations diminished to 1.0 and 2.6 mg/L during the two subsequent steps.

LA and Sargent completed the constant rate test on September 28, 2011. Based on the stepped rate test data, a target rate of 90 gpm was selected. The constant rate test was conducted for four hours at a discharge rate of 84 gpm. The specific capacity of the well held steady during the test at 2.4 gpm/ft after both 60 minutes and four hours. Total drawdown after four hours of pumping was 35.5 feet. Figure 2.7 graphically summarizes the drawdown associated with the test. Results of the constant rate test are also summarized in Table 2.4.
The results of the constant rate test are summarized as follows:

- Well A3 can sustain production rates of 80-90 gpm for long pumping periods. Higher pumping rates may be possible with a deeper pump setting.
- The test did not reveal any adverse boundary conditions in the High Plains Aquifer.
- The hydrogeologic parameters associated with the High Plains Aquifer at this location are typical of sandstone. Transmissivity and hydraulic conductivity values of 11,700 gpd/ft and 74 gpd/ft², respectively, were calculated from the test data.
- Pumping this well for long periods does not produce significant volumes of sand. Sand production rates of only 0.2 mg/L were measured during the test period.

2.2.4 Well A3 Water Quality

When groundwater from Well A3 was analyzed for water quality parameters under the Level I study, lead was reportedly detected above its MCL at a concentration of 0.112 mg/L, and gross alpha was detected at 13.6 pCi/L (Lidstone, 2011). Given those sampling results and the hope that this well might be connected to the Town's water system, LA planned to sample the well for a full EPA drinking water analysis to assess the groundwater quality for municipal water supply purposes. With the structural damage to the screen and associated limitations on pump setting depth, LA reduced its sampling and analysis to a major ion and radionuclide analysis of the water. LA collected and submitted samples of groundwater from this well to Energy on September 28, 2011. Well A3 yields low TDS, calcium bicarbonate type groundwater from the High Plains Aquifer. Results of the analyses are summarized in Table 2.5. The full analytical results are included in Appendix B.

Based on the analytical results, the quality of groundwater from the High Plains Aquifer from Well A3 generally meets EPA standards, but there are constituents of concern. Nitrate was detected at a concentration of 5.6 mg/L or slightly higher than in 2009 during the Level I study. Lead was again detected, but only at a concentration of 0.001 mg/L, well below its MCL. The current low detection level suggests the previous 2009 Level I study sampling results were due to lab error. Uranium was detected at a concentration of 0.013 mg/L, but gross alpha was detected at 16.9 mg/L or close to the MCL.

2.2.5 Well A3 Water Supply Improvement Alternatives

The results of the Well A3 evaluation revealed that the Town has a serviceable well capable of supplying sufficient water to the athletic fields at the school. Due to problems with well construction, however, it would be inappropriate to tie this well into the water system. The fracture in the lower screened interval is a potential failure point, and the well does not appear to have a sanitary seal to comply with Wyoming Department of Environmental Quality/Water Quality Division (DEQ/WQD) Chapter 26 water quality regulations.

With these points in mind, the Town has the following respective short term and long term options for this well:

1. **Continue to utilize the current 80 gpm production rate for irrigation of the athletic fields.** This well provides value to the Town for irrigation purposes. Well A3 provides sufficient water to maintain healthy turf grasses, and effectively lowers the demand on the Town’s water system. When the well fails in the future, that demand could fall back on the Town’s water system.
2. **Drill a replacement well and abandon the current well.** When the present well is no longer serviceable due to casing failure, sand pumping, or backfilling, a replacement well could be drilled and completed at this site. That well should be completed with 10-inch diameter casing, wire-wrapped well screen and gravel pack, and an appropriate sanitary seal such that it can be plumbed into the Town water system. In this way, the well would maximize groundwater production and minimize sand production both for irrigating the athletic fields, and for the Town water supply system. The hydrogeologic properties, productivity, and water quality of Well A3 suggest that a successful replacement well can be completed at this location in the future.

The cost associated with the second alternative is presented in Section 6 of this report.

### 2.3 Well A4 Assessment

LA and Sargent completed an evaluation of Well A4 in October 2011. Based on SEO records, this well was originally completed in 1977 to a depth of 235 feet with 16-inch diameter blank and wheel cut perforated casing. The well reportedly yielded 1,500 gpm at the time of construction. No details on the pumping equipment were available. At the time of this investigation, the well was producing 200 gpm to the water system. Original reports, field notes, and details of the investigation are included in the Project Notebook.

#### 2.3.1 Well A4 Video Survey

As noted in **Table 2.1**, the video survey revealed the well completion had changed significantly since its original construction in 1977. Based on discussions and notes from DC Drilling (DC) of Lusk, Wyoming, this well was lined with steel casing and stainless steel screen in 1994 to reduce sand production following test hole drilling near the well. A test hole was drilled via flooded reverse rotary methods approximately 70 feet northeast of Well A4. SEO records indicate that DC lost circulation in a sandstone at a depth of 103 feet, and terminated drilling at that time because a direct hydraulic connection with Well A4 was observed.

With the test hole effort abandoned, the Town reportedly asked DC what could be done to reduce the sand production of Well A4. In response, DC perforated the casing, which allowed the gravel pack to fall in when the casing failed. DC then mobilized a reverse rotary rig to clean the sand and gravel pack from the well, and lined it with 10 3/4-inch diameter 0.365-inch thick blank steel casing and 50 feet of Johnson stainless steel 0.015 inch slot wire-wrapped well screen. The annular space was filled with 16X30 silica sand from the well bottom depth of 219 feet to 80 feet. The upper 80 feet of annular space was filled with cement. Copies of DC’s well rehabilitation notes are included in the Project Notebook.

The well video survey revealed the following:

- Well screens are present at depth intervals of 97-118 and 176-207 feet.
- Approximately 50% of the screen was partially or completely blocked with encrustations, and there was significant tubercle growth on blank casing sections.
- The screen appeared to be in good physical condition, but there were many tubercles covering sections of the screen. Deterioration and corrosion of the original 16 inch casing appeared to be accelerating the corrosion of the current well casing and screen.
Gravel pack was visible behind the screen.

- The well was measured to be 216 feet deep, and likely had 3 feet of fill at the well bottom.

### 2.3.2 Well A4 Existing Pumping Equipment

As noted in Table 2.2, the pumping equipment in Well A4 was generally in good condition. The pump was originally set at a depth of 147 feet. The pump, motor, electrical cable, and transducer all appeared to be in good condition. However, several sections of the pump column pipe exhibited corrosion. Sargent extended the wellhead casing to a height of 18 inches above the building floor and reconfigured the discharge line. Sargent reinstalled the existing equipment with a few modifications following the aquifer tests. The modifications included replacing four joints of iron drop pipe with galvanized pipe, and installing a new check valve at water level. The pump was reset to a depth of approximately 147 feet.

### 2.3.3 Well A4 Aquifer Testing

In August 1994, following the lining of this well, DC completed a 48 hour constant rate test of the well in collaboration with Western Water. The well reportedly was tested at a discharge rate of 450 gpm, and produced minimal sand from the aquifer.

For this study, Sargent installed a test pump in the well. The stepped rate test was completed on October 11, 2011. The stepped rate test was completed with discharge rates of 115, 271, and 292 gpm. The first step was limited to 40 minutes due to extremely high back pressures (>300 psi) on the discharge manifold, but the subsequent steps were generally completed for 60 minutes. The discharge rate was increased at the end of each step. Figure 2.8 graphically summarizes the drawdown associated with each pumping rate, and Figure 2.9 illustrates the specific capacity curve of Well A4. Results of the stepped rate test are also summarized in Table 2.3.

The results of the stepped rate test of Well A4 revealed that:

- This well does not yield water efficiently at all production rates. The specific capacity diminished from 13.5 to 9.5 gpm/ft over the first two steps, and dropped to 3.5 gpm/ft at a discharge rate of 292 gpm. The maximum drawdown over the course of the test was approximately 83 feet.

- The maximum yield point of the well is approximately 250 gpm. As shown on Figure 2.9, the slope of the discharge vs. drawdown plot changes abruptly after 270 gpm, indicating that in its current condition this well will not sustain any higher discharge rates.

- Sand production during the stepped rate test was minimal. Sand concentrations over the course of the three hour test were measured to be approximately 1.8 mg/L.

The constant rate test was completed on October 13, 2011. Based on the stepped rate test data, LA selected a target rate of 225 gpm, and completed the test for eight hours at a discharge rate of 220 gpm. At this pumping rate the specific capacity of the well diminished from 9.6 gpm/ft after 30 minutes to 9.1 gpm/ft after eight hours. Total drawdown after eight hours of pumping was 24.2 feet. Figure 2.10 graphically summarizes the drawdown associated with the test. Results of the constant rate test are also summarized in Table 2.4.
The results of the constant rate test are summarized as follows:

- Well A4 can sustain a production rate of 200 gpm. While the constant rate test did not reveal any adverse boundary conditions in the High Plains Aquifer, it indicated that the production capability of this well has deteriorated since DC completed their test in 1994.
- Pumping Well A4 results in virtually no sand production indicating DC’s recompletion effort was successful in that regard. Over the course of the aquifer testing, sand production was 0.05 mg/L.
- The hydrogeologic parameters associated with the High Plains Aquifer at this location are typical of fractured sandstone. Transmissivity and hydraulic conductivity values of 89,600 gpd/ft and 551 gpd/ft², respectively, were calculated from the results of the constant rate aquifer test.

2.3.4 Well A4 Water Quality

LA collected and submitted samples of groundwater from this well to Energy on October 13, 2011, and to IML on August 9, 2012, respectively. Results of the analyses are summarized in Table 2.5. The analytical results of these sampling events are included in Appendix B. Of the three production wells sampled, Well A4 yields groundwater with the lowest concentration of TDS. Calcium and magnesium are the principal cations, while bicarbonate is the predominant anion.

Water from this well meets EPA drinking water standards. The water contains arsenic and uranium at concentrations 0.003 mg/L and 0.0075 mg/L, respectively. These concentrations are both below present MCLs. Nitrate concentrations remain elevated at 4.8 mg/L, but are less than nitrate concentrations measured at Wells A2 and A3. Based on the Energy results, gross alpha concentrations are near the MCL and radium 226 is present. In contrast, the IML results indicate radium is not present above detection limits and gross alpha is only one half of the MCL. The results of further sampling and analyses of the radionuclide parameters are presented in Section 5.

Deterioration of the well was observed, but there does not appear to be a microbial basis for it. Iron related and sulfate reducing bacteria were not detected in the samples submitted to Energy. It is possible that the corrosion is simply due to water chemistry. Based on calculations of the Ryznar stability index and Langelier saturation index, groundwater from this well is highly corrosive and aggressive to metal. Any proposed improvements to the current or future infrastructure will need to account for this condition.

2.3.5 Well A4 Water Supply Improvement Alternatives

Comparing the Level II evaluation work to historic documentation, the groundwater production capability of this well has declined from 1,500 to approximately 250 gpm, which represents an 83% loss in yield. Given the 44% drop in production from 450 to 250 gpm over the 18 years since the 1994 rehabilitation effort, the groundwater production capabilities of Well A4 will continue to diminish without additional rehabilitation. It is uncertain how long it will take for that deterioration to impact the Town’s ability to maintain production from Well A4. The Town can continue to utilize the 200 gpm production of essentially sand free water from the well with no additional financial costs beyond standard operating costs. Continued utilization of this well as is does nothing to improve its remaining serviceable life, eliminate the ongoing losses in efficiency and/or yield, or increase the amount of water available for the Town.
LA presents the following short term and long term options to maintain the viability of the groundwater produced from the vicinity of Well A4:

1. **Rehabilitate the existing well.** Based on the data evaluated, the deterioration of this well is primarily due to chemical corrosion of the well casing and screen within the wellbore. The Town could contract a licensed well drilling contractor in an effort to further improve the yield and/or efficiency of the existing well. Using mechanical tools such as sonar jetting could be used to break up and remove the encrustations and tubercles, and improve the water yielding capability of the well. If this approach is successful, it is only a short term solution because it will not change the local groundwater chemistry or reverse the corrosion process. There is risk in proceeding with mechanical rehabilitation of the well. It could lead to collapse of the screen or casing resulting in well failure depending upon how fragile the well casing and screen have become.

2. **Drill a replacement well and abandon the current well.** Based on the well video, calculated hydrogeologic parameters, reported historic production, and local hydraulic communication with a previous test hole, it appears that additional groundwater could be produced from this location with a properly completed well. A higher capacity replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production. This option provides the Town a more reliable long term water supply with potentially additional yield.

The costs associated with these alternatives are presented in Section 6.
### Table 2.1
Existing Production Well Completion Details and Observations

<table>
<thead>
<tr>
<th>Permit No.</th>
<th>Well Name</th>
<th>Well Location (T, R, Sec.)</th>
<th>Surface Elevation (ft)</th>
<th>Reported Well Depth (ft)</th>
<th>Actual Well Depth (ft)</th>
<th>Reported Well Diameter (in)</th>
<th>Actual Well Diameter (in)</th>
<th>Screened Interval (ft)</th>
<th>Well Screen Type</th>
<th>Original Depth to Water (ft)</th>
<th>Current Depth to Water (ft)</th>
<th>High Point Aquifer Water Level Elevation (ft)</th>
<th>Permitted/Adjudicated Water Right (gpm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1360W</td>
<td>Well A2</td>
<td>T14N, R21W, Sec. 7 NWSE</td>
<td>5,522</td>
<td>200</td>
<td>190.5</td>
<td>12</td>
<td>16, 12</td>
<td>146-184†</td>
<td>Vertical punch</td>
<td>128</td>
<td>118.31</td>
<td>5,404</td>
<td>275</td>
<td>Well has 16 inch diameter casing at surface, which reduces to 12 inch diameter approximately 8 feet below surface. Below that depth, residual cement was visible along the casing/screen. Could not see casing below depth of 184 feet because casing dezined through pump shroud which had fallen to the bottom of the well. Well likely perforated between 184 and 190.5 feet. Best water yielding zone appeared to be 146-152 feet at the top of the screened interval.</td>
</tr>
<tr>
<td>P9110W</td>
<td>Well A3</td>
<td>T14N, R21W, Sec. 7 NWSE</td>
<td>5,517</td>
<td>250</td>
<td>237</td>
<td>6</td>
<td>6</td>
<td>114-154, 174-234</td>
<td>0.034&quot; Horizontal field-slated PVC in five vertical columns</td>
<td>--</td>
<td>101.90</td>
<td>5,415</td>
<td>150</td>
<td>Well has a 2 foot long vertical crack within the screened interval between 193-195 feet. Test pump installed to depth of 181 feet.</td>
</tr>
<tr>
<td>P17502W</td>
<td>Well A4</td>
<td>T14N, R21W, Sec. 7 WNE</td>
<td>5,483</td>
<td>235</td>
<td>216</td>
<td>16</td>
<td>10.75</td>
<td>97-118; 176-207</td>
<td>0.015&quot; Stainless steel wire-wrapped well screen</td>
<td>76</td>
<td>72.60</td>
<td>5,410</td>
<td>850</td>
<td>Well originally completed with 10 inch diameter casing, but was lined with 10.75 inch diameter casing and well screen in August 1994 by DC Drilling. 10K 300yd pack placed in annular space between casings over screened interval to depth of 80 feet.</td>
</tr>
<tr>
<td>P19748W</td>
<td>Well A5</td>
<td>T14N, R21W, Sec. 7 WSW</td>
<td>5,516</td>
<td>200</td>
<td>NA</td>
<td>6</td>
<td>6</td>
<td>141-195</td>
<td>0.015&quot; screen</td>
<td>97</td>
<td>NA</td>
<td>NA</td>
<td>350</td>
<td>Not evaluated during this study.</td>
</tr>
<tr>
<td>P1358W</td>
<td>Well A6</td>
<td>T14N, R21W, Sec. 7 SSE</td>
<td>5,518</td>
<td>232</td>
<td>NA</td>
<td>10.75</td>
<td>10.75</td>
<td>125-155; 170-190</td>
<td>0.015&quot; screen</td>
<td>104.3</td>
<td>NA</td>
<td>NA</td>
<td>100</td>
<td>Not evaluated during this study.</td>
</tr>
</tbody>
</table>

Notes:
1. Permit number on file with the Wyoming State Engineer's Office.
2. Well locations shown on Figure 2.1.
3. Surface Elevation Estimated from handheld GPS and Google Earth. Elevation above mean sea level.
4. Reported Information Obtained from UWES well completion reports on file with the Wyoming State Engineer's Office.
5. Information obtained through downstream color video survey of the well. For Wells A5 and A6, information was obtained from Wyoming State Engineer's Office Records or not available (NA).
6. Depth to water measured prior to stepped rate test on each respective well.

### Table 2.2
Existing Production Well Pumping Equipment

<table>
<thead>
<tr>
<th>Permit No</th>
<th>Well Name</th>
<th>Pumping Equipment Status</th>
<th>Pump Column Pipe</th>
<th>Check Valve</th>
<th>Pump Setting (HP)</th>
<th>Pump Wire</th>
<th>Well Pump</th>
<th>Well Motor</th>
<th>Pressure Transducer</th>
<th>Condition/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1360W</td>
<td>Well A2</td>
<td>Prior to aquifer testing</td>
<td>4&quot; Galvanized pipe</td>
<td>4&quot; Clayton Mark</td>
<td>181</td>
<td>1.3986 8 AWG Submersible pump cable</td>
<td>Grundfos PC 3763630-5</td>
<td>6&quot; Franklin, 30 Horsepower</td>
<td>Endress Hauser, Water Pilot</td>
<td>Pump and motor in relatively good condition; pump column pipe showed some evidence of deterioration.</td>
</tr>
<tr>
<td>P1358W</td>
<td>Well A3</td>
<td>Prior to aquifer testing</td>
<td>2.5&quot; Galvanized pipe</td>
<td>--</td>
<td>220</td>
<td>46, 3&quot;Wine ungrounded</td>
<td>Goulds 90L15-11</td>
<td>4&quot; Franklin, 15 Horsepower</td>
<td>--</td>
<td>Pump motor, pump, electrical wire, and column pipe all required replacement. Town paid for replacement equipment.</td>
</tr>
<tr>
<td>P1360W</td>
<td>Well A2</td>
<td>Post aquifer testing</td>
<td>2&quot; Schedule 80 PVC pipe</td>
<td>2&quot; valve</td>
<td>169</td>
<td>820 Grounded submersible pump cable</td>
<td>Goulds 800575</td>
<td>4&quot; Franklin, 7.5 Horsepower</td>
<td>--</td>
<td>Replaced existing equipment with all new pumping equipment.</td>
</tr>
<tr>
<td>P9110W</td>
<td>Well A3</td>
<td>Post aquifer testing</td>
<td>2&quot; Galvanized pipe</td>
<td>4&quot; valve</td>
<td>147</td>
<td>3-WAG Grounded Centrifugal submersible pump cable</td>
<td>Grundfos PC 3763630-5</td>
<td>6&quot; Franklin, 30 Horsepower</td>
<td>Endress Hauser, Water Pilot</td>
<td>Pump, motor and electrical cable in good condition; mild steel pipe exhibited sufficient corrosion requiring replacement of most pump column pipe.</td>
</tr>
<tr>
<td>P17502W</td>
<td>Well A4</td>
<td>Post aquifer testing</td>
<td>2&quot; Galvanized and steel pipe</td>
<td>4&quot; valve</td>
<td>147</td>
<td>3-WAG Grounded Centrifugal submersible pump cable</td>
<td>Grundfos PC 3763630-5</td>
<td>6&quot; Franklin, 30 Horsepower</td>
<td>Endress Hauser, Water Pilot</td>
<td>Replaced four joints of mild steel pump column pipe; installed check valve at water level; extended wellhead casing 18 inches above wellhouse floor.</td>
</tr>
</tbody>
</table>

Notes:
1. Permit number on file with the Wyoming State Engineer's Office.
2. More detailed notes on the pumping equipment and condition for each well are contained in the Project Notebook.

Lidstone and Associates, Inc. 2-11
May 2013
Burns Well Level II Study
Wyoming Water Development Commission

K:\OPEN\WYWDC111\LEVEL II REPORT\FINAL report.docx
Table 2.3  Burns Existing Production Well Stepped Rate Test Summaries

<table>
<thead>
<tr>
<th>Date</th>
<th>Elapsed Time (min)</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)¹</th>
<th>Drawdown (ft)²</th>
<th>Sc (gpm/ft)³</th>
<th>pH</th>
<th>Sand Production (mg/L)</th>
<th>Electrical Conductivity (µS/cm)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/4/2011</td>
<td>60</td>
<td>170</td>
<td>125.18</td>
<td>6.87</td>
<td>24.7</td>
<td>7.25</td>
<td>6.3</td>
<td>428</td>
<td>15.5</td>
</tr>
<tr>
<td>10/4/2011</td>
<td>60</td>
<td>299</td>
<td>131.74</td>
<td>13.43</td>
<td>22.3</td>
<td>7.31</td>
<td>4.0</td>
<td>485</td>
<td>15.1</td>
</tr>
<tr>
<td>10/4/2011</td>
<td>60</td>
<td>490</td>
<td>142.43</td>
<td>24.12</td>
<td>20.3</td>
<td>7.31</td>
<td>46.5</td>
<td>516</td>
<td>14.1</td>
</tr>
</tbody>
</table>

A2 – Static Water Level = 118.31 feet

<table>
<thead>
<tr>
<th>Date</th>
<th>Elapsed Time (min)</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)¹</th>
<th>Drawdown (ft)²</th>
<th>Sc (gpm/ft)³</th>
<th>pH</th>
<th>Sand Production (mg/L)</th>
<th>Electrical Conductivity (µS/cm)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/27/2011</td>
<td>60</td>
<td>45</td>
<td>116.59</td>
<td>14.69</td>
<td>3.1</td>
<td>7.37</td>
<td>--</td>
<td>450</td>
<td>18.2</td>
</tr>
<tr>
<td>9/27/2011</td>
<td>60</td>
<td>94</td>
<td>142.10</td>
<td>40.20</td>
<td>2.3</td>
<td>7.32</td>
<td>1.0</td>
<td>471</td>
<td>17.9</td>
</tr>
<tr>
<td>9/27/2011</td>
<td>60</td>
<td>111</td>
<td>171.84</td>
<td>69.94</td>
<td>1.6</td>
<td>7.29</td>
<td>2.6</td>
<td>471</td>
<td>25.2</td>
</tr>
</tbody>
</table>

A3 – Static Water Level = 101.90 feet

<table>
<thead>
<tr>
<th>Date</th>
<th>Elapsed Time (min)</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)¹</th>
<th>Drawdown (ft)²</th>
<th>Sc (gpm/ft)³</th>
<th>pH</th>
<th>Sand Production (mg/L)</th>
<th>Electrical Conductivity (µS/cm)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/11/2011</td>
<td>40</td>
<td>115</td>
<td>81.12</td>
<td>8.52</td>
<td>13.5</td>
<td>6.89</td>
<td>1.8</td>
<td>412</td>
<td>14.8</td>
</tr>
<tr>
<td>10/11/2011</td>
<td>60</td>
<td>271</td>
<td>101.34</td>
<td>28.74</td>
<td>9.4</td>
<td>6.38</td>
<td>0.0</td>
<td>414</td>
<td>12.7</td>
</tr>
<tr>
<td>10/11/2011</td>
<td>60</td>
<td>292</td>
<td>155.52</td>
<td>82.92</td>
<td>3.5</td>
<td>6.37</td>
<td>1.8</td>
<td>409</td>
<td>12.3</td>
</tr>
</tbody>
</table>

A4 – Static Water Level = 72.60 feet

Notes:
1. Depth to water represents dynamic water level conditions at the end of each step during the test.
2. Drawdown at the end of each step, generally 60 minutes.
3. Specific capacity for the well at the end of each step. Equal to discharge divided by drawdown.
   – Symbol indicates data either not available or not estimated.

Table 2.4  Burns Existing Production Well Constant Rate Test Summaries

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Elapsed Time (Min)</th>
<th>Date</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)¹</th>
<th>Pump Depth Setting (ft)²</th>
<th>Drawdown (ft)³</th>
<th>Sc (gpm/ft)³</th>
<th>Transmissivity¹ (gpd/ft²)</th>
<th>Estimated Aquifer Thickness (ft)⁴</th>
<th>Hydraulic Conductivity² (gpd/ft²)</th>
<th>Sand Production (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>480</td>
<td>10/5/2011</td>
<td>394</td>
<td>139.03</td>
<td>179</td>
<td>19.90</td>
<td>19.8</td>
<td>40,800</td>
<td>124</td>
<td>329</td>
<td>26-72</td>
</tr>
<tr>
<td>A3</td>
<td>240</td>
<td>9/28/2011</td>
<td>84</td>
<td>137.54</td>
<td>185</td>
<td>35.54</td>
<td>2.4</td>
<td>11,700</td>
<td>158</td>
<td>74</td>
<td>0.2</td>
</tr>
<tr>
<td>A4</td>
<td>480</td>
<td>10/13/2011</td>
<td>220</td>
<td>96.35</td>
<td>167</td>
<td>24.24</td>
<td>9.1</td>
<td>89,600</td>
<td>162</td>
<td>551</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Notes:
1. Depth to water represents pumping water level at the end of each test.
2. Pump settings were the same for both the stepped and constant rate tests.
3. Drawdown at the end of each test period shown.
4. Specific capacity for the well at the end of the test period. Equal to discharge divided by drawdown.
5. Hydrogeologic parameters derived from pumping or recovery data for each pumping well. Hydraulic conductivities based on estimated thickness of High Plains Aquifer shown at each respective well site. Storage coefficients could not be calculated due to the lack of observed drawdown at observation wells. Observation well water level data graphed in Project Notebook.
## Table 2.5 High Plains Aquifer Water Quality Summary, Burns Existing Production Wells

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>--</td>
<td>T14N, R62W, Sec. 7 NENE</td>
<td>T14N, R62W, Sec. 7 NESE</td>
<td>T14N, R62W, Sec. 7 SWSE</td>
<td>T14N, R62W, Sec. 7 SWNE</td>
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<td>Water Temp b</td>
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<td>pH c</td>
<td>6.5-8.5</td>
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<td>414</td>
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<td>30</td>
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<td>Silica</td>
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<td>58.8</td>
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<td>60.5</td>
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<td>0.003</td>
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<td>&lt;0.05</td>
<td>--</td>
<td>0.001</td>
<td>&lt;0.001</td>
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<tr>
<td>Selenium</td>
<td>0.05</td>
<td>0.002</td>
<td>--</td>
<td>0.003</td>
<td>0.001</td>
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<td>0.008</td>
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<td>Gross Alpha a</td>
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<td>20.1</td>
<td>5.7</td>
<td>16.9</td>
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<td>--</td>
<td>--</td>
<td>7.3</td>
<td>3.4</td>
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<td>Radium 226 a</td>
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<td>&lt;0.01</td>
<td>&lt;0.2</td>
<td>0.2</td>
<td>1.6</td>
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<td>Radium 228 a</td>
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<td>1</td>
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</table>

**Notes:**

a Primary standards shown in bold.

Bold and italicized results indicate result exceeds EPA primary standard.

Results in mg/L unless noted otherwise.

-- Indicates not applicable or no analytical data available.

> Symbol indicates analyte concentration was below laboratory method detection limit shown.

1. Temperature in degrees centigrade. Measured in field at time of sampling.
2. pH reported in standard units. Measured in field at time of sampling.
3. Conductivity reported in µS/cm. Measured in field at time of sampling.
4. Reported in terms of CFU/ml.
5. Reported in terms of pCi/L.

Energy Labs reported concentrations for Radium 226 and 228 that were below method detection limits.

Energy Labs reported Gross Alpha concentrations appear to be erroneous.
Figure 2.2
Town of Burns, Wyoming Level II
Well A2
Stepped Rate Test, 10/4/2011

Q = 170 gpm
Q = 299 gpm
Q = 402 gpm
Q = 490 gpm
Figure 2.3
Town of Burns, Wyoming Level II
Well A2
Specific Capacity Curve

Drawdown (ft)

Discharge (gpm)

10/4/2011 Test
Figure 2.4
Town of Burns, Wyoming Level II
Well A2
Constant Rate Test, 10/5/2011

Depth to Water (ft) vs Time (min)
Figure 2.5
Town of Burns, Wyoming Level II
Well A3
Stepped Rate Test, 9/27/11

The graph shows the depth to water in feet plotted against time in minutes for Well A3 at the Town of Burns, Wyoming. The graph includes data points for different flow rates: Q = 45 gpm, Q = 94 gpm, and Q = 111 gpm. The flow rates were measured during the stepped rate test on 9/27/11.
Figure 2.6
Town of Burns, Wyoming Level II
Well A3
Specific Capacity Curve
Figure 2.7
Town of Burns, Wyoming Level II
Well A3
Constant Rate Test, 9/28/11

Q = 84 gpm
Figure 2.8
Town of Burns, Wyoming Level II
Well A4
Stepped Rate Test, 10/11/11

Q = 115 gpm
Q = 271 gpm
Q = 292 gpm
Figure 2.9
Town of Burns, Wyoming Level II
Well A4
Specific Capacity Curve

Drawdown (ft)

Discharge (gpm)

10/11/11 Test
Figure 2.10
Town of Burns, Wyoming Level II
Well A4
Constant Rate Test, 10/13/11

\[ Q = 220 \text{ gpm} \]
3.0 Hydrogeologic Investigation and Well Siting

Based on the results of the testing of the existing wells and discussions with WWDC personnel, the Town developed objectives for a new production well. The Town wanted to complete a test well capable of producing approximately 350 gpm. The new well also needed to be located on Town-owned land or lands controlled by individuals favorable to the development of additional supply for the Town. The Town expressed a preference for completing the well on the east or northeast side, but minimizing the transmission line distance to the Town system was also an important consideration in well siting. The Town noted concerns regarding crossing the fiber optic line on the west side along Luther Avenue. Potential sources of contamination that the Town identified were the closed Burns Landfill and the Panhandle COOP both of which are located northwest of Town as shown on Figure 3.1. WWDC noted a preference for maintaining sufficient spacing from the existing wells to minimize the potential for well interference.

Based on these concerns, the following well siting criteria were utilized to determine potential locations for a test well:

- Developing groundwater from an aquifer capable of yielding the desired production rate of 350 gpm;
- Obtaining groundwater that would meet EPA drinking water standards;
- Locating the well in close proximity to the Town with favorable landownership; and
- Locating the well sufficient distance from the existing production wells to avoid well interference.

The following sections present details on the geologic and hydrogeologic setting of the Burns area and the potential test hole locations that were identified.

3.1 Geologic and Hydrogeologic Setting

The Town of Burns lies within the Denver-Julesburg Basin near the contact between the Tertiary Ogallala Formation and the underlying Arikaree Formation. As shown on Figure 2.1, the Town is built on a thin veneer of Quaternary Terrace deposits that overlie the Tertiary Ogallala and Arikaree Formations, and the White River Group. There are no mapped geologic structures present within the immediate area.

The Ogallala Formation is exposed at land surface in the area, and consists of unconsolidated to well-cemented sandstone, siltstone, volcanic ash, and conglomerate interbedded with claystone and thin beds of limestone (Ver Ploeg and others, 1998). The sand and gravel in the Ogallala were derived from the Laramie Mountains to the west, and consist mainly of quartz, quartzite, feldspar, gneiss, and schist. Owing to their western origin, the deposits are mostly coarse grained near the range front and become finer to the east due to their deposition via braided streams (Lowry and Crist, 1967). This unit ranges in thickness from more than 400 feet in the western part of Laramie County and thins rapidly to the east. The thickness of the Ogallala in the Burns area is less than 100 feet (JR Engineering and others, 2008).

The Arikaree Formation is exposed at land surface to the northeast as shown on Figure 2.1, and underlies the Ogallala Formation beneath the Town. This unit predominantly consists of friable, gray, tuffaceous, calcareous, very fine to fine-grained, crossbedded sandstone that is interbedded with lenses of siltstone and volcanic ash (Ver Ploeg and others, 1998). Elongate, cylindrical,
calcareous concretions, 2 to 3 feet thick and up to 10 feet long, occur locally in the sandstones. These concretions have a predominant northwest-southeast alignment (Rapp and others, 1953). Coarse conglomerate locally occurs near the base of the formation in many areas (Lowry and Crist, 1967). While absent to the south and farther west, the Arikaree Formation is approximately 200 feet thick in the Burns area (JR Engineering and others, 2008; SEO, Various).

Underlying the Arikaree Formation, the Tertiary White River Group is comprised of both the Brule and underlying Chadron Formations. The Brule Formation consists of light pink to buff, massive, argillaceous, calcareous siltstone interbedded with minor sandstone, conglomerate, and volcanic ash beds. The silt is imbedded in a matrix of carbonate flakes, volcanic ash, and montmorillonitic clay. The Chadron Formation consists of interbedded red and green bentonitic claystone, sandstone, siltstone, and conglomerate (Ver Ploeg and others, 1998). The White River Group in the Burns area has a thickness ranging from 300 to 400 feet (JR Engineering and others, 2008).

Below the White River Group and Lance Formation, the Fox Hills Sandstone also underlies this area. The Fox Hills Formation consists of fine to medium grained, friable sandstone interbedded with shale (Lowry and Crist, 1967). Kirkham and others (1980) reported the Fox Hills Sandstone can be subdivided into upper and lower members. The upper Fox Hills consists of up to five massive, moderately cemented sandstone beds that tend to be laterally continuous. The lower Fox Hills consists of three to seven upwardly coarsening sandstone beds that are interbedded with shale (Weist, 1965; Kirkham and others, 1980).

The uppermost aquifer in the area capable of meeting the needs of this project, the High Plains Aquifer is composed of saturated portions of the Ogallala Formation, Arikaree Formation, and White River Group. The Ogallala Formation is the principal member of the High Plains Aquifer in Laramie County, but is not sufficiently saturated locally to provide enough water. The Arikaree Formation is the principal water source for the Town’s existing production wells which yield between 30 and 200 gpm. The White River Group comprises the stratigraphically lowest portion of the High Plains Aquifer in Laramie County. Due to the difficulty and unpredictability associated with obtaining a high capacity well from the White River Group, it was not considered a viable target aquifer for this investigation. Based on the production of the existing Town and local irrigation wells, the Arikaree Formation was determined to be the most suitable target within the High Plains Aquifer for test hole exploration and test well drilling.

The High Plains Aquifer has been the preferred aquifer for development in Laramie County for decades due to its favorable hydrogeologic characteristics, high capacity well yields, good water quality, and relatively shallow well depths. Well yields of several hundred gpm are typical from the coarse-grained channel deposits and sandstones in this aquifer. Within Laramie County, hydraulic conductivities range from 160 to 4,000 gpd/ft², while reported transmissivities lie between 45 and 343,000 gpd/ft (JR Engineering, 2008). Test results from the existing production wells fell within these ranges of aquifer parameters. The High Plains Aquifer typically yields calcium bicarbonate water with TDS concentrations ranging from 195 to 380 mg/L (Libra and others, 1981). While groundwater from this aquifer is generally suitable for municipal purposes, nitrate concentrations locally have been a concern (Lidstone, 2011). A closer look at the nitrate concentrations obtained during the Level I study revealed they are typically higher east of Town. Nitrate concentrations are also high in the vicinity of the water table. At the former Burns Landfill northwest of Town, Wyoming Environmental Consulting (2009; 2010) reported nitrate concentrations ranging from 22.0-32.3 mg/L for four monitoring wells that were completed within the upper 10 feet of the High Plains Aquifer.
LA also considered the Fox Hills Aquifer due to its potential yields, good water quality, and usefulness for dilution to mitigate water quality concerns within the High Plains Aquifer. The Fox Hills Aquifer has not been extensively developed in Laramie County to date, but has been proven as a water source in the eastern part of the County. The Fox Hills Aquifer typically meets EPA drinking water standards, and is essentially nitrate free. That feature makes it a prime water source for blending with higher nitrate laden water to reduce overall nitrate concentration levels. LA had proposed to drill a test hole through the Fox Hills to evaluate this source as a future development option.

Most of the hydrogeologic information that has been acquired for the Fox Hills Aquifer has come from two municipal wells that were completed for the Town of Pine Bluffs. While these wells were completed to shallower depths than would be anticipated at Burns, they indicated that the aquifer will yield up to 395 gpm to individual wells. For the well that LA completed in 2010, the well yielded 250 gpm of high quality water over a seven-day test period. Aquifer testing revealed hydraulic conductivities range from 15 to 36 gpd/ft², and transmissivities range from 600 to 2,900 gpd/ft (Dahlgren Consulting, 2005; Lidstone, 2010). The aquifer is confined by the overlying White River Group, but accurate storage coefficients could not be estimated from the single well aquifer tests that have been conducted. Generally, the Fox Hills Aquifer yields sodium bicarbonate type water with TDS concentrations ranging from 231 to 443 mg/L (Bjorklund, 1957; Weist, 1965; Libra and others, 1981; Lidstone, 2010). Water quality in the Lance/Fox Hills Aquifer can be problematic in some areas. Kirkham and others (1980) indicated TDS concentrations ranged from 508 to 1,680 mg/L in northern Colorado, and noted that roll front type uranium deposits occur in the Fox Hills Sandstone.

### 3.2 Potential Test Hole and Test Well Sites

Given the well siting criteria and the local hydrogeologic setting, LA evaluated the High Plains Aquifer data to identify favorable drilling locations for the test holes and test well to be drilled in the Arikaree Formation. Potential depths and locations for drilling a test hole through the Fox Hills Sandstone to evaluate its local hydrogeologic character were also considered. LA collaborated with the Town to identify landowners favorable to the development of additional water supplies, and AVI negotiated with the landowners to acquire access. As shown in **Table 3.1**, eight potential test hole/test well sites were identified. The locations of the test hole sites are shown on **Figure 3.1**.

The locations of water and oil wells in the local area were mapped and geologic cross sections were prepared to identify potential preferred groundwater flow paths through the area and ultimately well sites. Resulting from this process, the following observations of the local hydrogeology near Burns were made:

- The saturated thickness of the Arikaree Formation appeared to be approximately 180 feet.
- Most local irrigation and Town wells only partially penetrate the Arikaree Formation.
- Wells A2 and A4 obtain their groundwater from somewhat different zones within the Arikaree Formation.
- The middle to the lower sections of the Arikaree Formation appeared to be the most productive zones.
- Lower permeability siltstone and claystone lenses have been deposited randomly within the formation, both laterally and vertically.
There is a permeable sandstone horizon aligned east to west along the north side of Town into which Wells A2 and A4 and other high capacity irrigation wells had been completed.

Lodgepole Creek recharges the High Plains Aquifer in this area.

The bottom of the Fox Hills Sandstone lies within approximately 1,300 feet of land surface and dips slightly to the south.

The implications of these observations are as follows:

- Locations along the east-west trend of permeable sandstone at the north end of Town were considered most likely to yield a successful test well.
- The test holes should be drilled to depths of up to 300 feet to fully penetrate and test the Arikaree Formation.
- The test well should fully penetrate the Arikaree Formation, and the lower half of the formation should generally be screened.
- Due to the presence of lower permeability materials within the Arikaree Formation, geophysical logging and detailed lithologic characterization would be necessary to place the well screens at optimal locations within the test well.

Eight sites for test hole drilling were identified recognizing that only three of the selected locations would actually be drilled. Originally, it was LA's intent to drill two test holes to depths of 300 feet and one to 1,300 feet to test both the High Plains and Fox Hills Aquifers. Five of the test hole sites were located on lands owned by private parties considered favorable by the Town, while the other three sites were located on town property. The highest priority drill sites included 1-Anderson, 2-Anderson, and 6-Phillips as shown on Figure 3.1. As noted in Table 3.1, these sites ranked highest because of their favorable locations within the trend of permeable sandstone, proximity to existing infrastructure, favorable landowners, and relatively low nitrate concentrations. The three Town owned sites were lower priority or fallback sites in case negotiations with the landowners proved unsuccessful. AVI successfully negotiated access with the three highest priority drill site landowners.

### 3.3 Test Hole Drilling

LA supervised the completion of three test holes by Sargent in January 2012. Test holes were drilled at 1-Anderson, 2-Anderson, and 6-Phillips using direct mud rotary techniques. Due to high drilling bids that exceeded the approved budget, the Fox Hills test was eliminated to conserve money for a test well. LA logged the geologic and hydrogeologic characteristics of the test holes, and collected and submitted formation samples to Johnson Screens for sieve analysis. Following drilling, Sargent obtained geophysical logs of each borehole. The test holes were plugged with neat cement and abandoned following the geophysical logging runs. Lithologic logs of the three test holes are presented on Figures 3.2 through 3.4. Test hole drilling logs and sandstone sieve analyses are included in the Project Notebook.

While the drill sites were all located along what appeared to be the most favored local trend of permeable sandstone, the geologic and hydrogeologic character of the Arikaree Formation encountered in the test holes varied. Farthest west, the 1-Anderson test hole encountered approximately 112 feet of saturated sandstone in the Arikaree Formation, and two oxidized zones of brown sandstone that drilled very quickly and disintegrated during drilling. These two zones appeared to be the most permeable sandstones in the borehole, as noted on Figure 3.2. Closer to
and still west of Town as shown on Figure 3.1, the 2-Anderson test hole encountered approximately 105 feet of saturated sandstone in the Arikaree Formation. The sandstone in this hole was generally well cemented and consequently appeared to be less permeable, as noted on Figure 3.3. Sargent also noted that this hole took the least amount of water to drill and complete. East of Town, the 6-Phillips test hole encountered only 67 feet of saturated sandstone due to the presence of interbedded and less permeable siltstone, sandy siltstone, and sandy claystone. During drilling, Sargent lost circulation of its drilling fluid at a depth of 115 feet, which was below the anticipated static water level of approximately 90 feet, as noted on Figure 3.4. Although Sargent regained circulation and finished the hole, the borehole below this point was predominantly composed of finer grained, less permeable aquifer materials. Sargent noted this hole took more water to drill than the others.

Given the hydrogeologic character of the test holes, LA recommended drilling and completing the test well at the 1-Anderson site. This site was selected because it featured the most saturated sandstone, had the most permeable sandstone zones over the full thickness of the Arikaree Formation, and likely had the lowest nitrate concentration. While very favorable, the 6-Phillips site ranked second due to the location of the highly permeable sandstone zone that lay near the top of the aquifer. The lower sandstones and other aquifer materials in this hole did not appear to be as permeable or favorable as those in the 1-Anderson test hole. LA was concerned that any significant lowering of the water table in this area of the 6-Phillips site would result in a production well unable to produce sufficient water for the Town. The 2-Anderson site ranked last because it did not appear to have sufficient permeability to supply an acceptable quantity of water.
<table>
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<th>Test Well Site No.</th>
<th>SEO Permit # Site Name</th>
<th>Location (T, R, Sec.)</th>
<th>Location (lat, long)</th>
<th>Ownership</th>
<th>Arikaree Formation Drill Depth (ft)</th>
<th>Fox Hills Formation Drill Depth (ft)</th>
<th>Flowable Hydrogeologic Site Characteristics</th>
<th>Remarks</th>
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</thead>
<tbody>
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<td>1-Anderson</td>
<td>P196738W Burns 1</td>
<td>T14, R62W Sec. 7 NW5W</td>
<td>41.192676’-104.368802’</td>
<td>Mark Anderson</td>
<td>290</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; nitrate concentrations diminish to west; located away from existing production wells; likely underlain by permeable sand and gravel deposits.</td>
<td>NW corner of Anderson’s property, 3-phase power along 1st Street.</td>
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<td>2-Anderson</td>
<td>P196739W Burns 2</td>
<td>T14, R62W Sec. 7 NESW</td>
<td>41.192560’-104.362650’</td>
<td>Mark Anderson</td>
<td>310</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; nitrate concentrations diminish to west.</td>
<td>NE corner of Anderson’s property, 3-phase power along 1st Street. Close to 8 inch waterline on 1st Street. Alternate to 3.</td>
</tr>
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<td>3-Schlske</td>
<td>P196739W Burns 2</td>
<td>T14, R62W Sec. 7 NESW</td>
<td>41.192274’-104.362033’</td>
<td>Kay Schliske</td>
<td>310</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; nitrate concentrations diminish to west.</td>
<td>NW corner of Schlske’s property, close to 3-phase power on 1st Street and 8 inch waterline that crosses through her property to east of drill site. Potentially shorter transmission line needed. Alternative to 2.</td>
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<td>P195739W Burns 2</td>
<td>T14, R62W Sec. 7 NW5W</td>
<td>41.194375’-104.359531’</td>
<td>Town of Burns</td>
<td>290</td>
<td>1300</td>
<td>Located near producing sandstones for Wells A2 and A4; likely underlain by permeable sand and gravel deposits.</td>
<td>SW corner of town property. Alternative to 1, 2, or 3. Very close proximity to A4. 6 inch waterline on Luther. Proximity to COOP a potential liability.</td>
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<tr>
<td>5-Frye</td>
<td>P196740W Burns 3</td>
<td>T14, R62W Sec. 7 NESE</td>
<td>41.192822’-104.353159’</td>
<td>Boyd Frye</td>
<td>280</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; likely underlain by permeable Arikaree Formation sandstones.</td>
<td>Near fenceline and close to 8 inch waterline on Jefferson. Alternative to 6.</td>
</tr>
<tr>
<td>6-Phillips</td>
<td>P196740W Burns 3</td>
<td>T14, R62W Sec. 7 NESE</td>
<td>41.192633’-104.353188’</td>
<td>Don Phillips</td>
<td>285</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; likely underlain by permeable Arikaree Formation sandstones.</td>
<td>Near fenceline and close to 8 inch waterline on Jefferson. Alternative to 5.</td>
</tr>
<tr>
<td>7-Town of Burns</td>
<td>P196741W Burns 4</td>
<td>T14, R62W Sec. 8 NW5W</td>
<td>41.193288’-104.347784’</td>
<td>Town of Burns</td>
<td>250</td>
<td>1300</td>
<td>Located along E-W trend of high capacity wells; site likely underlain by permeable sand and gravel deposits; located away from existing Arikaree Formation production wells.</td>
<td>SE corner of Town property NE of Town, requires consent from Frye to cross his property with transmission to reach 8 inch waterline on 2nd Street. Alternative to 5 or 6. WYDOT purchased west half of this area in 2011. Site considered for wastewater disposal at one time.</td>
</tr>
<tr>
<td>8-Town of Burns</td>
<td>P196742W Burns 5</td>
<td>T14, R62W Sec. 7 SE5W</td>
<td>41.188016’-104.360551’</td>
<td>Town of Burns</td>
<td>285</td>
<td>1300</td>
<td>Located close to producing sandstones in Well A3; nitrate concentrations diminish to the west.</td>
<td>Town property on SE side of Town, near area of clean fill dirt on native ground. Six inch waterline on Luther or 8 inch line on 4th Street. Close to Town’s wastewater lagoons.</td>
</tr>
</tbody>
</table>

Notes:
1. Land ownership according to Laramie County Assessor’s Office in 2011.
2. Drilling depth through the base of the Arikaree Formation, estimated from surface elevation and cross sectional analysis.
3. Drilling depth through the base of the Fox Hills Sandstone, estimated from geophysical logs from four oil wells near the Town.
4. Site list includes private land and Town property that may be accessible for test hole and production well drilling. Alternatives represent sites that could be drilled in the event that landowner negotiations are unsuccessful or too costly at any particular site. Anticipated that only two to three test holes would be drilled and that only one test hole would be drilled through the Fox Hills Sandstone.
NOTES:
BACKGROUND IMAGERY: 2009 NAIP true-color digital ortho-quadrange created from the 2009 NAIP quarter-quads

DATE: 3/18/13
DRAWN BY: JHF
DESIGN: MES
FILE:
L:\NYWD\111\GIS\BURNS TEST WELL LOC MAP.mxd

LEGEND
- UNDRILLED TEST HOLE LOCATION
- DRILLED TEST HOLE LOCATION
- MW-3 MONITORING WELL
- 1-ANDERSON TEST WELL
- EXISTING PRODUCTION WELLS

BURNS WELL LEVEL II STUDY

FIGURE 3.1
TEST HOLE AND
WELL LOCATIONS MAP
Notes: This test hole lies west of Burns on the northwest corner of Mark Anderson's property. It was drilled under Wyoming State Engineer's Office Permit No. 196738. Sargent Drilling Co. drilled and geophysically logged the test hole in one day. LA collected lithologic samples of Arikaree Formation sandstone, and submitted those to Johnson Screens for sieve analysis and screen/sand pack design purposes. Following collection of the geophysical log, the test hole was plugged with neat cement and abandoned.

Figure 3.2 1-Anderson Test Hole Completion
Notes: This test hole lies west of Burns on the northeast corner of Mark Anderson’s property. It was drilled under Wyoming State Engineer’s Office Permit No. 196739. Sargent Drilling Co. drilled and geophysically logged the test hole over two days. LA collected a lithologic sample of the Arikaree Formation sandstone, and submitted it to Johnson Screens for sieve analysis and screen/sand pack design purposes. Following collection of the geophysical log, the test hole was plugged with neat cement and abandoned.
Figure 3.4  6-Phillips Test Hole Completion

Notes: This test hole lies east of Burns on the northeast corner of Don Phillips’ property. It was drilled under Wyoming State Engineer’s Office Permit No. 196740. Sargent Drilling Co. drilled and geophysically logged the test hole in one day. LA collected a lithologic sample of the Arikaree Formation sandstone, and submitted it to Johnson Screens for sieve analysis and screen/sand pack design purposes. Following collection of the geophysical log, the test hole was plugged with neat cement and abandoned.
4.0 1-Anderson Test Well Drilling

With the concurrence of the WWDC and the Town in March 2012, LA completed the test well at the 1-Anderson test hole location. As shown on Figure 3.1, the 1-Anderson Test Well (test well) is located in the NWSW of Section 7 in Township 14N, Range 62W on property owned by Mark Anderson. This site lies approximately 0.5 miles west of Town along 1st Street adjacent to three-phase overhead powerlines.

LA subcontracted the well drilling contractor and obtained the necessary permits from the appropriate agencies. Bids were publically solicited according to WWDC procedures. LA obtained drilling bids from Sargent and Water System Drilling of Gillette, Wyoming. The drilling contract was awarded to Sargent in May 2012. With AVI assistance, the WWDC acquired a temporary access agreement from Mark Anderson to complete the test well on his property. Permits to complete the work were obtained from the SEO (Permit No. U.W. 196738) for test well construction, and the DEQ/WQD (Permit Nos. 12-144 and WYG720316) for both well construction and discharge of aquifer test water. Approved permit documents are included in Appendix A. An Environmental Report was not prepared for this project because the Town indicated at the July 2011 scoping meeting that it would not seek federal funds to finance the new well.

4.1 Drilling Conditions and Well Completion

Sargent completed the drilling and construction of the test well between June 25 and 27, 2012, in accordance with the drilling specifications. The well design incorporated PVC casing and a small screen slot size to increase the corrosion resistance of the well, and to minimize the production of fine-grained sand. An as-built diagram of the well is shown on Figure 4.1. Sargent completed the well in two phases with a modified Speedstar drill rig, reverse rotary drilling methods, and water based drilling fluids. For the completion of the surface casing, a 24-inch diameter hole was drilled to a depth of 21 feet, and 21 feet of 20-inch diameter blank steel casing was grouted into the hole. During the second phase, a 17.5-inch diameter borehole was drilled to a depth of 227 feet. Within that borehole, the well was completed with 10.75-inch diameter SDR 17 PVC casing and Johnson Hi-Flow, 0.020 inch slotted, 304 stainless steel wire wrapped screen. As shown on Figure 4.1, the screened intervals were placed between depths of 110-130 and 155-225 feet. The annular space was filled with 16X30 silica sand from the borehole bottom to 80 feet and with sand cement bentonite grout from 80 feet to land surface.

No problems were encountered in drilling and completing this well. Overall, the drilling progressed relatively quickly, as drilling penetration rates ranged from 26.7 to 66.6 feet per hour. Despite the fast penetration rates, the borehole deviated only one degree or less.

4.2 Geologic and Hydrogeologic Conditions

LA completed the geologic and hydrogeologic logging of the test well. Over the full depth of the test well, discrete samples of the drill cuttings were collected at regular intervals, and composited over 10 foot intervals. The samples were obtained from the end of the discharge line that directed the drilling fluids back into the mud pit. LA logged the samples in the field, and collected portions of these samples into chip trays. The drill cuttings were described with respect to lithology, stratigraphic location, and potential hydrogeologic properties. The lithologic log for the test well is summarized on Figure 4.1, and the detailed field log is included in the Project Notebook along with geophysical logs and other well construction documents.
Only the Arikaree Formation was encountered during drilling. Below a thin veneer of topsoil and weathered material, drilling encountered sandstone to a depth of 175 feet with only a few feet of silty sandstone within this interval. From 175 feet, 15 feet of sandy siltstone were encountered before drilling through another sandstone bed from 190 to 227 feet. The most favorable water bearing sandstones were observed within the following depth intervals: 111-132, 148-175, and 190-222 feet. Within these intervals, the sandstones consisted of very fine to medium grained, arkosic, friable, oxidized quartz sand. Within the 148-175 foot interval, drill cuttings that contained iron concretions shaped like hollow tubes were observed. The presence of the oxidized zones and tubular concretions were interpreted to indicate the highest permeability observed in the sandstones logged in the borehole.

4.3 Well Development

Following well construction and initial drilling fluid removal, Sargent proceeded to develop the well using a combination of techniques. A phosphate-free liquid polymer dispersant, Aqua-Clear PFD™ was added to the borehole and swabbed into place. After allowing the polymer sufficient time to work, development of the well screens was initiated using a snug fitting double flanged surge block and submersible pump. The development process involved swabbing the screens over 10 foot intervals while simultaneously pumping water from the perforations located between the rubber flanges of the development tool. This process allowed for concurrent agitation of the sand pack around the well and sediment removal through pumping. Working from the bottom to the top screened interval and back down, the screens were developed over a period of approximately 24 hours. During development, groundwater was discharged to land surface east of the wellhead.

Based upon field parameters, the chemical quality of the water produced was excellent, and sand concentrations at the end of development were acceptable. Upon completion of well development, indicator water quality parameters included pH of 7.71, electrical conductivity of 370 µS/cm, and a temperature of 14.1 degrees Centigrade. Imhoff cone samples included only trace amounts of both sediment and sand. As measured by an orifice plate at the end of the discharge hose, discharge rates during development ranged from 45 to 194 gpm, and were generally maintained between 75 and 100 gpm. The development records for the well are included in the Project Notebook.

4.4 Hydrogeologic Evaluation of the High Plains Aquifer

LA completed stepped and constant rate aquifer tests of the test well between July 17 and August 1, 2012. The purposes in testing this well were to assess the sustainable yield of the new production well, evaluate the hydrogeologic properties of aquifer, identify any boundary conditions, and evaluate the potential for interference between this well and the Town’s other production wells. Original data for the aquifer tests are included in the Project Notebook.

For test pumping purposes, Sargent installed the pump and all necessary appurtenances, and assisted in data collection. A submersible electric Berkeley 7T-450 pump was utilized to complete the stepped rate test. The pump intake was positioned at a depth of 196 feet. Due to the yields observed during the stepped rate test, a submersible electric Berkeley 6TS-300 pump was installed for the constant rate test. The pump intake was positioned at a depth of 194 feet. During the tests, groundwater was lifted from the pump through 4-inch diameter steel column pipe, and routed through a 4-inch discharge manifold at ground surface that consisted of a totalizing McCrometer flowmeter, air release valve, pressure gage, sample port, Rossum sand tester, and a gate valve. Below the gate valve, a 4-inch flexible hose was used to discharge the water to ground surface east of the wellhead through an orifice plate. Discharge rates were monitored with both the in-line
McCrometer flowmeter and the orifice plate. The flowmeter was used to record both total gallons pumped and instantaneous flow. During the stepped and constant rate tests, water level changes were monitored with an In-Situ pressure transducer, while manual measurements were obtained with a water level tape.

Water quality samples were collected toward the middle and end of the constant rate aquifer test to evaluate the test well’s ability to meet EPA drinking water standards. Analytical results are summarized in Section 4.5.

4.4.1 Stepped Rate Testing
LA evaluated the potential yield of the test well through stepped rate aquifer testing. The stepped rate test was completed on July 17, 2012. Prior to the test, the static water level was measured at 69.49 feet below the top of the casing. The stepped rate test was completed at discharge rates of 75, 127, 179, and 207 gpm. The discharge rate was increased at the end of each step such that there was no water level recovery between steps. The fourth step was terminated after 30 minutes because the well would not sustain that pumping rate at the pump setting. Figure 4.2 graphically summarizes the drawdown associated with each pumping rate, and Figure 4.3 illustrates the specific capacity curve of the well. Results of the stepped rate test are also summarized in Table 4.1.

Based on the results of the test, the following conclusions were reached concerning the test well:

- This well yields water efficiently at all pumping rates. The specific capacity of the well diminished gradually from 3.2 to 2.5 gpm/ft over the first three steps indicating the well was properly developed prior to the tests. The maximum drawdown over the course of the test was approximately 85 feet.

- The maximum yield point of the well is approximately 150 gpm. As shown on Figure 4.3, the slope of the discharge vs. drawdown plot changes noticeably after 180 gpm, indicating that this well will not sustain any higher discharge rates.

- The hydrogeologic parameters of the High Plains Aquifer at this location are typical of sandstone. Aquifer test analysis revealed transmissivity and hydraulic conductivity values of 9,950 gpd/ft and 63 gpd/ft².

- Sand production during the stepped rate test was minimal. Sand concentrations during the first three steps were measured to range from trace to 1.3 mg/L.

4.4.2 Constant Rate Testing
The sustainable yield of the test well was evaluated through long term constant rate testing. Prior to the test, LA measured the static water level to be 69.52 feet below the top of the casing. The constant rate test was completed between July 25 and August 1, 2012. Based on the stepped rate test data, LA selected a target rate of 150 gpm, and completed the test for seven days at a discharge rate of 149 gpm. Figure 4.4 graphically summarizes the drawdown associated with the test, while Figure 4.5 summarizes the recovery data. Results of the constant rate test are also summarized in Table 4.2.

To assess the radius of influence of the test well, data from three observation wells were obtained. As shown on Figure 3.1, these wells included MW-3 near the closed Burns Landfill, Well A2, and Well A4. Water level data in MW-3 were collected manually with a water level tape and with an In-Situ pressure transducer that were calibrated via the water level tape measurements. Water level
and pumping information for Wells A2 and A4 were retrieved from the Town’s SCADA computer. **Figure 4.6** graphically summarizes the water level data obtained from these wells during the constant rate test. While Well A2 was pumped several times near the beginning of this test, Well A4 was pumped frequently and almost continuously.

The results of the constant rate test are summarized as follows:

- The well can sustain a production rate of 150 gpm. The test did not reveal any significant hydrogeologic boundary conditions in the High Plains Aquifer.
- The well is located a sufficient distance from the other wells to reduce the potential for well interference. The water level data for the three observation wells yielded no quantifiable evidence of water level drawdown associated with the pumping of this well.
- As noted during the stepped rate test, the hydrogeologic parameters associated with the High Plains Aquifer at this location are typical of sandstone. Transmissivity and hydraulic conductivity values of 16,400 gpd/ft and 103 gpd/ft², respectively, were calculated from the constant rate test data.
- Pumping this well results in very little sand production. Sand production for the test was measured at 0.08 mg/L.

### 4.4.3 Projected Development Impact

To further assess well interference potential, LA evaluated the drawdowns associated with pumping the test well on two existing Town production wells, Wells A2 and A4. This evaluation was completed using Theisian well principles and AquiferTest Pro™ with the hydrogeologic parameters obtained from analyses of the previous aquifer tests.

Some minor well interference was observed through this investigation. For this analysis, the test well was pumped continuously at 150 gpm for up to 20 years. Under this scenario, LA anticipates that pumping water from the test well will reduce the water levels in Well A2 by 2 feet and A4 by 1 foot after 10 days, and by 5 and 2 feet, respectively, after 20 years. Under typical operational conditions of intermittent pumping, the likelihood of interference between wells will be negligible. The results of this analysis are included in **Appendix C**.

### 4.5 Water Quality

During the constant rate test, water quality samples were collected midway and at the end of the test and submitted to Energy for analysis. A duplicate of the July 26 midway sample was also submitted to IML. Similar to the existing Town production wells, this well yields calcium bicarbonate type groundwater. A summary of the analytical results from this sampling is included in **Table 4.3**. Complete analytical results of these samples are included in **Appendix D**.

Groundwater from the test well meets EPA primary and secondary drinking water standards. Despite concern elsewhere in Town, the concentrations of several reported constituents of concern, (i.e. nitrate and gross alpha) are below their respective MCLs. While gross alpha concentrations of 8.7 to 9.8 pCi/L were obtained early in the constant rate test, the concentration diminished to 6.1 pCi/L near the end of the test. Uranium concentrations were similarly low at 0.0065 to 0.0067 mg/L. Nitrate concentrations were observed to be relatively low at 3.3 to 3.7 mg/L, which is typical of the conditions that have been observed west of town in deeper well completions.
4.6 Video Survey

To assess the physical integrity of the well following construction, development, and testing, Sargent completed a downhole color video survey of the well on August 9, 2012. The video revealed some fine-grained sand resting on the screen wires at a depth of 196 feet which appeared to be related to pumping from the well. Some electrolysis of the stainless steel screen was also observed where lifting lugs had been placed on the outside of the screen section. There was also some fine-grained sand on the bottom of the well. Aside from those items, the video generally revealed the well is in excellent condition and prepared for use.

4.7 Recommendations

The 1-Anderson Test Well was completed in the Arikaree Formation to a depth of 225 feet and will yield 150 gpm of high quality groundwater to the Town. LA recommends the Town acquire this well and place this well in service with its other existing wells. Costs associated with this alternative are presented in Section 6.
Table 4.1  1-Anderson Test Well Stepped Rate Test Summary

<table>
<thead>
<tr>
<th>Date</th>
<th>Elapsed Time (min)</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)</th>
<th>Drawdown (ft)</th>
<th>$Sc$ (gpm/ft)$^3$</th>
<th>pH</th>
<th>Sand Production (mg/L)</th>
<th>Electrical Conductivity (µS/cm)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/17/2012</td>
<td>60</td>
<td>75</td>
<td>93.13</td>
<td>23.64</td>
<td>3.2</td>
<td>7.84</td>
<td>1.3</td>
<td>366</td>
<td>14.7</td>
</tr>
<tr>
<td>07/17/2012</td>
<td>60</td>
<td>127</td>
<td>111.78</td>
<td>42.29</td>
<td>3.0</td>
<td>7.89</td>
<td>0.4</td>
<td>367</td>
<td>14.2</td>
</tr>
<tr>
<td>07/17/2012</td>
<td>60</td>
<td>179</td>
<td>141.93</td>
<td>72.44</td>
<td>2.5</td>
<td>7.83</td>
<td>0.0</td>
<td>367</td>
<td>14.1</td>
</tr>
<tr>
<td>07/17/2012</td>
<td>30</td>
<td>207</td>
<td>154.75</td>
<td>85.26</td>
<td>-</td>
<td>-</td>
<td>16.5</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes:
1. Depth to water represents dynamic water level conditions at the end of each step during the test.
2. Drawdown at the end of each step, generally 60 minutes.
3. Specific capacity for the well at the end of each step. Equal to discharge divided by drawdown.
4. Discharge reduced after 13.5 minutes because well could not sustain this pumping rate. Specific capacity not calculated due to discharge reduction.
- Symbol indicates data either not available or not estimated.

Static water level prior to test measured to be 69.49 feet below top of casing.

---

Table 4.2  1-Anderson Test Well Constant Rate Test Summary

<table>
<thead>
<tr>
<th>Elapsed Time (min)</th>
<th>Date</th>
<th>Discharge (gpm)</th>
<th>Depth to Water (ft)</th>
<th>Pump Depth Setting (ft)</th>
<th>Drawdown (ft)</th>
<th>$Sc$ (gpm/ft)$^3$</th>
<th>Transmissivity (gpd/ft)$^4$</th>
<th>Hydraulic Conductivity (gpd/ft)$^4$</th>
<th>Sand Production (ppm)</th>
<th>Design Pumping Rate (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1008</td>
<td>7/25-8/1/2012</td>
<td>149</td>
<td>126.15</td>
<td>198</td>
<td>56.63</td>
<td>2.6</td>
<td>16,400</td>
<td>103</td>
<td>0.08</td>
<td>150</td>
</tr>
</tbody>
</table>

Notes:
1. Depth to water at the end of the test. Static water level prior to the test measured to be 69.52 feet below top of casing.
2. Drawdown at the end of the test period.
3. Specific capacity for the well at the end of the test period. Equal to discharge divided by drawdown.
4. Hydrogeologic parameters derived from pumping or recovery data for pumping well, or observation well. Hydraulic conductivities based on thickness of High Plains Aquifer at 1-Anderson Test Well location. Storage coefficient could not be calculated due to the lack of drawdown in observation wells used.
### Table 4.3  High Plains Aquifer Water Quality Summary, 1-Anderson Test Well

<table>
<thead>
<tr>
<th>Analyte</th>
<th>EPA Primary and Secondary Standards&lt;sup&gt;a&lt;/sup&gt;</th>
<th>1-Anderson Test Well Midway (IML)</th>
<th>1-Anderson Test Well Midway (Energy)</th>
<th>1-Anderson Test Well Final (Energy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Source</td>
<td>--</td>
<td>High Plains Aquifer</td>
<td>High Plains Aquifer</td>
<td>High Plains Aquifer</td>
</tr>
<tr>
<td>Location</td>
<td>--</td>
<td>T14N, R62W, Sec. 7 NWSW</td>
<td>T14N, R62W, Sec. 7 NWSW</td>
<td>T14N, R62W, Sec. 7 NWSW</td>
</tr>
<tr>
<td>Sample Date</td>
<td>--</td>
<td>7/26/2012</td>
<td>7/26/2012</td>
<td>8/1/2012</td>
</tr>
<tr>
<td>Water Temp&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>13.3</td>
<td>13.3</td>
<td>13.6</td>
</tr>
<tr>
<td>pH&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>8.3</td>
<td>7.89</td>
<td>7.87</td>
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<td>Calcium</td>
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<td>Magnesium</td>
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<td>9</td>
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<tr>
<td>Sodium</td>
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<td>3.4</td>
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<td>Sulfate</td>
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<td>0.6</td>
<td>0.6</td>
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<td>&lt;5</td>
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<td>180</td>
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<td>Iron Related Bacteria&lt;sup&gt;4&lt;/sup&gt;</td>
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<td>--</td>
<td>8.6</td>
<td>4.3</td>
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<td>Hardness</td>
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<td>--</td>
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<td>&lt;0.1</td>
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<td>&lt;0.005</td>
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<td>0.002</td>
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<tr>
<td>Uranium, Total</td>
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<td>0.0066</td>
<td>0.0067</td>
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<tr>
<td>Zinc, Total</td>
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<td>0.01</td>
</tr>
<tr>
<td>Gross Alpha&lt;sup&gt;5&lt;/sup&gt;</td>
<td>15</td>
<td>8.7</td>
<td>9.8</td>
<td>6.1</td>
</tr>
<tr>
<td>Gross Beta&lt;sup&gt;5&lt;/sup&gt;</td>
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<td>5.2</td>
<td>1.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Radium 226&lt;sup&gt;5&lt;/sup&gt;</td>
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<td>&lt;2.2</td>
<td>0.004</td>
<td>&lt;0.003</td>
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<td>Radium 228&lt;sup&gt;5&lt;/sup&gt;</td>
<td>5</td>
<td>&lt;1</td>
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**Notes:**
- <sup>a</sup> Primary standards shown in bold.
- Bold and italicized results indicate results exceeds EPA primary standards.
- Results listed in mg/L unless noted otherwise.
- -- Indicates not applicable or no analytical data available.
- < Symbol indicates analyte concentration was below laboratory method detection limit shown.
- 1. Temperature in degrees centigrade. Measured in field at time of sampling
- 2. pH reported in standard units.
- 3. Conductivity reported in µS/cm.
- 4. Reported in terms of CFU/ml.
- 5. Reported in terms of pCi/L.
- Energy Labs reported concentrations for Radium 226 and 228 that were below method detection limits.
Notes: This figure presents the completion details for the test well, which was drilled under Wyoming State Engineer's Office Permit No. 196738. The well lies west of Burns on the northwest corner of Mark Anderson's property, adjacent to the 1-Anderson test hole. Sargent Drilling Co. drilled the well using reverse circulation rotary techniques. Following geophysical logging and 10 3/4 inch diameter casing and screen installation, Sargent developed the well using Aqua-Clear PFD, and simultaneous dual flange surge block swabbing and pumping. The well screens were developed for approximately 24 hours. Final water quality parameters upon completion of development included the following: pH = 7.71, temperature = 14.1C, and electrical conductivity = 370 uS/cm. Subsequent stepped and constant rate testing of this well indicated it would yield up to 207 gpm. The constant rate test lasted 7 days, and was completed at a discharge rate of 149 gpm.

Figure 4.1 1-Anderson Test Well Completion
Figure 4.2
Wyoming Water Development Commission, Burns Well Level II
1-Anderson Test Well
Stepped Rate Test, 7/17/12

\[ Q = 75 \text{ gpm} \]
\[ Q = 127 \text{ gpm} \]
\[ Q = 179 \text{ gpm} \]
\[ Q = 207 \text{ gpm} \]
Figure 4.3
Wyoming Water Development Commission, Burns Well Level II
1-Anderson Test Well
Specific Capacity Curve
Figure 4.4
Wyoming Water Development Commission, Burns Well Level II
1-Anderson Test Well
Constant Rate Test, 7/25-8/1/12

\[ Q = 149 \text{ gpm} \]
Figure 4.5
Wyoming Water Development Commission, Burns Well Level II
1-Anderson Test Well
Constant Rate Test Recovery, 8/1-6/12

\[ Q = 149 \text{ gpm} \]
Figure 4.6
Wyoming Water Development Commission, Burns Well Level II Observation Well Water Level Elevations during the Constant Rate Test of the 1-Anderson Test Well between 7/25 and 8/1/12

Water Level Elevation (Ft. AMSL)

Date


MW-3 lies 2,410 feet from the test well; water level monitoring well (no pumping)

Well A4 lies 3,115 feet from the test well; Town well pumped almost constantly during the test.

Well A2 lies 3,200 feet from the test well; Town well pumped several times during the early part of the test.
5.0 Additional Water Quality Testing

Additional sampling of both the Town’s production wells, the test well, and several neighboring domestic wells was proposed because gross alpha concentrations at Well A6 had spiked in 2010 and 2011 and because nitrate concentrations in the area had been persistently high since the Level I study that LA completed in 2011. The June 2012 memorandum attached in Appendix E provides details on gross alpha concentration trends for Well A6 and several other Town production wells. This memorandum also addresses the calculation method, which is directly pertinent to the EPA MCL. Specifically the EPA MCL for gross alpha is an adjusted gross alpha (gross alpha (measured) – concentration of uranium in pico curies per liter). LA acquired and submitted these samples for analysis on February 27, 2013. Samples from Wells A2 and A6 were submitted to Energy for analysis. Samples from Wells A2, A4, A5, A6, and the test well were submitted to IML along with samples from the following domestic wells: Wisroth and Anderson. An attempt was made to resample Frye’s well, but the plumbing had changed since its previous sampling in 2009 and access for sampling could not be acquired. The locations of these wells are shown with respect to Town on Figure 5.1. Sample results are summarized along with previous analytical results in Table 5.1. Complete analytical reports of these samples are attached in Appendix F. Both adjusted and unadjusted values of gross alpha are presented on these tables.

Results of the 2013 sampling effort indicated that the concentration of nitrate exhibits a regional pattern. As shown on Figure 5.1, nitrate concentrations generally increase to the east across this area, with the highest concentrations observed at Well A6 and the Frye well. Wells A2, A3, A4, A5 and A6 all had nitrate concentrations of approximately 5 mg/L or higher, as shown in Table 5.1. While these levels remain a concern, the concentrations are similar on a well-by-well basis to average nitrate concentrations reported for the 1999 to 2007 period under the Level I project (Lidstone, 2011). This indicates that nitrate concentrations have been relatively stable since at least 1999. If it is determined through subsequent EPA required drinking water quality monitoring that concentrations are rising, the Town may need to install water treatment equipment or to construct wells that produce water with lower nitrate levels. The 1-Anderson Test Well is such a well and exhibits nitrate concentrations ranging from 3.3 to 3.7 mg/L, as shown in Table 5.1. The construction of an isolated transmission line will provide water quality mixing of all wells and can effectively dilute wells with higher concentrations of gross alpha or nitrate with those of lower concentrations.

Gross alpha concentrations do not appear to exhibit any regional patterns, but concentrations are commonly more than half of the MCL. Results were obtained from Wells A2, A3, and A6, as noted in Table 5.1, that were above the MCL at some time during the course of this study. However, when gross alpha was adjusted for uranium as shown in Table 5.1, none of the sample results exceeded the MCL, including those from both Energy and IML for Well A6. Due to adjusted gross alpha values that exceeded the MCL in 2010 and 2011, EPA was prepared to require quarterly radionuclide sampling of Well A6 in 2012. The Town took the well offline temporarily to repair a leak so that sampling was not required during that time. With that leak repaired, EPA now is requiring the Town as of February 2013 to conduct quarterly radionuclide sampling of Well A6. The initial sample collected as part of this study has been submitted to EPA to meet the first quarterly sampling requirement. If after four quarters of sampling the average adjusted gross alpha concentration is less than the MCL, then the Town will be returned to routine sampling every three years. If the average is above the MCL, EPA enforcement will be summoned to remedy the situation with the Town. Possible solutions could involve water treatment or supply dilution, via the construction of an isolated transmission line.
## High Plains Aquifer Water Quality Summary, Burns Area Wells

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### Notes:
- <1 Symbol indicates analyte concentration below laboratory detection limit.
- Results are reported in mg/L unless noted otherwise.
- Results are in mg/L unless noted otherwise.
- Field temperature is reported in degrees Fahrenheit at time of sampling.
- Field conductivity is reported in µS/cm.
- Field pH is reported in pH units.
- Field temperature is reported in °C.
- Field pH is reported in pH units.
- Field temperature is reported in °C.
LEGEND
- EXISTING PRODUCTION WELLS
- TEST WELL
- DOMESTIC WELLS

NOTES:
BACKGROUND IMAGERY: 2009 NAIP true-color digital ortho-quadrangle
created from the 2009 NAIP quarter-quad

Well A6 = WELL ID
6.9 = Nitrate+Nitrite (mg/l)
15.9 = Gross Alpha (pCi/L)

DATE: 4/8/13
DRAWN BY: JHF
DESIGN: MES
FILE:
BURNS WELL LEVEL II STUDY
FIGURE 5.1
BURNS AREA
WATER QUALITY SAMPLE LOCATIONS
6.0 Development Alternatives, Conceptual Designs, and Cost Estimates

Several alternatives for improvement of the Town’s water system have been developed from this investigation into the existing wells and completion of the test well. These include the construction of a new transmission line to connect the test well to the water system, the installation of an isolated transmission line, and increases to the existing water supply through improvement of the existing wells, and connection to the new test well. The following sections provide details on these options, conceptual designs, and cost estimates.

6.1 Existing Well Improvements

The testing and evaluation of Wells A2, A3, and A4 indicated that the Town has a few options for each of these wells that could either increase the quantity of the water supply or improve well longevity. The Town always has the option of simply continuing to use the wells as is without any further work or enhancement as discussed in Section 2.

6.1.1 Well A2

Two alternatives are proposed to increase the groundwater production of Well A2. As noted in Section 2, the first alternative, installing alternate pumping equipment, can be completed with the existing well. The second alternative involves the completion of a new well and abandonment of the existing well. Both of these options involve using the existing well building.

Alternative one is to increase the production rate of the existing well from 200 to 400 gpm. This change could be made by exchanging the current pumping equipment with a variable frequency drive (VFD), pump, and motor. To determine the size of pump and associated equipment costs, a hydraulic analysis was completed to evaluate total dynamic head (TDH) from Well A2 to the farthest storage tank from the well. For this well, that storage tank is located on the east side of Washington Avenue between 2nd and 3rd Street. The hydraulic analysis is based on all wells pumping at their maximum capacity. With Well A2 pumping at a rate of 400 gpm, the estimated TDH is 409 feet. Assuming 75% efficiency, the required motor size is 60 hp. A pump sizing spreadsheet for Well A2 is included in Appendix G. A VFD would be used to power the pump so that normal operating pumping rate of 200 gpm can be achieved with the 60 hp pump. During periods of high demand, the pump yield could be increased up to 400 gpm to meet higher demand. The increase in motor size (30 to 60 hp) would require that the electric utility service be improved. According to High West Energy, the Town’s electrical utility provider, there would be no cost to upsize the electrical service because they will sell more power due to the increase in power use and demand. The electrical equipment between the service and the pump will also need to be upsized. Table 6.1 presents the estimated costs associated with increasing the production rate from 200 gpm to 400 gpm.

To address the sand produced from the well, a new sand separator would need to be installed within the well house. Sand separators work by using centrifugal force; sand particles are spun against the wall of the cone-shaped vessel and gravitate towards the bottom into a collection tank. The velocity at which the water flows through the sand separator determines the efficiency at which the particles are separated from the water; removal efficiency improves at higher velocities ranging between 90 to 100%. The clean water is forced into the center of the separator and up through an outlet. The collection tank can be manually emptied or automated by installing a solenoid valve to discharge the sand at adjustable intervals. For the purpose of preparing cost estimates, the automated flushing system was added to the sand separator.
The second and preferred alternative is to drill a replacement well within the same Town-owned parcel of land, and abandon the current well. Replacement of Well A2 addresses the need for a long term solution, minimizes sand production, and potentially increases the amount of water supply available to the Town. The replacement well would be completed similar to the 1-Anderson Test Well with 10.75-inch diameter SDR 17 PVC casing and Johnson Hi-Flow, 0.020 inch slotted, 304 stainless steel wire wrapped screen. Given the similarity in formation sand size, it is anticipated the annular space would be filled with 16X30 silica sand and sand cement bentonite grout to appropriate depths. This design proved to be effective in maximizing well yield and minimizing sand production. The replacement well may be drilled up to a depth of 300 feet to fully penetrate the Arikaree Formation, and allow for full access to the High Plains Aquifer at this site. The well would be completed with a pitless adaptor to take advantage of the existing building, and equipped with a VFD capable of yielding between 200 and 400 gpm. LA recommends and has included costs for test hole drilling for well design purposes. Table 6.2 presents the costs associated with the construction of a replacement well at this site.

### 6.1.2 Well A3

Given the hydrogeologic parameters obtained from testing, LA believes it would be possible to complete a high capacity replacement well at the location of Well A3. The original well that had been completed at this location yielded 150 gpm with only 20 feet of drawdown during a 4 hour aquifer test. In completing a high capacity replacement well at this location, the Town would have the option of tying this well into the system, and potentially allowing the school to exclusively use Well A5 for athletic field irrigation. Table 6.3 presents the costs associated with the construction of a new well at this site.

A replacement well would be offset from the current location and the current well would be abandoned. Again, this well would be completed similar to the 1-Anderson Test Well with 10.75-inch diameter SDR 17 PVC casing and Johnson Hi-Flow, 0.020 inch slotted, 304 stainless steel wire wrapped screen. Depending on the results of sieve analysis, the annular space would likely be filled with 16X30 silica sand and sand cement bentonite grout to appropriate depths. This well may be drilled up to a depth of 325 feet to fully penetrate the Arikaree Formation, and allow for full access to the High Plains Aquifer at this site. LA recommends that a test hole be drilled for well design purposes and has included costs for test hole drilling in the estimates for this replacement well.

The well would be completed with a submersible pump and pitless adapter; a building sized to accommodate electrical and controls equipment, chlorine feed equipment, flow meter, valves, discharge to waste outlet, and piping. To accommodate the equipment, a building approximately 10 feet by 15 feet would be required. The building will be either a fiberglass reinforced plastic (FRP) or prefabricated steel. A chain link fence will be installed to help secure the well building and light duty access routes will be constructed for the entry/exit to the well site/well building. The pump would be equipped with a VFD capable of yielding approximately 200 gpm, and plumbed into the water system. To determine the size of pump and associated equipment costs, a hydraulic analysis was completed from Well A3 to the farthest storage tank from the well which is located at 1st Street and Prairie Avenue. The hydraulic analysis is based on all wells pumping at their maximum capacity. With Well A3 pumping at a rate of 200 gpm, the estimated TDH is 364 feet. Assuming 75% efficiency, the required motor size is 25 hp. A pump sizing spreadsheet for Well A3 is included in Appendix G.
6.1.3 Well A4

Similarly to Well A2, LA has proposed two alternatives to increase the overall groundwater production capacity at this location. As noted in Section 2, the first alternative is rehabilitation of the existing well. The second alternative involves drilling a replacement well and abandoning the existing well. Due to its current condition and limited size, both alternatives include the replacement of the existing well house building. The new building would be sized to accommodate electrical and controls equipment, chlorine feed equipment, flow meter, valves, discharge to waste outlet, and piping. To accommodate the equipment, a building approximately 10 feet by 15 feet would be required. The building would be either FRP or prefabricated steel. A chain link fence will be installed to help secure the well building and light duty access routes will be constructed for the entry/exit to the well site/well building.

The first alternative is to rehabilitate the existing Well A4. It may be possible to rehabilitate this well through a combination of techniques. Following pulling of the existing pump, the well would first be treated through sonar jetting. The second step would be to redevelop the well using a combination of water jetting and simultaneous pumping. Following redevelopment, another round of stepped and constant rate aquifer tests would be completed. Following those tests, either the existing pumping equipment or alternatively a higher capacity VFD drive pump could be reinstalled into the well if the rehabilitation proved to be successful in increasing both well efficiency and yield.

For the purposes of estimating the costs for this option, LA assumes that the well rehabilitation will increase the yield to a rate of 400 gpm. To determine the size of the pump and associated equipment costs, a hydraulic analysis was conducted from Well A4 to the farthest storage tank which is located on the east side of Washington Avenue between 2nd and 3rd Street near Well A6. The hydraulic analysis is based on all wells pumping at their maximum capacity. With Well A4 pumping at a rate of 400 gpm, the estimated TDH is 448 feet. Assuming 75% efficiency, the required motor size is 75 hp. A pump sizing spreadsheet for Well A4 is included in Appendix G. Table 6.4 presents the costs associated with the rehabilitation of the existing Well A4.

The second and preferred alternative is to drill a replacement well within the same Town-owned parcel of land, and abandon the existing well. Replacement addresses the need for a long term solution and potentially increases the amount of water supply available to the Town. Based on the results of this investigation, this well would likely be completed with 10.75-inch diameter SDR 17 PVC casing and Johnson Hi-Flow, 0.020 inch slotted, 304 stainless steel wire wrapped screen. Given the formation sand size, the annular space would be filled with 16X30 silica sand and sand cement bentonite grout to appropriate depths. This well may be drilled up to a depth of 275 feet to fully penetrate the Arikaree Formation, and allow for full access to the High Plains Aquifer at this site. The well would be completed with a new building, and equipped with a VFD pump capable of yielding approximately 400 gpm. LA assumes that the pump size required for a new well would be identical to the pump used for the rehabilitated well. Test hole drilling for well design purposes is recommended, and costs are included in Section 6. Table 6.5 presents the costs associated with the construction of a new well at the Well A4 site.

6.2 1-Anderson Test Well and Transmission Line Connection

As shown on Figure 6.1, the test well is located approximately one-half mile west of Main Street on the south side of 1st Street. The proposed location to connect the test well to the system is adjacent to the Town’s new (2012) 200,000-gallon elevated water storage tank. The new storage tank is located on the same site as Well A2, on the southeast corner of 1st Street and Prairie Avenue,
approximately 3,200 linear feet due east of the test well. The proposed location will allow the Town to connect the test well to the proposed isolated transmission line, as shown in Figure 6.1.

The proposed pipe diameter and material for the transmission line is 6 inch C900 PVC pipe. The proposed transmission line alignment will start at the test well and head east towards the water storage tank along 1st Street to Prairie Avenue and tie to the proposed isolated transmission line. The first 2,000 linear feet of the alignment lies within a 2-track road right-of-way (ROW) which is unencumbered by improvements and utilities. The remaining 1,200 linear feet is within gravel roadway and 400 linear feet of concrete pavement. The 400 foot concrete paved section includes the crossing of Wyoming State Highway 213/Main Street. Both buried and overhead utilities will also need to be crossed in this section. The buried utilities include a fiber optic line that runs along the west side of Luther Avenue. Photo 6.1 in Appendix H provides a view of the proposed transmission line alignment within the 2-track road from the test well site looking east towards the Town.

Crossing the 400 linear feet of concrete paved road can be completed by open trench construction or by using trenchless technologies such as Horizontal Directional Boring (HDD). Open trench construction would require 800 feet of concrete saw cutting (400 feet on each side of trench), excavation through the Wyoming State Highway 213 ROW, crossing overhead and buried utilities, backfilling the trench with flowable fill, and replacement of the concrete surface. HDD construction would eliminate all construction within the concrete pavement with the exception of potholing all of the utility crossings. The HDD contractor will need to know the bury depth and diameter of the utilities/pipelines to insure that they do not disturb them while drilling. Therefore, all utilities crossing the transmission line would need to be potholed prior to excavation work. Photo 6.2 in Appendix H provides a view of the proposed transmission line alignment crossing Highway 213 looking east.

It is estimated that open trench construction is approximately 35% more expensive than HDD construction. Based on the cost savings and being less intrusive construction, it is recommended that HDD be used in constructing the proposed transmission line through the concrete paved corridor.

To determine the size of the pump and associated equipment costs, LA completed a hydraulic analysis from the test well to the farthest storage tank, which is located on the east side of Washington Avenue between 2nd and 3rd Street near Well A6. The hydraulic analysis is based on all wells pumping at their maximum capacity. With the new test well pumping at a rate of 150 gpm, the estimated TDH is 371 feet. Assuming 75% efficiency, the required motor size is 20 hp. A pump sizing spreadsheet for Well A4 is included in Appendix G.

Equipment required for the test well site will be similar to the Town’s other municipal wells. A conceptual layout of the well site is presented on Figure 6.2. Costs associated with connecting this well to the Town are presented in Table 6.6. A submersible pump and pitless adapter will be installed at the well; and a building sized to accommodate the well, electrical and controls equipment, chlorine feed equipment, flow meter, valves, discharge to waste outlet, and piping. To accommodate the equipment, a building approximately 10 feet by 15 feet will be constructed. The building will be of FRP or prefabricated steel. A chain link fence will be installed to help secure the well building and light duty access routes will be constructed for the entry/exit to the well site/well building. Power will be supplied by High West Energy. Three-phase power is available from across the road on 1st Street approximately 100 feet from the well site. The estimated lot size
for the well site is 120 feet by 75 feet (9,000 sf). The primary access route to the well site will be along 1st Street.

The costs associated with funding this alternative were submitted to the WWDC in September 2012, and were approved for Level III construction in 2013. Funds for the Level III project will be released in June 2013, with construction anticipated to be completed in 2014.

6.3 Isolated Transmission Line

Currently the Town's water system includes the four supply wells that are directly connected to the distribution system. An isolated transmission line is proposed that will connect the wells directly to water tanks. Currently the Town provides chlorination at each of the supply wells and there is minimal contact time before the chlorinated water is conveyed to the first water tap. By constructing an isolated transmission line, an alternative to chlorinating at each well would then be to consolidate chlorination at each water tank location. This would reduce the operational requirements for the sodium hypochlorite metering pumps and re-filling multiple sodium hypochlorite supply tanks. It would also provide adequate contact time for disinfection of the water. The isolated transmission line would also result in all of the water from each of the wells being commingled. If at some time in the future one of the supply wells had a water quality parameter that exceeded the EPA MCL, blending of the water from multiple wells could result in the overall water quality still meeting the MCL. If it becomes necessary to implement water treatment for the water system, the isolated transmission system will allow treatment at the tank locations rather than each well site. **Figure 6.1** provides an overall system map with proposed isolated transmission line alignment.

Another benefit of constructing the isolated transmission line is that it will reduce water age within the system. Connecting the wells directly to the tanks will provide a continual fresh supply of water to the tanks and minimize water age. As part of the 2012 200,000-gallon water storage tank project, the new and existing tanks were outfitted with separate inlet and outlet pipes in anticipation of the isolated transmission line. Additionally, both tanks were outfitted with active (continuous) mixers to eliminate thermal stratification which provides a homogeneous chlorine residual within the tank and also minimizes water age.

The proposed isolated water transmission line traverses the east edge of Town. Costs associated with the completion of the isolated transmission line are presented in **Table 6.7**. The line will consist of sections of 6-inch and 8-inch PVC C-900 pipe, and will include all appurtenant structures and fixtures (bends, tees, valves, reducers, etc.). The line will extend approximately 4,240 linear feet from Well A5 near the southeast corner of the athletic field to Well A4 near the northeast corner of Town. The installation of the line would utilize open trench construction along the entire transmission line corridor, which will consist of mainly gravel surfacing, some vegetative surfacing, and a small concrete area. Several utilities, which will need to be accounted for, exist along the proposed transmission line alignment. Existing utilities will need to be located and potholed prior to design and excavation.

The following paragraphs summarize the proposed alignment, design, layout, and considerations for construction of the isolated water transmission line. Additionally, for discussion purposes, the proposed line is divided into three separate sections, although they will be tied together in series. **Appendix I** contains conceptual drawings of the isolated transmission line prepared by AVI. The drawings provide aerial images with the proposed alignment and how the line is divided up into three sections.
Section 1:

A 6-inch PVC C-900 line is proposed to be installed for Section 1 of the isolated water transmission line. This section extends approximately 1,110 linear feet from Well A4 south to Well A2, along North Prairie Avenue and East 1st Street, and has very few obstacles along the alignment. The Section 1 transmission line is proposed to be installed within the gravel roadways, and the construction costs include new 4-inch Crushed Base Grading ‘W’ within the installation corridor. Some other minor construction items and costs within Section 1 include a water main crossing, culvert crossing, and chain link fence removal and replacement.

Section 2:

Section 2 of the isolated water transmission line extends from Well A2 to Well A6. The proposed alignment will follow east along East 1st Avenue to Jefferson Avenue, and then south along Jefferson Avenue to Well A6. Pipe size and type along this section is proposed to be 8-inch PVC C-900, and will extend approximately 1,990 linear feet. Section 2 follows along the existing gravel roads, with East 1st Avenue having minimal obstacles to work around. Jefferson Avenue is a much narrower corridor, and will have considerably more construction conflicts and obstacles (underground and overhead utilities, vegetation, etc.). Other minor construction items and costs along the Section 2 corridor include water main crossings, sewer main crossings, culvert crossings, and revegetation.

Section 3:

Section 3 consists of approximately 1,140 linear feet of 6-inch PVC C-900. Section 3 will extend from Well A6 to Well A5 near 4th Street. The proposed alignment will run along Jefferson Avenue, cross 3rd Street, follow the fence line at the west side of the school gravel parking lot, and then traverse another gravel parking lot at the east side of the athletic field. There will be several obstacles to work around when installing the Section 3 transmission line. Many water and sanitary sewer main crossings will be encountered. Concrete pavement removal and replacement, chain link fence removal and replacement, steel post and rail fence removal and replacement, topsoil stripping and placing, and revegetation will also be construction costs associated with Section 3. Working in and around various overhead and underground utilities and existing infrastructure will make this water line section more complex than Sections 1 and 2.

The portion of Section 3 south of 3rd Street is on Laramie County School District No. 2 property, and construction will need to be coordinated with the school district. Additionally, a utility easement approximately 650 feet long, and 16 feet wide, will be needed for the portion of water main which will be installed on the Laramie County School District No. 2 property. This utility easement will need to be in place prior to the water main being installed.

The costs associated with funding this alternative were submitted to the WWDC in September 2012, and were approved for Level III construction in 2013. Funds for the Level III project will be released in June 2013, with construction anticipated to be completed in 2014.

6.4 Water Treatment

The Town’s wells are not considered to be under the influence of surface water; however, they choose to chlorinate at each of their supply wells to protect against potential contamination. A chlorine-metering pump is located at each of the supply wells to add a 10% sodium hypochlorite solution to the water when the wells are in operation. The metering pumps are set to achieve a
minimum of 0.2 mg/L at the point of entry and maintain chlorine residual at all points on the water system and maintain a detectable residual in the distribution system per National Primary Drinking Water Regulations.

The proposed isolated transmission line would make it possible to consolidate the points of disinfection from each well site to each storage tank site. To do so would require a new chlorine feed system at each storage tank site consisting of a magnetic flow meter, chlorine feed pump, injection tap, chlorine residual analyzer, and sample tap. The chemical feed equipment and residual analyzer should be able to be placed within existing Well A2 and A6 buildings, but the magnetic flow meter and taps would need to be placed within a new meter vault located on the inlet lines to the tanks. Because each of the wells is equipped with chlorine feed systems and there are only two high production wells (Wells A2 and A4) and potentially a third with the test well, we recommend that the chlorine feed systems be maintained at their existing locations. If in the future the Town adds new wells to their system, it may be advantageous to consolidate the disinfection feed points to the tanks for operational and maintenance reasons.

Nitrate concentrations in the groundwater are elevated, but are below the MCL of 10 mg/L and at this point, no treatment for nitrate removal is required. If in the future nitrate concentrations were to increase, treatment may be required. Options include ion exchange and reverse osmosis. Another option is to mix the wells with higher concentrations of nitrate with wells that have lower concentrations prior to distribution. Mixing will be possible by the construction of the isolated transmission line.

The gross alpha concentration of Well A6 is being monitored per EPA requirements. If the well exceeds its MCL after four quarters of sampling, the Town will need to be prepared to take this well offline, or develop an appropriate treatment plan. Options that can be used for addressing gross alpha emitters include reverse osmosis. Another potential option is blending the water from Well A6 with water from other wells that have lower concentrations. Mixing will be possible when the isolated transmission line is constructed.
Table 6.1  Well A2 Pump Replacement Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Estimated Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
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<tbody>
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<td>LS</td>
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**Note:** Costs based on 2013 dollars.
### Table 6.2  Well A2 Replacement Costs

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**Note:** Costs based on 2013 dollars.
## Table 6.3  Well A3 Replacement Costs

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<th>Cost</th>
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</tr>
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<td>$10,000</td>
</tr>
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<td>$1,300</td>
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<td>$20,000</td>
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<tr>
<td>Rig Time</td>
<td>HR</td>
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<tr>
<td>Standby Time</td>
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<td>$1,200</td>
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<td>Plug and Abandon Well</td>
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**Note:** Costs based on 2013 dollars.
### Table 6.4   Well A4 Rehabilitation Costs

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<td>Conduct Aquifer Testing</td>
<td>HR</td>
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<tr>
<td>Reset Existing Pumping Equipment</td>
<td>LS</td>
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<td><strong>Pumping Equipment and Supporting Infrastructure</strong></td>
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<td>Mobilization/Demobilization</td>
<td>LS</td>
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<tr>
<td>Demolition</td>
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<td>Well Pump, Motor, VFD, and Cable</td>
<td>LS</td>
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<td>Pitless Adapter, Column Pipe and Check Valves</td>
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<td>Well Building</td>
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<td>Well Building Pumping and Pump to Waste</td>
<td>LS</td>
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<td>Controls</td>
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<td>Fence at Well Site</td>
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<tr>
<td>Site Piping</td>
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<tr>
<td>Site Restoration</td>
<td>LS</td>
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<td>$3,000</td>
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<tr>
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<td></td>
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</tr>
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</tr>
<tr>
<td><strong>SUBTOTAL 2</strong></td>
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<tr>
<td>CONTINGENCY @ 15% OF SUBTOTAL 2</td>
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<tr>
<td><strong>TOTAL CONSTRUCTION COSTS</strong></td>
<td></td>
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<td>SURVEYING AND GEOTECHNICAL</td>
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<td>LEGAL FEES</td>
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</tr>
<tr>
<td>PERMITTING</td>
<td></td>
<td></td>
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<td></td>
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<td><strong>FINAL PLANS AND SPECIFICATIONS</strong></td>
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<td><strong>TOTAL COSTS</strong></td>
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**Note:** Costs based on 2013 dollars.
### Table 6.5  Well A4 Replacement Costs

<table>
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<th>Item</th>
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<th>Estimated Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
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<tbody>
<tr>
<td><strong>Replacement of Well A4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization</td>
<td>LS</td>
<td>1</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Test Hole Drilling</td>
<td>FT</td>
<td>275</td>
<td>$17</td>
<td>$4,675</td>
</tr>
<tr>
<td>Geophysical Logging</td>
<td>FT</td>
<td>275</td>
<td>$4</td>
<td>$1,100</td>
</tr>
<tr>
<td>Borehole Abandonment</td>
<td>FT</td>
<td>275</td>
<td>$10</td>
<td>$2,750</td>
</tr>
<tr>
<td>Site Restoration</td>
<td>LS</td>
<td>1</td>
<td>$2,000</td>
<td>$2,000</td>
</tr>
<tr>
<td><strong>Replacement Well Drilling, Completion, and Testing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
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<td>Bonds and Insurance</td>
<td>LS</td>
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<td>$4,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Site Restoration</td>
<td>LS</td>
<td>1</td>
<td>$3,000</td>
<td>$3,000</td>
</tr>
<tr>
<td>Drill, Furnish, and Install 20-inch Surface Casing</td>
<td>FT</td>
<td>20</td>
<td>$250</td>
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<tr>
<td>Drill 17.5-inch Diameter Borehole</td>
<td>FT</td>
<td>260</td>
<td>$100</td>
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<tr>
<td>Furnish and Install 10.75-inch Stainless Steel Screen</td>
<td>FT</td>
<td>100</td>
<td>$200</td>
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<tr>
<td>Furnish and Install 10.75-inch PVC Casing</td>
<td>FT</td>
<td>155</td>
<td>$60</td>
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<tr>
<td>Furnish and Install 10.75-inch Steel Casing</td>
<td>FT</td>
<td>22</td>
<td>$60</td>
<td>$1,320</td>
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<tr>
<td>Furnish and Install Gravel Pack</td>
<td>CF</td>
<td>260</td>
<td>$30</td>
<td>$7,800</td>
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<td>Furnish and Install Sand Cement Grout</td>
<td>CY</td>
<td>4</td>
<td>$500</td>
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<tr>
<td>Rig Time</td>
<td>HR</td>
<td>8</td>
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<td>Standby Time</td>
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<td>$1,200</td>
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<td>Plug and Abandon Well</td>
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<td>275</td>
<td>$40</td>
<td>$11,000</td>
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<td>Geophysical Logging-Mob/Demob</td>
<td>LS</td>
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<td>$2,500</td>
</tr>
<tr>
<td>Geophysical Logging – 17.5-inch Hole</td>
<td>FT</td>
<td>260</td>
<td>$10</td>
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<td>Downhole Video</td>
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<td>$2,500</td>
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<tr>
<td>Well Development</td>
<td>HR</td>
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<td>$350</td>
<td>$8,400</td>
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<td>Mobilize and Set Test Pump</td>
<td>LS</td>
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<td>$10,000</td>
<td>$10,000</td>
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<tr>
<td>Conduct Aquifer Testing</td>
<td>HR</td>
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<td>$200</td>
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<tr>
<td>Disinfection</td>
<td>LS</td>
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<td><strong>Abandonment of Existing Well</strong></td>
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<td>Well Abandonment</td>
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<td>220</td>
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<td>$13,200</td>
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<td><strong>Pumping Equipment and Supporting Infrastructure</strong></td>
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<tr>
<td>Mobilization/Demobilization</td>
<td>LS</td>
<td>1</td>
<td>$27,000</td>
<td>$27,000</td>
</tr>
<tr>
<td>Demolition</td>
<td>LS</td>
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<td>$2,500</td>
<td>$2,500</td>
</tr>
<tr>
<td>Well Pump, Motor, VFD, and Cable</td>
<td>LS</td>
<td>1</td>
<td>$50,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Column Pipe and Pitless Adapter</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>Well Building</td>
<td>LS</td>
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<td>$30,000</td>
<td>$30,000</td>
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<td>Well Building Piping and Pump to Waste</td>
<td>LS</td>
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<td>$35,000</td>
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<td>Electrical</td>
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<td>Telemetry and Programming</td>
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<tr>
<td>Site Piping</td>
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<td>100</td>
<td>$200</td>
<td>$20,000</td>
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<td>Site Restoration</td>
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<td><strong>HYDROGEOLOGY AND WELL DESIGN</strong></td>
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<td></td>
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<tr>
<td><strong>SURVEYING AND GEOTECHNICAL</strong></td>
<td></td>
<td></td>
<td>$2,000</td>
<td></td>
</tr>
<tr>
<td><strong>LEGAL FEES</strong></td>
<td></td>
<td></td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td><strong>PERMITTING</strong></td>
<td></td>
<td></td>
<td>$7,500</td>
<td></td>
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<tr>
<td><strong>FINAL PLANS AND SPECIFICATIONS</strong></td>
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<td>$36,000</td>
<td></td>
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<tr>
<td><strong>TOTAL COSTS</strong></td>
<td></td>
<td></td>
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</table>

**Note:** Costs based on 2013 dollars.
### Table 6.6  Costs for 1-Anderson Test Well Pumping Equipment and Transmission Line

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<tr>
<th>Item</th>
<th>Unit</th>
<th>Estimated Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization/Demobilization</td>
<td>LS</td>
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<td>$32,000</td>
<td>$32,000</td>
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<tr>
<td>Well Pump, Motor, VFD, and Cable</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>Column Pipe and Pitiless Adapter</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Well Building</td>
<td>LS</td>
<td>1</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td>Well Building Piping and Pump to Waste</td>
<td>LS</td>
<td>1</td>
<td>$24,000</td>
<td>$24,000</td>
</tr>
<tr>
<td>Electrical</td>
<td>LS</td>
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<td>$36,000</td>
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<td>Telemetry and Programming</td>
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<tr>
<td>Flow Meter</td>
<td>LS</td>
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<td>$10,000</td>
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<tr>
<td>Pipeline (Open Trench Construction)</td>
<td>LF</td>
<td>2900</td>
<td>$60</td>
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<tr>
<td>Restoration</td>
<td>LS</td>
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<td>$10,000</td>
</tr>
<tr>
<td>Pipeline (Directional Drill Highway Crossing)</td>
<td>LF</td>
<td>500</td>
<td>$130</td>
<td>$65,000</td>
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<tr>
<td>Fence at Well Site</td>
<td>LS</td>
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<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Miscellaneous Cost and Testing</td>
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<td>$5,000</td>
<td>$5,000</td>
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<tr>
<td>Well Site Easement</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
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</table>

**SUBTOTAL 1**  
ENGINEERING @ 10% OF SUBTOTAL 1  
$475,000

**SUBTOTAL 2**  
CONTINGENCY @12% OF SUBTOTAL 2  
TOTAL CONSTRUCTION COSTS  
SURVEYING AND GEOTEchnical  
PERMITTING/LEGAL  
FINAL PLANS AND SPECIFICATIONS  
**TOTAL COSTS**  
$642,350

**Note:** Costs in 2012 dollars. Costs provided at time of Level III application submittal.

### Table 6.7  Costs for Isolated Transmission Line

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Estimated Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization/Demobilization</td>
<td>LS</td>
<td>1</td>
<td>$29,000</td>
<td>$29,000</td>
</tr>
<tr>
<td>6-inch DR-18 PVC Transmission Line and Appurtenances</td>
<td>LF</td>
<td>2250</td>
<td>$60</td>
<td>$135,000</td>
</tr>
<tr>
<td>8-inch DR-18 PVC Transmission Line and Appurtenances</td>
<td>LF</td>
<td>1990</td>
<td>$70</td>
<td>$139,300</td>
</tr>
<tr>
<td>Import Backfill</td>
<td>CY</td>
<td>2000</td>
<td>$4</td>
<td>$8,000</td>
</tr>
<tr>
<td>Production Well Connections</td>
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<td>4</td>
<td>$15,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Utility Potholing and Crossings</td>
<td>EA</td>
<td>15</td>
<td>$1,000</td>
<td>$15,000</td>
</tr>
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<td>Gravel Road Surface Restoration</td>
<td>TON</td>
<td>1830</td>
<td>$15</td>
<td>$27,450</td>
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<td>Turf Restoration</td>
<td>ACRE</td>
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<td>$1,700</td>
<td>$1,700</td>
</tr>
<tr>
<td>Concrete Removal and Replacement</td>
<td>SY</td>
<td>30</td>
<td>$75</td>
<td>$2,250</td>
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<tr>
<td>Fence Removal and Replacement</td>
<td>LF</td>
<td>100</td>
<td>$30</td>
<td>$3,000</td>
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</table>

**SUBTOTAL 1**  
ENGINEERING @ 10% OF SUBTOTAL 1  
$420,700

**SUBTOTAL 2**  
CONTINGENCY @12% OF SUBTOTAL 2  
TOTAL CONSTRUCTION COSTS  
SURVEYING AND GEOTEchnical  
PERMITTING/LEGAL  
FINAL PLANS AND SPECIFICATIONS  
**TOTAL COSTS**  
$570,847

**Note:** Costs in 2012 dollars. Costs provided at time of Level III application submittal.
FIGURE 6.2
ANDERSON TEST WELL CONCEPTUAL LAYOUT

LEGEND

BLOW-OFF HYDRANT
GATE VALVE

PROJECT: WYDCC11
DATE: 3/18/13
DESIGN/DRAWN: MES/SOM
CHECKED:
REVISIONS:
FILE:

SCALE IN FEET

0 25 50
7.0 Financing Analysis of Recommended Improvements

A financial evaluation was conducted for completing the recommended improvements presented in Section 6. The financial obligations were estimated for costs that would be incurred by the Town for completing each improvement and their associated operating and maintenance costs. To estimate the operational (electrical) costs, LA contacted High West Energy, the Town’s electrical utility provider, to obtain their electrical rates and charges. A copy of High West Energy's rate and charges schedule is included in Appendix J. High West Energy informed LA that they will be raising their rates June 2013; however, they did not have details concerning the rate increase information available. For the purposes of this analysis, LA assumed a 3% increase of their current rates.

To estimate electrical usage, LA used the Town’s annual water use (40 MG) and assumed an average production/pumping rate of 350 gpm using a combination of two wells operating simultaneously (e.g. A2 plus A3 and A4 plus the new test well). Wells A5 and A6 were not included in this assessment due to the minimal yield and associated low operating costs. To estimate the annual maintenance costs of the wells, LA assumed 15% of the electrical costs. The tables used to calculate the estimated power requirements at each well and their associated electrical costs are located in Appendix J. Table 7.1 provides a summary of the annual O&M costs.

To complete the financial analysis, information was provided by the Town for their number of billing customers. The analysis assumed a 67% WWDC grant and 33% WWDC 30-year loan at 4% interest. Based on the estimated construction costs and annual O&M costs, the total annual payment for each project was determined and the monthly cost per tap for each improvement. Table 7.2 provides a summary of the financial analysis.
### Table 7.1  Summary of Anticipated Annual Operating Costs with Recommended Alternatives Constructed

<table>
<thead>
<tr>
<th>Well Identification</th>
<th>Well A2</th>
<th>Well A3</th>
<th>Well A4</th>
<th>Test Well</th>
<th>Total (all wells)</th>
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<td>Annual Water Volume (gal.)</td>
<td>11,428,571</td>
<td>8,571,429</td>
<td>11,428,571</td>
<td>8,571,429</td>
<td>40,000,000</td>
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<tr>
<td>Annual Power Use (kW)</td>
<td>13,495</td>
<td>11,879</td>
<td>14,007</td>
<td>11,188</td>
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<tr>
<td>Power Cost ($/kWh)(^1)</td>
<td>0.422</td>
<td>0.448</td>
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<td></td>
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<tr>
<td>Annual Power Costs</td>
<td>$5,689</td>
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</tr>
<tr>
<td>Annual Maintenance Costs(^2)</td>
<td>$853</td>
<td>$798</td>
<td>$871</td>
<td>$631</td>
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<td><strong>Total Annual O&amp;M Costs</strong></td>
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<td><strong>$6,121</strong></td>
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<td><strong>$4,839</strong></td>
<td><strong>$24,177</strong></td>
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</tbody>
</table>

**Notes:**
1. Includes owner cost, demand charge, facility charge, transformer KVA charge, and pump nameplate horsepower charge.
2. Maintenance costs estimated by multiplying annual power costs by 15%.

### Table 7.2  Construction Cost Summary and Financial Analysis

<table>
<thead>
<tr>
<th>Item</th>
<th>Test Well and Transmission Line</th>
<th>Well A2 Replacement</th>
<th>Well A4 Replacement</th>
<th>Well A3 Replacement</th>
<th>Isolated Transmission Line</th>
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<tbody>
<tr>
<td></td>
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<td>Construction Costs</td>
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<td>$663,100</td>
<td>$705,700</td>
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<td>Project Cost: Per Tap/Month</td>
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<td>$56.21</td>
<td>$77.36</td>
<td>$61.75</td>
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**Notes:**
1. Based on all pumps pumping a total of 40 MG per year.
8.0 Permitting and Environmental Issues

For the project alternatives presented in Section 6 to proceed to construction, the Town will be required to obtain certain permits, rights-of-way, and easements. Appropriate state, county, and federal agencies must be contacted as part of the Level III process. The following issues for each alternative must be addressed during the final design.

**SEO Water Rights** - Increasing the production of any existing well above its currently adjudicated amount will need to be permitted with the SEO. It may also be necessary to obtain consent from the Board of Control. With respect to the test well, the SEO will need to be contacted in order to determine the process by which a valid water right can be obtained for the well given the present moratorium on the issuance of new water rights within the Laramie County Control Area. Whenever the application is submitted for a new water right, the well should be referenced as Well A7. As part of the permitting process, the SEO will determine whether or not the Town is in compliance with all permit conditions and limitations on its existing water rights. The SEO may also apply a system wide water right cap on the Town, which typically amounts to their average use over the last five years, plus 25%.

**WDEQ/WQD Permit** - All system improvements, including the new and existing well improvements, transmission line, and isolated transmission line will require a Permit to Construct from the WDEQ/WQD.

**Private Land Easements** - The test well and transmission line corridor (up to Laramie Avenue) are located on private property owned by Mark Anderson. Permanent easements will be required for both the test well site and the pipeline. The Town may want to consider extending the 1st Street ROW westward to the test well and constructing the transmission line within the ROW instead of a utility permit for the transmission line.

The isolated transmission line will primarily be located within the Town's property and ROW. However, at the south end of the isolated transmission line at 3rd Street, the pipeline enters private property owned by the Laramie County School District No. 2. The Town will need to obtain an easement to connect the isolated transmission line to Well A5.
9.0 Recommendations

Based on the completed evaluation of the Town’s existing high capacity wells and testing of the 1-Anderson Test Well, LA has developed the following prioritized recommendations for further development of the Town’s water supply:

1. Tie the 1-Anderson Test Well into the Town water system. This will add an additional 150 gpm of supply capacity for a combined total of 610 gpm with the existing wells. With the 1-Anderson well online, if either Well A2 (200 gpm) or A4 (200 gpm) were to fail, the Town could still meet and exceed the estimated 2040 peak summertime demand of 325 gpm. A project to tie the 1-Anderson Test Well into the Town water system was submitted and approved for Level III funding by the WWDC in early 2013.

2. Construct an isolated transmission line to tie all of the Town’s wells (including the test well) to the storage tanks. Installing the isolated transmission line will improve water quality through mixing and minimize water age by supplying the storage tanks with a continuous supply of fresh water. A project to construct the isolated transmission line was submitted and approved for Level III funding by the WWDC in early 2013.

3. Construct a new well on Town owned land adjacent to Well A4 and abandon the existing well. Based on the well video, calculated hydrogeologic parameters, reported historic production, and local hydraulic communication with a previous test hole, it appears that there is additional groundwater that could be produced from this location, but is being prevented from entering the existing well due to its current condition. A potentially higher capacity replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production for the Town. This option provides the Town a more reliable long term water supply with potentially additional yield.

4. Replace Well A2 with a new production well located on the same Town owned land. Well A2 was originally drilled as a replacement for Well A1 which was abandoned and lies beneath the storage tank completed onsite in 2012. Given the productivity of Well A2, LA anticipates an approximately 10-inch diameter replacement well could be drilled and completed at this location with an appropriate screen and gravel pack to maximize groundwater production and minimize sand production for the Town.

5. Replace Well A3 with a new production well when the current well fails. The current well screen has a fracture in the lower screened interval and does not appear to have a sanitary seal. Replacing Well A3 would provide the Town another reliable well that could produce up to 200 gpm and increase the Town’s operational flexibility and minimize the potential for overuse of the other three higher capacity wells.

6. Dedicate Well A5 to the school and allow them to utilize it for watering athletic fields. Allowing the school to irrigate from a dedicated well will continue to keep their water demand off the Town’s water system. If Well A5 is used for irrigating the athletic fields the well will need to be enlarged to produce 50-60 gpm in order to provide an adequate supply.

7. Continue to monitor and work with the analytical laboratories to ensure that all certified laboratory reports present gross alpha as both adjusted and non-adjusted values and that the EPA MCL be presented with the adjusted gross alpha value.
10.0 References


Wyoming State Engineer's Office, Various, Water Well Completion Reports (U.W. 6): Lithologic and well completion reports on file with the State of Wyoming.
Wyoming Water Development Commission  
6920 Yellowtail Rd.  
Cheyenne, Wyoming 82002

Dear Applicant or Agent:

You are advised that the State Engineer approved the following application(s) to appropriate ground water for MONITOR/TEST on October 5, 2011. A copy of each permit is enclosed. Also enclosed are forms and instructions for submitting data to the State Engineer relating to the completion of the well, as required by law.

PERMIT NUMBER  
U.W. 196738-196742

By Statute the well must be completed by -DECEMBER 31, 2012. IF THE REQUIRED NOTICES ARE NOT RETURNED TO THIS OFFICE WITHIN THE STATUTORY TIME LIMITS SET FORTH, THE PERMIT(S) WILL BE SUBJECT TO CANCELLATION, WHICH ACTS AS A FORFEITURE OF THE WATER RIGHT GRANTED BY THIS PERMIT.

An extension of time may be requested for completion of work when good reason is provided. A request for such extension must be received in the State Engineer’s Office prior to the expiration date shown on the permit. Requests for extension of time must indicate due diligence on the part of the applicant to comply with the time limits imposed by this permit.

Sincerely,

Lisa Lindemann, Administrator  
Ground Water Division

xc: DIV 1 (1)

Surface Water  
(307) 777-6475  
Ground Water  
(307) 777-6163  
Board of Control  
(307) 777-6178
IMPORTANT NOTICE - PLEASE READ CAREFULLY

The approval by the State Engineer of a permit grants an appropriation of water only and does not grant any authority or permission to use the property of someone else, or the requirement to obtain other state and federal permits as required.

If the water well to be constructed will be utilized by more than one (1) landowner, a written water users agreement should be secured and filed with the State Engineer's Office stating all conditions relating to the use of the water well.

If you do not own the land upon which your facility will be constructed, you should, before starting construction, take immediate steps to secure a permanent right-of-way.

If any part of the facility is located on State Land, and you are the lessee of record, communicate with the State Land Commission for necessary applications for construction of improvements. If you are not the lessee of record, Land Board approval is needed for right-of-way across or upon the leased area.

If the facility is to be located on Federal Lands, it will be necessary that you contact the Bureau of Land Management, P. O. Box 1828, Cheyenne, WY 82003, for information as to what is needed. If lands controlled by the Forest Service are involved with this facility, the local Forest Service Office should be contacted for the proper procedure required to obtain a right-of-way.

If privately owned lands are involved with this facility, right-of-way should be secured by written agreement from the land owner, securing sufficient land to properly allow any work that may be necessary. This written agreement should be made a matter of record in the Office of the County Clerk of the County in which the land is situated and the State Engineer's Office.

Such procedure will save you a great deal of unnecessary expense in the future, as any person subsequently filing on Federal Lands or purchasing State Lands, may claim damages, unless such right-of-way is made a matter of record and patent given subject to a right-of-way for existing facilities.

Construction of this facility may require the discharge of dredged or fill material into Wyoming water bodies and wetlands, including intermittent streams, as authorized by Section 404 of the Clean Water Act (33 U.S.C. 1344), the permittee is advised to contact the nearest Corps of Engineers' office to determine if their proposed work requires authorization from that agency. The Corp office is located as follows: U.S. Army Corps of Engineers, Wyoming Regulatory Office, 2232 Dell Range, Suite 210, Cheyenne, WY 82009, 307-772-2300.
If the water right is for a source to be developed for human consumption serving 15 or more service connections, or 25 or more persons, for 60 days or more of the year, then regulations developed under the Federal Safe Drinking Water Act apply. Specific requirements of the Act are available from the Water Supply Section, Region VIII, U. S. Environmental Protection Agency, One Denver Place, 999 18th Street., Suite 500, Denver, CO 80202-2405. The provisions of Chapter III of the Wyoming Water Quality Rules and Regulations also apply. You are advised that plans and specifications covering the proposed construction, installation, or modification of any system designed for this purpose are required to be submitted to and a permit to construct obtained prior to the start of construction from, the Water Quality Division, Wyoming Department of Environmental Quality (WDEQ/WQD), Herschler Building-4th Floor West, Cheyenne, WY 82002; phone number 307-777-7781.

If construction of the facility will disturb one (1) or more surface acres, a Wyoming Pollutant Discharge Elimination System (WYPDES) storm water permit will be required by the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ/WQD). If there will be any discharge of produced wastewater or drilling muds to the surface, a WYPDES permit may be required by the WDEQ/WQD. The permittee is advised to contact WDEQ/WQD, Herschler Building-4th Floor West, Cheyenne, WY 82002; phone number 307-777-7781 to determine specific WDEQ/WQD WYPDES requirements.

If the water right facilities are to be constructed in areas subject to local governmental laws and regulations, the proper authorities should be contacted to avoid violation of established laws, such as zoning.

Statutory time limits during which the project must be completed and notices filed with the State Engineer's office are set forth for each approved permit. Failure to return the required notices within the statutorily required time limits acts as forfeiture of the water right granted by the permit and will cause the permit to be subject to cancellation.

With best regards,

Patrick T. Tyrrell,
State Engineer

Rev. 3/4/2008
INSTRUCTIONS FOR COMPLETING
STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING, FORM U.W. 6
AND
PROOF OF APPROPRIATION AND BENEFICIAL USE OF GROUND WATER, FORM U.W. 8

General Instructions
- Address all communications to the State Engineer, Herschler Building 4-E, Cheyenne, WY 82002. Please put your Permit Number on all communications sent to this office.
- These forms must be signed in ink by the well (spring) owner or authorized agent.
- Photocopies or Poor Quality Reproductions are Unacceptable.
- When a Statement of Completion is returned to the permittee or authorized agent for correction, it should be understood that the corrections are required for the protection of the applicant and in the interest of maintaining accurate records. Please make the corrections and return to this office as promptly as possible.
- The Statement of Completion is required by law to be submitted within thirty (30) days of the date that a well is completed and ready for use.
- Proof of Appropriation and Beneficial Use of Ground Water (Form U.W. 8) is required to be submitted by December 31 of the year following the year in which the permit was granted. This form is not required for wells utilized for Domestic, Stock, Monitor, Test or other uses where the requirement for the Proof of Appropriation and Beneficial Use of Ground Water has been waived.

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING
(FORM U.W. 6)

- Statements of Completion must not be folded.
- Statements of Completion must not be defaced by crossing out, erasing or whitling-out printed matter, or by changing/cutting the form in any way. Preferably, the form should by typed. If a typewriter is not available, the form should be lettered neatly with black ink or ball point pen. (Colored inks do not microfilm)
- PLEASE NOTE: If any of the information required in the Statement of Completion is not available or is unknown, your best estimate will be acceptable.
- STATEMENTS OF COMPLETION MUST BE SIGNED IN INK ON THE 2ND SIDE BY THE PERMITTEE OR AUTHORIZED AGENT.

The Statement of Completion should completed as follows:

Item No. & Description
PERMIT NO. & NAME OF WELL (SPRING) - These should be the exact permit number & name as shown on the permit.
1. NAME OF OWNER - This should be the name of the original applicant (permittee) or present owner of the well.
2. ADDRESS - Give the respective mailing address of each permittee or present owner. Please check the box if address has changed from that shown on permit.
3. USE OF THE WATER - If use of water is not the same as shown on the approved permit, an explanatory note should be included on the back in the REMARKS section. In some cases, an ENLARGEMENT (expansion of the water right) of the original permit will necessary.
4. LOCATION OF WELL - A specific 40-acre location must be submitted. A surveyor’s tie is required for all irrigation, industrial, municipal and miscellaneous use wells. If a surveyor’s tie is not available, a distance measurement from a known reference point such as a section or quarter corner must be provided.
5. TYPE OF CONSTRUCTION - This item is self-explanatory.
6. CONSTRUCTION - Method by which the well was completed.
   a. Total Depth of Well/Spring: How deep is the well drilled or spring dug?
   b. Depth to Static Water Level: Static Water Level is the level at which the water stands in a well when no water is being removed, either by pumping or free flow. It is generally expressed as the distance from ground surface to the water level in the well. If a well/spring is flowing - “flowing” should be written here.
   c. Casing Height Above Ground (ft) - This item is self-explanatory.
   d. Diameter of borehole (Bit size): What is the diameter of the drilling bit used to construct the well or spring?
   e. Casing Schedule: This is the pipe that’s placed in the hole. Is the casing new or used? What is the diameter of the casing?
   f. Did the diameter of the casing change at a certain depth? If so, please show the depths.
   g. Joint Type: Indicate the type of joint used to connect the casing together.
   h. Grouted Interval: Is the pipe grouted/cemented into the hole? If so, at what depth interval is it grouted/cemented? Also indicate the amount and type of grout/cement used.
   i. Type of Completion: Indicate what type of completion was made.
   j. Perforation: What type of perforator was used? What are the sizes of the openings and at what depth are they located? How were the openings in the casing made to allow water to flow into the pipe?
   k. Open Hole: If no casing was installed, what is the open hole interval?
   l. Well Screen: Well screen is a factory constructed perforated casing. If it was installed, indicate diameter, slot size and interval it was set.
   m. Well Development Method: All new wells should be developed before being put into production. What method was used to develop the well? Overpumping, backwashing, mechanical surging, air development, jetting, etc. How long did development last?

SEE REVERSE SIDE
This item is self-explanatory

This item should reflect the date the pumping facility was installed and water put to Beneficial Use. If for a spring and no pump is installed, indicate the date the facility was first put to Beneficial Use. Failure to give date will delay processing of your Statement of Completion. The State Engineer does not consider a well complete until a pump has been installed. (For Monitor/Test Wells use the date the drilling was completed, since no beneficial use of water is made.)

PUMP INFORMATION - This item should be completed as accurately and thoroughly as possible. The number of gallons per minute being pumped, the type of pump and the depth of pump setting must be shown. Monitor/Test uses need not fill out this item.

Total Volumetric Gallons Used Per Calendar Year: The unit of measurement should be in acre-feet per year.

Flowing Well/Spring: If the well or spring flows, the yield should be written here. Surface pressure should be shown here also. Information relating to this item should be available from the driller and should be as complete as possible. It is the permittee's responsibility to obtain this information. How is the flow controlled? Does well leak around the casing?

If this is a spring describe method of development and means of conveyance to point of use. Some method of artificial diversion, i.e., spring box, cribbing, etc., is necessary to qualify for a water right.

Pump Test: Information relating to these items should be available from the driller and should be as complete as possible. It is the permittee's responsibility to obtain this information.

Log of Well/Drill Cuttings Description: Information relating to these items should be available from the driller and should be as complete as possible. It is the permittee's responsibility to obtain this information. Land surface elevation (ft. above mean sea level): If this information is available to you, please provide it and how it was determined.

QUALITY OF WATER INFORMATION - This item is self-explanatory. Water quality information is not required for our records; however, we would like a copy to be filmed as part of the permanent record associated with your well/spring.

REMARKS: This is where you can explain any special or unusual peculiarity of your well and your water system or conveyance.

SIGNATURE OF OWNER OR AUTHORIZED AGENT - This form must be signed with an original signature in ink by the permittee or authorized agent. (Stamped signatures are not acceptable.) Failure to do so will delay processing of the Statement of Completion, as it will be returned to you for signature.

PROOF OF APPROPRIATION AND BENEFICIAL USE OF GROUND WATER

(FORM U.W. 8)

This form (U.W. 8) must be signed on the reverse side by the permittee or authorized agent. Failure to do so will delay processing of the form, as it will be returned to you for signature.

PART I:
The information submitted on this form will be used as a basis for the adjudication of the ground water right. The items are self-explanatory and each item should be completed as accurately and thoroughly as possible.

PART II:
For Irrigation, Industrial, Municipal and Miscellaneous Wells. If the form is stamped "MAP NOT REQUIRED", Parts II & III of this form are waived.

THE PREPARATION OF THE PLAT - This should be read carefully BEFORE the form is completed.

CERTIFICATE OF OWNERSHIP - This may be obtained from the County Clerk's Office showing ownership or control of land(s) involved and MUST ACCOMPANY the Proof of Appropriation and Beneficial Use of Ground Water Form (U.W. 8).

Part III:
A State Engineer Representative will prepare part III at time of inspection.

PHOTOCOPIES OF THE FORMS ARE UNACCEPTABLE
MEMORANDUM

February 9, 2006

TO: State Engineer's Office

FROM: Patrick T. Tyrrell, State Engineer

SUBJECT: State Engineer's Office Requirements for Coordinates on Permits and Petitions.

Effective Date: April 1, 2006

Background

The State Engineer's Office (SEO) is currently implementing an information management technology system for the entire agency. This system will allow for more efficient data retrieval and is the initial step in creating a statewide geographic information system (GIS) for water rights in the state. A key component for GIS is accurate locations of the spatial data being depicted. Historically, the SEO has required maps prepared by an engineer or surveyor for larger projects to depict locations. On stock pond permits and well permits, only the Public Land Survey quarter/quarter locations have been required.

With the advent of hand held Global Positioning System (GPS) units, coordinates for specific locations are easier to acquire. As such, the SEO will begin requiring coordinates for permitting and petitioning processes in the agency. The respective divisions will be administered as follows:

Surface Water Division

Prior to the SEO issuing a new permit, the applicant shall provide coordinates on all proposed points of diversion and centerlines of dam embankments.

Ground Water Division

This division will continue to issue permits without the requirement of the applicant providing coordinates on the application form (UW-5). The permittee will be required to provide coordinates when filing the Statement of Completion (UW-6) for completed wells or spring developments. A Statement of Completion will not be considered acceptable until coordinates have been provided.
Board of Control

In the State Board of Control (BOC) Rules and Regulations, approved in November, 2004, all maps and surveys submitted to the BOC are to indicate the location of points of diversion, reservoir outlets, wells, pumps and pivot points by latitude and longitude (coordinates). The BOC considers coordinates to be an essential component of any map submitted to the BOC.

Coordinates Systems

The SEO will accept coordinates in one of three coordinate systems. They are as follows:

1. Latitude and Longitude – Preferred
2. Universal Transverse Mercator (UTM)
3. State Plane Coordinates

The adopted datums are North American Datum of 1983 (NAD83) for horizontal measurements and the North American Vertical Datum of 1988 (NAVD 88) for vertical measurements.

Accuracy

The SEO will allow two levels of accuracy to be used in providing coordinates on submittals to the agency. The accuracy level will be dependent on the type of submittal being made and described as follows:

1. For those applications, Statements of Completion, proofs, petitions, etc. that require a map prepared by a licensed surveyor or engineer, the coordinates shall be ascertained using survey-grade equipment with an accuracy of ±5 feet.
2. For those applications, Statements of Completion, etc. that do not require a detailed map (stock ponds, stock and domestic wells), the coordinates may be determined using a hand-held recreational GPS unit. Using the Wide Area Augmentation System (WAAS) feature on GPS units generally achieves an accuracy of ±10 feet and is preferred. However, coordinates generated with recreational GPS units without WAAS capability are also acceptable.
PERMIT NO. U.W. 196738  NAME OF WELL/SPRING BURNS 1

1. NAME OF OWNER  WYOMING WATER DEVELOPMENT COMMISSION

2. ADDRESS
   City ____________________________ State __________ Zip Code __________ Phone No. __________
   □ Please check if address has changed from that shown on permit.

3. USE OF WATER
   □ Domestic □ Stock Watering □ Irrigation □ Municipal □ Industrial □ Miscellaneous
   □ Monitor or Test □ Coal Bed Methane    Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING
   Subdivision Name ____________________________
   Land description:  1/4 1/4 of Section ____, T. ____, R. ____, of the 6th P.M. ( or W.R.M.)
   Geographical Coordinates:  Latitude ________ N Longitude ________ W (degrees, minutes, seconds)
   UTM: Zone ________ Northing ________ Easting ________ (meters)
   State Plane Coordinates: Zone ________ Northing ________ Easting ________ (Feet)
   Land surface elevation (ft. above mean sea level) ________ Datum ________ NAVD29 ________ NAVD88
   Source □ GPS □ Map □ Survey □ Unknown □ Other □ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION
   □ Drilled ________ Dug ________ Driven ________ Other ________
   (type of rig, and fluid used, if any)
   Describe ____________________________

6. CONSTRUCTION
   Total depth of well/spring ________ ft.
   Depth to static water level ________ ft. (below land surface)    Casing height ________ ft. above ground
   □ Diameter of borehole (bit size) ________ inches
   □ Casing schedule □ New □ Used Joint type □ Threaded □ Glued □ Welded
   □ diameter from ________ ft. to ________ ft.
   □ diameter from ________ ft. to ________ ft.
   □ Cemented/grouted interval, from ________ ft. to ________ ft.
   □ Amount of grout used ________ type ________
   □ Type of completion □ Customized perforations □ Open hole □ Factory screen
   □ Type of perforator used ________
   □ Size of perforations ________ inches by ________ inches
   □ Number of perforations and depths where perforated ________ perforations from ________ ft. to ________ ft.
   □ diameter from ________ ft. to ________ ft.
   □ diameter from ________ ft. to ________ ft.
   □ Open hole from ________ ft. to ________ ft.
   □ Well screen details
   □ Diameter ________ slot size ________ set from ________ ft. to ________ ft.
   □ Diameter ________ slot size ________ set from ________ ft. to ________ ft.
   □ e. Well development method ________ How long was well developed ________
   □ f. Was a filter/gravel pack installed? □ Yes □ No  □ Size of sand/gravel ________
   □ Filter pack/gravel installed from ________ ft. to ________ ft.
   □ g. Was surface casing used? □ Yes □ No  □ Was it cemented in place? □ Yes □ No
   □ Surface casing installed from ________ ft. to ________ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY ____________________________

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) ____________________________

9. PUMP INFORMATION
   Manufacturer ____________________________ Horsepower ________ Type
   Source of power ____________________________ Depth of pump setting or intake ________ ft.
   Amount of water being pumped ________ gal./min.* (For springs or flowing wells, see item 10)
   Total volumetric quantity used per calendar year.*

10. FLOWING WELL OR SPRING
    (Owner is responsible for control of flowing well)
    □ If well yields artesian flow or if spring, yield is ________ gal./min.*  □ Surface pressure is ________ lb./sq.inch, or ________ feet of water
    The flow is controlled by □ Valve □ Cap □ Plug
    □ Does well leak around casing? □ Yes □ No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 196738 ____________________________

SEE REVERSE SIDE
11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right)

12. PUMP TEST  Was a pump test conducted?  □ Yes  □ No
If so, by whom __________________________________________
Yield ___________ gal./min. with ___________ ft. drawdown after ___________ hours
Yield ___________ gal./min. with ___________ ft. drawdown after ___________ hours

13. LOG OF WELL  Total depth drilled ___________ ft.
Depth of completed well ___________ ft.  Diameter of well ___________ inches.
Depth to first water bearing formation ___________ ft.
Depth to principal water bearing formation  Top ___________ ft. to bottom ___________ ft.

**DRILL CUTTINGS DESCRIPTION:**

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<th>Rock Type Or Description</th>
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<th>Water Bearing? (Yes or no)</th>
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14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM?  □ Yes  □ No

15. QUALITY OF WATER INFORMATION

Does a chemical and/or bacteriological water quality analysis accompany this form?  □ Yes  □ No
It is recommended that chemical and bacteriological water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2904.)
If not, do you consider the quality of water as  □ Good  □ Acceptable  □ Poor  □ Unusable

REMARKS

__________________________________________

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

__________________________________________

Signature of Owner or Authorized Agent  Date

__________________________________________

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 196738
Date of Receipt ____________________________  Date of Approval ____________________________
Date of Priority 9/19/2011

__________________________________________

for State Engineer
APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is Domestic and/or Stock Watering, will be considered as ground water appropriations.

Temporary Filing No. U.W. 42-3-413

NAME AND NUMBER OF WELL OR SPRING

1. Name of applicant(s) Wyoming Water Development Commission
   Phone 307-777-7626

2. Address of applicant(s) 4920 Yellowstone Road, Cheyenne, WY 82002
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name and address of agent to receive correspondence and notices
   Mark Stacy c/o Lidstone and Associates, Inc
   4925 Automation Way, Bldg. E; Fort Collins, CO 80525
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied
   • Domestic
   • Stock Watering
   • Irrigation
   • Municipal
   • Industrial
   • Miscellaneous
   • Coalbed Methane
   • Monitor

5. Location of the well or spring: (NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 58 West)
   Laramie County, WY 1/4 SW 1/4 of Sec. 7, T. 46 R. 56 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract Block of the Subdivision (if Add’n) of ____________________ . Resurvey Location: Tract _____, (or Lot) _____, _______ .

6. Estimated depth of the well or spring is ______ ft. Estimated production interval is _____ ft. to _____ ft.

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: _______ gallons per minute.
   NOTE: if Domestic and/or Stock-watering use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 0
   Circle appropriate units: (Gallons) (Acre Foot) NOTE: A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

<table>
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<tr>
<th>TWP</th>
<th>RNG</th>
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Permit No. U.W. 196738

SEE REVERSE SIDE

Book No. 1417
Page No. 38
9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the table box above.
   b. [ ] Land will be irrigated from this well only.
   c. [ ] Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.
10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.

11. The well or spring is to be constructed on lands owned by Mark Anderson
   (The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant’s. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by [Not applicable]
   (If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARDS: Under this permit, it intends to drill one test borehole that will be abandoned per state regulations and if hydrogeologic conditions are favorable, may drill a test production well that could be used for the Town of Burns. The well would be drilled, developed, and tested to determine its adequacy for providing municipal supply.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

[Signature of Applicant or Authorized Agent]

September 15, 2011

Date

THE LEGALLY REQUIRED FILING FEE MUST ACcompany THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES
   (Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less.)
   $50.00

COAL BED METHANE USE
   $50.00

IRRIGATION, MUNICIPAL, INDUSTRIAL, AND MISCELLANEOUS USES
   $75.00

MONITOR (For water level measurements or chemical quality sampling) or TEST WELL USES
   No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING

STATE ENGINEER’S OFFICE

This instrument was received and filed for record on the 19 day of September, A.D. 2011 at 02:35 o’clock A. M.

Permit No. U.W. 196738

[Signature for State Engineer]

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attached page.

This permit is to drill a test well within the Lake County Control Area. However, no water will be beneficially used, therefore, advertising and recommendation by the Control Area Advisory Board is not required. Approval of this permit does not obligate the State Engineer to approve the permanent production permit.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion must be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 2011.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 5th day of October, A.D. 2011.

[Signature] PATRICK T. TYRELL, State Engineer
STATE OF WYOMING  
OFFICE OF THE STATE ENGINEER  
HERSCHLER BLDG., 4-E  
CHEYENNE, WYOMING 82002  
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

PERMIT NO. U.W. 196739  NAME OF WELL/SPRING BURNS 2

1. NAME OF OWNER  WYOMING WATER DEVELOPMENT COMMISSION

2. ADDRESS  
   City  
   State  
   Zip Code  
   Phone No.  

3. USE OF WATER  
   □ Domestic  □ Stock Watering  □ Irrigation  □ Municipal  □ Industrial  □ Miscellaneous  
   □ Monitor or Test  □ Coal Bed Methane  Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING  
   1/4 1/4 of Section  , T. N., R. W., of the 6th P.M. (or W.R.M.)  
   Subdivision Name  
   Lot  
   Block  
   Resurvey Location Trct: or Lot: Datum: NAD27: NAD83:  
   Geographic Coordinates: Latitude: N. Longitude: W. (degrees, minutes, seconds)  
   UTM: Zone: Northing: Easting (meters)  
   State Plane Coordinates: Zone: Northing: Easting (Feet)  
   Land surface elevation (ft. above mean sea level): Datum: NAVD29: NAVD88  
   Source: GPS: Map: Survey: Unknown: Other: Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION  
   □ Drilled  □ Cased  □ Dug  □ Driven  □ Other  
   Describe

6. CONSTRUCTION  
   Total depth of well/spring:  
   (Feet) (below land surface)  
   (Feet) above ground  
   a. Diameter of borehole (bit size):  
   (Inches)  
   b. Casing schedule:  
   New: Used:  
   Joint type: Threaded: Glued: Welded:  
   Casing diameter:  
   (Inches)  
   from ft. to ft.  
   Material:  
   Gage:  
   Casing diameter:  
   (Inches)  
   from ft. to ft.  
   Material:  
   Gage:  
   c. Cemented/grouted interval, from ft. to ft.:  
   Amount of grout used:  
   (Type)  
   (Example: bentonite pellets)  
   d. Type of completion:  
   Customized perforations: Open hole: Factory screen:  
   Type of perforator used:  
   Size of perforations:  
   (Inches)  
   Number of perforations and depths where perforated:  
   (Inches)  
   from ft. to ft.  
   perforations from ft. to ft.  
   Open hole from ft. to ft.:  
   Well screen details:  
   Diameter:  
   slot size:  
   set from ft. to ft.  
   Diameter:  
   slot size:  
   set from ft. to ft.  
   e. Well development method:  
   How long was well developed?  
   f. Was a filter/gravel pack installed?  
   Yes: No: Size of sand/gravel:  
   Filter pack/gravel installed from ft. to ft.:  
   g. Was surface casing used?  
   Yes: No: Was it cemented in place?  
   Yes: No:  
   Surface casing installed from ft. to ft.:  

7. NAME AND ADDRESS OF DRILLING COMPANY

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used)

9. PUMP INFORMATION  
   Manufacturer:  
   Type:  
   Source of power:  
   Horsepower:  
   Depth of pump setting or intake:  
   (Feet)  
   Amount of water being pumped:  
   gal./min.*  
   (For springs or flowing wells, see item 10)  
   Total volumetric quantity used per calendar year.*

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)  
   If well yields artesian flow or if spring, yield is  
   (gal./min.)* Surface pressure is  
   (lb./sq.inch, or feet of water)  
   The flow is controlled by:  
   Valve: Cap: Plug:  
   Does well leak around casing?  
   Yes: No:  
   *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 196739  Book No. 1417  Page No. 39

SEE REVERSE SIDE
11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right)

______________________________

12. PUMP TEST Was a pump test conducted? □ Yes □ No
If so, by whom ________________________________
Yield ___________________ gal./min. with ____________ ft. drawdown after ____________ hours
Yield ___________________ gal./min. with ____________ ft. drawdown after ____________ hours

13. LOG OF WELL Total depth drilled ____________ ft.
Depth of completed well ____________ ft. Diameter of well ____________ inches.
Depth to first water bearing formation ____________ ft.
Depth to principal water bearing formation Top ____________ ft. to bottom ____________ ft.

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? □ Yes □ No

15. QUALITY OF WATER INFORMATION
Does a chemical and/or bacteriological water quality analysis accompany this form? □ Yes □ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the quality of water as □ Good □ Acceptable □ Poor □ Unusable

REMARKS
_______________________________________
_______________________________________
_______________________________________

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

Signature of Owner or Authorized Agent __________________________ Date __________ , 20__

FOR STATE ENGINEER’S USE ONLY

Permit No. U.W. 196739 __________________________
Date of Receipt __________________________ Date of Approval __________ , 20__
Date of Priority 9/19/2011 __________________________ for State Engineer
STATE OF WYOMING
OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E, CHEYENNE, WY 82002
(307) 777-6163
APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER
APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is domestic and/or stock watering, will be considered as ground water appropriations.

FOR OFFICE USE ONLY

Temporary Filing No. U.W. 42-1-473

NAME AND NUMBER OF WELL OR SPRING

Municipal

1. Name of applicant(s)

Wyoming Water Development Commission

Phone 307-777-7626

2. Address of applicant(s)

6920 Yellowtail Road, Cheyenne, WY 82002

(MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices

Mark Siecy c/o Lidstone and Associates, Inc

6925 Automation Way, Bldg k, Fort Collins, CO 80525

(MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied

Domestic

Use of water in 3 single family dwellings or less, non-commercial watering of lawns and gardens totaling one acre or less. Number of houses served:

Stock Watering

Normal livestock use at four tanks or less within one mile of well or spring. Stock-watering pipelines and commercial feedlots are a Miscellaneous use. Number of stock tanks:

Irrigation

Watering of any lands for agricultural purposes not covered by the definition of domestic use (large lawn watering of golf courses, cemeteries, recreation areas, etc., are Miscellaneous uses).

Municipal

Use of water in incorporated Towns and Cities. Note 1: use of water in unincorporated towns, subdivisions, improvement districts, mobile home parks, etc. are Miscellaneous uses. Note 2: a permit may be required by the Wyoming Department of Environmental Quality (WDEQ) if the well will be classified as a public water supply under the WDEQ's rules and regulations.

Industrial

Long term use of water for the manufacture of a product or production of oil or gas or other minerals (oil field water flood operations, power plant water supply, etc.). (Describe in REMARKS)

MISCELLANEOUS

Any use of water not defined under previous definitions such as stock-watering pipelines, subdivisions, mine dewatering, mineral exploration drilling, potable supplies in office, etc. (Describe in REMARKS). Note: a permit may be required by the WDEQ if the well will be classified as a public water supply under the WDEQ's rules and regulations.

Coalbed Methane

Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed methane gas will require a permit from the Wyoming Oil and Gas Conservation Commission.

Monitor, Observation

Test Well (Describe in REMARKS)

5. Location of the well or spring:

NOTE: Quarter-quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 66 West.)

LaCrosse County, NE 1/4 SW 1/4 of Sec. 7, T. 14 N. R. 62 W. of the 6th P.M. (W.R.M.), Wyoming. If located in a platted subdivision, also provide Lot/Tract Block of the

Subdivision (or Add'n) of Resurvey Location: Tract , (or Lot) .

6. Estimated depth of the well or spring is ft. Estimated production interval is ft.

0 0

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: gallons per minute. NOTE: if for Domestic and/or Stock-watering use, this application will be processed for a maximum of 25 gallons per minute. For a spring, after approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

(b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: gallons. NOTE: A four person family utilizes approximately one (1) acre-foot of water per year or 325,000 gallons.

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the quarter section.

TABULATION BOX

TWP RNG SEC NE NE NWNW NW NW SW SW SW SW SW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW NW
9. If for irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. □ Land will be irrigated from this well only.
   c. □ Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.

11. The well or spring is to be constructed on lands owned by Mark Anderson or Key Schleske or Town of Burns

   (The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant’s. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The well is to be used on lands owned by □ Not applicable

   (If the landowner is the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Under this permit, LA intends to drill one test borehole that will be abandoned per state regulations. If hydrogeologic conditions are favorable, may drill a test production well that could be used for the Town of Burns. The well would be drilled, developed, and tested to determine its adequacy for providing municipal supply. Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent ___________________________ Date ______________________

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES $50.00
( Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less.)

COAL BED METHANE USE $50.00

IRRIGATION, MUNICIPAL, INDUSTRIAL, AND MISCELLANEOUS USES $75.00

MONITOR (For water level measurements or chemical quality sampling) or TEST WELL USES No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THE STATE OF WYOMING )
STATE ENGINEER’S OFFICE )
   This instrument was received and filed for record on the 19 day of September, A.D.
   20... at 9:35 o’clock A.M.
Permit No. U.W. 196739

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment about.

This permit is to drill a test well within the Laramie County Control Area. However, no water will be beneficially used, therefore, advertising and recommendation by the Control Area Advisory Board is not required. Approval of this permit does not obligate the State Engineer to approve the permanent production permit.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion must be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 20... The amount of appropriation shall be limited to the quantity to which permittance is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 5th day of October, A.D. 20... of Burns, Wyoming

[Signature]

PATRICK T. TYRRELL, State Engineer
PERMIT NO. U.W. 196740   NAME OF WELL/SPRING BURNS 3

1. NAME OF OWNER WYOMING WATER DEVELOPMENT COMMISSION

2. ADDRESS
   City __________________________ State __________ Zip Code _____________
   [ ] Please check if address has changed from that shown on permit.
   Phone No. _____________________

3. USE OF WATER
   [ ] Domestic [ ] Stock Watering [ ] Irrigation [ ] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING
   1/4 ______ 1/4 of Section ______ T. ______ N., R. ______ W., of the 6th P.M. (or W.R.M.)
   [ ] Subdivision Name ______ Lot ______ Block ______
   [ ] Resurvey Location Tract ______ or Lot ______ Datum ______
   [ ] Geographic Coordinates: Latitude ______ N Longitude ______ W (degrees, minutes, seconds)
   [ ] UTM: Zone ______ Northing ______ Easting ______ (meters)
   [ ] State Plane Coordinates: Zone ______ Northing ______ Easting ______ (Feet)
   [ ] Land surface elevation (ft. above mean sea level) Datum ______
   [ ] Source ______ GPS ______ Map ______ Survey ______ Unknown ______ Other ______

5. TYPE OF CONSTRUCTION
   [ ] Drilled [ ] Dug [ ] Driven [ ] Other (type of rig, and fluid used, if any)
   Describe ________________________________________________ 

6. CONSTRUCTION
   Total depth of well/spring ______ ft. (below land surface) Casing height ______ ft. above ground
   [ ] Diameter of borehole (bit size) ______ inches
   [ ] Casing schedule [ ] New [ ] Used Joint type [ ] Threaded [ ] Glued [ ] Welded
     ______ diameter from ______ ft. to ______ ft.
     ______ diameter from ______ ft. to ______ ft.
   [ ] Cemented/grouted interval, from ______ ft. to ______ ft.
   [ ] Amount of grout used ______ type (example: 10 sacks)
   [ ] Size of perforations ______ inches
   [ ] Number of perforations and depths where perforated
     ______ perforations from ______ ft. to ______ ft.
     ______ perforations from ______ ft. to ______ ft.
   [ ] Open hole from ______ ft. to ______ ft.
   [ ] Well screen details
     Diameter ______ slot size ______ set from ______ ft. to ______ ft.
     Diameter ______ slot size ______ set from ______ ft. to ______ ft.
   [ ] Well development method ______ How long was well developed?
   [ ] Filter pack/gravel installed from ______ ft. to ______ ft.
   [ ] Was surface casing installed? [ ] Yes [ ] No
   [ ] Size of sand/gravel ______
   [ ] Surface casing installed from ______ ft. to ______ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used)

9. PUMP INFORMATION
   Manufacturer __________________________ Type __________
   [ ] Source of power ______ Horsepower ______ Depth of pump setting or intake ______ ft.
   [ ] Amount of water being pumped ______ gal./min.* (For springs or flowing wells, see item 10)
   [ ] Total volumetric quantity used per calendar year.* ______

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow or if spring, yield is ______ gal./min.* Surface pressure is ______ lb./sq.inch, or ______ feet of water
    The flow is controlled by [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 196740

SEE REVERSE SIDE
11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right)

12. PUMP TEST Was a pump test conducted? □ Yes □ No
   If so, by whom ________________________________
   Yield _______________ gal./min. with ____________ ft. drawdown after ____________ hours
   Yield _______________ gal./min. with ____________ ft. drawdown after ____________ hours

13. LOG OF WELL Total depth drilled _______________ ft.
   Depth of completed well _______________ ft. Diameter of well _______________ inches.
   Depth to first water bearing formation _______________ ft.
   Depth to principal water bearing formation Top _______________ ft. to bottom _______________ ft.

   DRILL CUTTINGS DESCRIPTION:

<table>
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<th>From Feet</th>
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<th>Rock Type Or Description</th>
<th>Formation</th>
<th>Water Bearing? (Yes or no)</th>
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14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? □ Yes □ No

15. QUALITY OF WATER INFORMATION

   Does a chemical and/or bacteriological water quality analysis accompany this form? □ Yes □ No
   It is recommended that chemical and bacteriological water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
   If not, do you consider the quality of water as □ Good □ Acceptable □ Poor □ Unusable

   REMARKS

   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

   Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

   ____________________________  ____________________________ , 20
   Signature of Owner or Authorized Agent Date

   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

   FOR STATE ENGINEER'S USE ONLY

   Permit No. U.W. 196740 ____________________________
   Date of Receipt ____________________________ Date of Approval ____________________________ , 20
   Date of Priority 9/19/2011 ____________________________
   for State Engineer
APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Name of applicant(s): Wyoming Water Development Commission
Address of applicant(s): 6920 Yellowtail Road, Cheyenne, WY 82002
Name & address of agent to receive correspondence and notices: Mark Stacy c/o Lidstone and Associates, Inc.

PERMIT NO. U.W. 196740
WATER DIVISION No. 1.
U.W. DISTRICT Laramie Co. Central Agency

1. Name of applicant(s):
   Wyoming Water Development Commission

2. Address of applicant(s):
   6920 Yellowtail Road, Cheyenne, WY 82002
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices:
   Mark Stacy c/o Lidstone and Associates, Inc.
   4025 Automation Way, Bldg. 5, Fort Collins, CO 80525
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)

4. Use to which the water will be applied
   - Domestic
   - Stock Watering
   - Irrigation
   - Municipal
   - Industrial
   - Miscellaneous
   - Coalbed Methane

5. Location of the well or spring:
   - Location of the well or spring:
     - Permit No. U.W. 196740
   - Water Division No. 1.
   - U.W. District Laramie Co. Central Agency

6. Use to which the water will be applied
   - Domestic
   - Stock Watering
   - Irrigation
   - Municipal
   - Industrial
   - Miscellaneous
   - Coalbed Methane

7. (a) MAXIMUM instantaneous flow of water to be developed and beneficially used: 0 gallons per minute.
   - NOTE: For Domestic and/or Stock-watering use, this application will be processed for a maximum of 25 gallons per minute. For a spring, approval of this application, some type of artificial diversion or improvement must be constructed to qualify for a water right.

   (b) MAXIMUM volumetric quantity of water to be developed and beneficially used per calendar year: 0
   - Circle appropriate units: (Gallons) (Acre Feet)

8. Mark the point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row refers to the quarter of the same section.

   TABULATION BOX
   - TWP 1
   - RING 1
   - SEC 1
   - NE 1
   - NW 1
   - SW 1
   - SE 1
   - NE 1
   - NW 1
   - SW 1
   - SE 1
   - TOTAL

   Permit No. U.W. 196740
   Book No. 1417
   Page No. 40
9. If for Irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. □ Land will be irrigated from this well only.
   c. □ Land is irrigated from maximum water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for Irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.: __________________________

11. The well or spring is to be constructed on lands owned by Boyd Frye or Phillips

   (The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by __________________________

   (If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Under this permit, LA intends to drill one test borehole that will be abandoned per state regulations, and if hydrogeologic conditions are favorable, may drill a test production well that could be used for the Town of Burns. The well would be drilled, developed, and tested to determine its adequacy for providing municipal supply.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Signature of Applicant or Authorized Agent  __________________________

Date  September 15, 2011

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES  $50.00

(Coal Bed Methane USE

COAL BED METHANE USE  $50.00

IRRIGATION, MUNICIPAL, INDUSTRIAL, AND MISCELLANEOUS USES  $75.00

MONITOR (For water level measurements or chemical quality sampling) or TEST WELL USES  No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING

STATE ENGINEER'S OFFICE

This instrument was received and filed for record on the 19 day of September, A.D. 2011, at 9:35 o'clock A. M.

Permit No. U.W. 196740

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

This permit is to drill a test well within the Laramie County Control Area. However, no water will be beneficially used, therefore, advertising and recommendation by the Control Area Advisory Board is not required. Approval of this permit does not obligate the State Engineer to approve the permanent production permit.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion must be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 2012.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this _______ day of October, A.D. 2011.

__________________________

PATRICK T. TYPRELL, State Engineer
STATE OF WYOMING
OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING 82002
(307) 777-6163

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL OR SPRING

PERMIT NO. U.W. 196741 NAME OF WELL/SPRING BURNS 4

1. NAME OF OWNER WYOMING WATER DEVELOPMENT COMMISSION

2. ADDRESS
   City ___________________________ State __ Zip Code ________ Phone No. ________
   □ Please check if address has changed from that shown on permit.

3. USE OF WATER □ Domestic □ Stock Watering □ Irrigation □ Municipal □ Industrial □ Miscellaneous
   □ Monitor or Test □ Coal Bed Methane Explain proposed use (Example: One single family dwelling)

4. LOCATION OF WELL/SPRING
   1/4 1/4 of Section ____. T. ___ N., R. ___ W., of the 6th P.M. (or W.R.M.)
   Subdivision Name ________________________________________________________________
   Lot ___________ Block ___________
   Resurvey Location Tract ___________ or Lot ___________ Datum □ NAD27 □ NAD83
   Geographic Coordinates: Latitude ___________ N Longitude ___________ W (degrees, minutes, seconds)
   Datum ___________ Datum ___________ Datum ___________
   UTM: Zone ___________ Latitude ___________ (meters) Northing ___________ Easting ___________
   State Plane Coordinates: Zone ___________ Northing ___________ Easting ___________
   (Feet)
   Land surface elevation (ft. above mean sea level) __________________________ Datum □ NAVD29 □ NAVD88
   Source □ GPS □ Map □ Survey □ Unknown □ Other □ Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION □ Drilled (type of rig and fluid used, if any) □ Dug □ Driven □ Other
   Describe ________________________________________________________________

6. CONSTRUCTION
   Total depth of well/spring __________________________ ft. (below land surface)
   Depth to static water level __________________________ ft. above ground
   a. Diameter of borehole (bit size) __________________________ inches
   b. Casing schedule □ New □ Used Joint type □ Threaded □ Glued □ Welded
   □ Casing diameter from ______ to ______ ft. Material _______ Gage ________
   □ Casing diameter from ______ to ______ ft. Material _______ Gage ________
   c. Cemented/grouted interval, from ______ to ______ ft.
   □ Amount of grout used ________ ft. (example: 10 sacks) Type ______
   d. Type of completion □ Customized perforations □ Open hole □ Factory screen
      Type of perforator used __________________________
      Size of perforations __________________________ inches by _________ inches
      Number of perforations and depths where perforated
      □ Perforations from ______ to ______ ft.
      □ Perforations from ______ to ______ ft.
      □ Open hole from ______ to ______ ft.
      □ Well screen details
      Diameter __________________________ slot size _________ set from ______ to ______ ft.
      Diameter __________________________ slot size _________ set from ______ to ______ ft.
   e. Well development method □ Customized □ Other __________________________
   f. Was a filter/gravel pack installed? □ Yes □ No Size of sand/gravel ________
   Filter pack/gravel installed from ______ to ______ ft.
   g. Was surface casing used? □ Yes □ No Was it cemented in place? □ Yes □ No
   □ Surface casing installed from ______ to ______ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used)

9. PUMP INFORMATION
   Manufacturer __________________________ Type __________________________
   Source of power __________________________ Horsepower ________ Depth of pump setting or intake ________ ft.
   Amount of water being pumped ________ gal./min.* (For springs or flowing wells, see item 10)
   Total volumetric quantity used per calendar year.* __________________________

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow or if spring, yield is ______ gal./min.* Surface pressure is ______ lb./sq.inch, or ______ feet of water
    The flow is controlled by □ valve □ Cap □ Plug
    Does well leak around casing? □ Yes □ No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 196741 Book No. 1417 Page No. 41

SEE REVERSE SIDE
11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right)

______________________________

12. PUMP TEST Was a pump test conducted? □ Yes □ No
If so, by whom ____________________________________________

Yield __________________________ gal./min. with ___________ ft. drawdown after ____________ hours
Yield __________________________ gal./min. with ___________ ft. drawdown after ____________ hours

13. LOG OF WELL Total depth drilled ___________ ft.
Depth of completed well ___________ ft. Diameter of well ___________ inches.
Depth to first water bearing formation ___________ ft.
Depth to principal water bearing formation Top ___________ ft. to bottom ___________ ft.

DRILL CUTTINGS DESCRIPTION:

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<th>From Feet</th>
<th>To Feet</th>
<th>Rock Type Or Description</th>
<th>Formation</th>
<th>Water Bearing? (Yes or no)</th>
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14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? □ Yes □ No

15. QUALITY OF WATER INFORMATION
Does a chemical and/or bacteriological water quality analysis accompany this form? □ Yes □ No
It is recommended that chemical and bacteriologic water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the quality of water as □ Good □ Acceptable □ Poor □ Unusable

REMARKS

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

_____________________________________________ 20__
Signature of Owner or Authorized Agent  Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 196741
Date of Receipt __________________________
Date of Priority 9/19/2011

_________________________________________ 20__
Date of Approval  Date of Priority  for State Engineer
APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

APPLICATION FOR WELLS AND SPRINGS

Note: Only springs flowing 25 gallons per minute or less, where the proposed use is Domestic and/or Stock Watering, will be considered as ground water appropriations.

FOR OFFICE USE ONLY

PERMIT NO. U.W. __ 196741
WATER DIVISION NO. ___ DISTRICT ___ 
U.W. DIVISION ___________ (Described Co. Contingent Area)

NAME AND NUMBER OF WELL OR SPRING

| Burns 4 |

1. Name of applicant(s): Wyoming Water Development Commission
   Phone 307-777-7626

2. Address of applicant(s): 6226 Yellowstone Road, Cheyenne, WY 82002
   (MAILING ADDRESS) (CITY) (STATE) (ZIP)

3. Name & address of agent to receive correspondence and notices:
   Mark Stacy c/o Lidstone and Associates, Inc.
   4025 Automation Way, Bldg. E, Fort Collins, CO 80525
   Phone 970-221-4705

4. Use to which the water will be applied
   - Domestic
   - Stock Watering
   - Irrigation
   - Municipal
   - Industrial
   - Miscellaneous
   - Coalbed Methane

5. Location of the well or spring: (NOTE: Quarter-quart (40 acre subdivision) MUST be shown. EXAMPLE: SE 1/4 NW 1/4 of Sec. 12, Township 14 North, Range 98 West.)
   County, ___________ ___________ 1/4 of Sec ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ 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___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___________ ___
9. If for Irrigation use:
   a. Describe MAXIMUM acreage to be irrigated in each 40 acre subdivision in the tabulation box above.
   b. Land will be irrigated from this well only.
   c. Land is irrigated from existing water right(s) with water from this well to be additional supply. Describe existing water right(s) under REMARKS.

10. If for irrigation use, describe method of irrigation, i.e. center pivot sprinkler, flood, etc.

11. The well or spring is to be constructed on lands owned by Town of Burns.
   (The granting of a permit does not constitute the granting of a right-of-way. If any easement or right-of-way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not the co-applicant.)

12. The water is to be used on lands owned by ___ (Not Applicable)
   (If the landowner is not the applicant, a copy of the agreement relating to the usage of the appropriated water on the land should be submitted to this office. If the landowner is included as co-applicant on the application, this procedure need not be followed.) NOTE: Water rights attach to the area(s) and/or point(s) of use.

REMARKS: Under this permit, LA intends to drill a test borehole that will be abandoned per state regulations, and if hydrogeologic conditions are favorable, may drill a test production well that could be used for the Town of Burns. The well would be drilled, developed, and tested to determine its adequacy for providing municipal supply.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

__________________________
Signature of Applicant or Authorized Agent

September 15, 2011
Date

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND/OR STOCK WATERING USES
(Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totaling one acre or less.)

COAL BED METHANE USE

IRRIGATION, MUNICIPAL, INDUSTRIAL, AND MISCELLANEOUS USES

MONITOR (For water level measurements or chemical quality sampling) or TEST WELL USES

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING )
) ss.
STATE ENGINEER'S OFFICE )

This instrument was received and filed for record on the 19 day of September, A.D. 2011, at 9:35 o'clock A.M.

196741

Permit No. U.W.

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have Additional Conditions and Limitations on attachment sheet.

This permit is to drill a test well within the Lakeview Control Area. However, no water will be beneficially used, therefore, advertising and recommendation by the Control Area Advisory Board is not required. Approval of this permit does not obligate the State Engineer to approve the permanent production permit.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion must be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in item 4 of this application will be made by December 31, 20_.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 5th day of October, A.D. 2011.

__________________________
PATRICK T. YRRELL, State Engineer
PERMIT NO. U.W. 196742 NAME OF WELL/SPRING BURNS 5

1. NAME OF OWNER WYOMING WATER DEVELOPMENT COMMISSION

2. ADDRESS
   City ___________________ State ___________ Zip Code ___________ Phone No. ___________
   [ ] Please check if address has changed from that shown on permit.

3. USE OF WATER [ ] Domestic [ ] Stock Watering [ ] Irrigation [ ] Municipal [ ] Industrial [ ] Miscellaneous
   [ ] Monitor or Test [ ] Coal Bed Methane
   Explain proposed use (Example: One single family dwelling) _______________________________________

4. LOCATION OF WELL/SPRING 1/4 1/4 of Section ___ T. ___ N., R. ___ W., of the 6th P.M. (or W.R.M.)
   Subdivision Name ___________________ Lot ___________ Block ___________
   Resurvey Location Tract: ___________________ or Lot ___________ Datum [ ] NAD27 [ ] NAD83
   Geographic Coordinates: Latitude ___________________ N Longitude ___________________ W (degrees, minutes, seconds)
   UTM: Zone ___________________ Northing ___________ Easting ___________ (meters)
   State Plane Coordinates: Zone ___________________ Northing ___________ Easting ___________ (Feet)
   Land surface elevation (ft. above mean sea level) Datum [ ] NAVD29 [ ] NAVD88
   Source [ ] GPS [ ] Map [ ] Survey [ ] Unknown [ ] Other [ ] Altimeter (for elevation only)

5. TYPE OF CONSTRUCTION [ ] Drilled [ ] Dug [ ] Driven [ ] Other (type of rig and fluid used, if any)
   Describe ________________________________________________________________

6. CONSTRUCTION Total depth of well/spring ___________________ ft.
   Depth to static water level ___________________ ft. (below land surface) Casing height ___________ ft. above ground
   a. Diameter of borehole (bit size) ___________________ inches
   b. Casing schedule [ ] New [ ] Used Joint type [ ] Threaded [ ] Glued [ ] Welded
      _____ diameter from ______ ft. to ______ ft. Material _________ Gage _________
      _____ diameter from ______ ft. to ______ ft. Material _________ Gage _________
   c. Cemented/grouted interval, from ______ ft. to ______ ft.
      Amount of grout used _________ type _________ (example: 10 sacks)
      Cementing material (example: bentonite pellets)
   d. Type of completion [ ] Customized perforations [ ] Open hole [ ] Factory screen
      Type of perforator used______________________
      Size of perforations ___________________ inches by ___________________ inches
      Number of perforations and depths where perforated
      _____ perforations from ______ ft. to ______ ft.
      _____ perforations from ______ ft. to ______ ft.
      Open hole from ______ ft. to ______ ft.
      Well screen details
      Diameter ___________________ slot size _________ set from ______ ft. to ______ ft.
      Diameter ___________________ slot size _________ set from ______ ft. to ______ ft.
   e. Well development method ____________________________ How long was well developed?
   f. Was a filter/gravel pack installed? [ ] Yes [ ] No Size of sand/gravel _____
      Filter pack/gravel installed from ______ ft. to ______ ft.
   g. Was surface casing used? [ ] Yes [ ] No Was it cemented in place? [ ] Yes [ ] No
      Surface casing installed from ______ ft. to ______ ft.

7. NAME AND ADDRESS OF DRILLING COMPANY ________________________________________________

8. DATE OF COMPLETION OF WELL (including pump installation) OR SPRING (first used) _______________

9. PUMP INFORMATION Manufacturer ___________________ Type ___________________
   Source of power ___________________ Horsepower _________ Depth of pump setting or intake _________ ft.
   Amount of water being pumped _________ gal./min.* (For springs or flowing wells, see item 10)
   Total volumetric quantity used per calendar year.* __________________

10. FLOWING WELL OR SPRING (Owner is responsible for control of flowing well)
    If well yields artesian flow or if spring, yield is _________ gal./min.* Surface pressure is _________ lb./sq inch, or _________ feet of water
    The flow is controlled by [ ] Valve [ ] Cap [ ] Plug
    Does well leak around casing? [ ] Yes [ ] No
    *If these amounts exceed permitted amount an enlargement is required.

Permit No. U.W. 196742 Book No. 1417 Page No. 42

SEE REVERSE SIDE
11. IF SPRING, HOW WAS IT CONSTRUCTED? (Some method of artificial diversion, i.e., springbox, cribbing, etc., is necessary to qualify for a water right) ______________________________

12. PUMP TEST  Was a pump test conducted? ☐ Yes ☐ No
If so, by whom _______________________________
Yield gal./min. with ft. drawdown after hours
Yield gal./min. with ft. drawdown after hours

13. LOG OF WELL  Total depth drilled ft.
Depth of completed well ft. Diameter of well inches.
Depth to first water bearing formation ft.
Depth to principal water bearing formation Top ft. to bottom ft.

<table>
<thead>
<tr>
<th>From Feet</th>
<th>To Feet</th>
<th>Rock Type Or Description</th>
<th>Formation</th>
<th>Water Bearing? (Yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
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</tbody>
</table>

14. DOES A GEOPHYSICAL LOG ACCOMPANY THIS FORM? ☐ Yes ☐ No

15. QUALITY OF WATER INFORMATION
Does a chemical and/or bacteriological water quality analysis accompany this form? ☐ Yes ☐ No
It is recommended that chemical and bacteriological water quality analyses be performed and that the report(s) be filed with the records of this well. (Contact Department of Agriculture, Analytical Lab Services, Laramie, 742-2984.)
If not, do you consider the quality of water as ☐ Good ☐ Acceptable ☐ Poor ☐ Unusable

REMARKS ______________________________

Under penalties of perjury, I declare that I have examined this form and to the best of my knowledge and belief it is true, correct, and complete.

______________________________  ________________________
Signature of Owner or Authorized Agent  Date

FOR STATE ENGINEER'S USE ONLY

Permit No. U.W. 196742
Date of Receipt __________________________  Date of Approval __________________________ , 20
Date of Priority 9/19/2011  __________________________

for State Engineer
~

I
I}

FORM U.W. 5
Rev. 9/09
FILING FEE SCHEDULE
ON REVERSE SIDE

I

I

STATE OF WYOMING
OFFICE OF THE STATE ENGINEER
HERSCHLER BLDG., 4-E
CHEYENNE, WYOMING B2002

(307) 777-6163

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER
,
. APPLICATION FOR WELLS AND SPRINGS
l
Note : Only springs flowing 25 gallons per minute or. lass, where the proposed use is
Dorriestic andlor Stock Watering, will be considared as ground water appropriations.
FOR OFFICE USE ONL):.
PERMIT NO.

Temporary Filing No.

19674 i:::

u.w.

WATER DIVISION NO ...L DISTRICT_-'-_ __

UW. DISTRICT t.~"'IH"'" Co

C~,,,! eo! frilBA:

NAME AND NUMBER OF WELL or SPRING
1. Name of applicant(s)

Burns 5

Wyoming Water Development Commission

2. Address of applicant(s)

6920 Yellowtail Road, Cheyenne, WY

(MAILING ADDRESS)

Phone

4025 Automation Way, Bldg. Ei Fort Collins. CO

307-777-7626

82002

(CITY)

3. Name & address of agent to receive correspondence and notices

(MAILING ADDRESS)

42- 1- 413

u.w.

NOTE: Do not fold this form. Use typewriter or print neatty
with btack ink.
ALL ITEMS MUST BE COMPLETED BEFORE
APPLICATION IS ACCEPTABLE

(STATE)

(ZIP)

Hark Stacy c/o Lidstone and AS!lociates,

Phone

SOS2S

Inc.

970-223-4705

(STATE) (ZIP)

(CITY)

4. Use to which the water will be applied

0

Domestic

Use of water in 3 single family dwellings or lass, noncommercial watering of lawns and gardens
totaling one acre or less. Number of houses servad? _ _ .

0

Stock Watering

Normal livestock use at four tanks or less within one mile of well or spring. Stock-watering pipelines
and commercial feedlots are a Miscellaneous use. Number of stock tanks?__ .

0

Irrigation

,."Y'ltering 01 any lands for agricultural purposas not covered by the defonition of domestic use (Iarga'
"-

isc,9le lawn watenng of golf courses, cemeteries, recreation areas, etc., are Miscellaneous uses).

0

Municipal

Use of water in incorporated Towns and Cities. Note 1: use of water In unincorporated towns, sub·
divisions, improvement districts, mobile home parks, etc. are Miscellaneous uses. Note 2:
a permit may be required by the Wyoming Department of Environmental Ouality (WDEO) if the well
will ba classified as a public water supply under the WDEO's rules and regulations.

0

Industrial

Long term use of water for the manufacture of a product or production of oillgas or other minerals
(oil field water flood oparations, power plant water supply, etc.). (Describe in REMARKS)

0

Miscellaneous

Any use of water not defined under pravious definitions such as stock,watering pipelines, subdivisions,
mine dewatering, mineralfoil exploration drilling, potable supplies in office, etc. (Describe in REMARKS).
Note: a permit may be required by the WDEO if the well will be classified as a public water supply
under the WDEO's rules and regulations.

0

Coalbed Methane

Water produced in the production of coal bed methane gas. Note: wells used in the production of coal bed
methane gas will raquire a permit from the Wyoming all and Gas Conservation Commission.

o

Monitor, Observation

Note: a WDEO parmit may be required.

~ Test Well (Describe in REMARKS)

5. Location of the well or spring: (NOTE: Ouarter·quarter (40 acre subdivision) MUST be shown. EXAMPLE: SE 114 NW 1/4 of Sac.
12, Township 14 North, Range 68 West.)
W of the 6th P.M. (W.R.M.).
Laramie
County, ~ 1/4 ~ 114 of Sec._7_ _ , T.~ N., R. 62
Wyoming. If located in a ptatted subdivision, also provide Lotrrract _Block __ of the _ _ _ _ _ _ _ _ _ _ _ _ _ __
Subdivision (or Add'n) of
. Resurvey Location: Tract _ _ _ , (or Lot) _ _ _ _ __
6. Estimated depth of the well or spring is _--=3_0_0_ _ _ _ H. Estimated production interval i5 _ _2_O_O_ _ _ ft. to __3_o_
o _ _ ft
7. (a) MAXIMUM instantaneous flow of water to be develop ad and beneficially used:
gallons per minute.
NOTE: if for Domestic and lor Stock-watering use, this application will be processed for a maximum of 25 gallons per minute. For a
spring, afler approval of this application, some type of artificiat diversion or improvement must be constructed to qualify for a water right.
(b) MAXIMUM volumetric quantity of water to be developed and benaficially used per calandar year: _ _ _ _ _ _ _ _ _ __
Circle appropriate units: (Gallons) (Acre Feet) NOTE: A four person family utilizes approximately one (1) acre·foot of water per year
or 325,000 gallons.
8. Mark tha point(s) or area(s) of use in the tabulation box below. Note: Upper row refers to the quarter of the section. Next row
refers to the quarter of the quarter section.
TABULATION BOX

TWP RNG SEC

NEt,.
NE1te NW',c SW"c

SE~.

NW"4
NEtIc NW',c SW"c

SE~.

SW'/c
NEV. NW1t4 SW". SE'/C

SEE REVERSE SIDE

1'967:.4,2 --__________
-==-=--=-....:....-=::...:..:'

Permit No. U.W. _ _

SE',c
NElle NW 1,c SW 1,c SE',c

1417

TOTAL

42

Book No. _ _ _ _ _ _ _ _ _ Page No. _ _ _ _..:...._ __


THIS IS TO CERTIFY
THE STATE

and conditions:
2011.

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have additional conditions and limitations on attachment sheet.

This permit is to drill a test well within the Laramie County Control Area.

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION

DOMESTIC AND OR STOCK WATERING USES $50.00
(Domestic use is defined as use of water in 3 single family dwellings or less, noncommercial watering of lawns and gardens totalling one acre or less.)

COAL BED METHANE USE $50.00

IRRIGATION, MUNICIPAL, INDUSTRIAL, AND MISCELLANEOUS USES $75.00

MONITOR (For water level measurements or chemical quality sampling) or TEST WELL USES No Fee

IF WELL WILL SERVE MULTIPLE USES, SUBMIT ONLY ONE (THE HIGHER) FILING FEE.

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING )
) ss.

STATE ENGINEER'S OFFICE )

This instrument was received and filed for record on the 19 day of September, A.D.

2011., at ___ 9:15 _ o'clock A.M.

Permit No. U.W. 196742

for State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum development and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use without loss of water into sub-surface formations or at the land surface.

Coal Bed Methane wells have additional conditions and limitations on attachment sheet.

This permit is to drill a test well within the Laramie County Control Area.

Approval of this application may be considered as authorization to proceed with construction of the proposed well or spring. A Statement of Completion must be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 2012.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 5th day of October, A.D. 2011.

PATRICK T. TYRRELL, State Engineer
WDEQ Permit to Construct
This permit hereby authorizes the applicant:

   Wyoming Water Development Commission  
   6920 Yellowtail Road  
   Cheyenne, WY, 82002

   to construct, install or modify one Municipal Test Well for Conversion to one Municipal Water Supply Well according to the procedures and conditions of the application number 12-144. The facility is located in NW 1/4 of the SW 1/4 of Section 7, T14N R62W; Laramie County, in the State of Wyoming. All construction, installation, or modification allowed by this permit shall be completed May 3, 2014.

The issuance of this permit confirms that the Wyoming Department of Environmental Quality (DEQ) has evaluated the application submitted by the permittee and determined that it meets minimum applicable construction and design standards. The compliance with construction standards and the operation and maintenance of the facility to meet the engineer's design are the responsibility of the permittee, owner, and operator.

Granting this permit does not imply that DEQ guarantees or ensures that the permitted facility, when constructed, will meet applicable discharge permit conditions or other effluent or operational requirements. Compliance with discharge standards remains the responsibility of the permittee.

Nothing in this permit constitutes an endorsement by DEQ of the construction or the design of the facility described herein. This permit verifies only that the submitted application meets the design and construction standards imposed by Wyoming statutes, rules and regulations. The DEQ assumes no liability for, and does not in any way guarantee or warrant the performance or operation of the permitted facility. The permittee, owner and operator are solely responsible for any liability arising from the construction or operation of the permitted facility. By issuing this permit, the State of Wyoming does not waive its sovereign immunity.

The permittee shall allow authorized representatives from DEQ to enter and inspect any property, premise or place on or at which the facility is located or is being constructed or installed for the purpose of investigating actual or potential sources of water pollution, and for determining compliance or non-compliance with any rules, regulations, standards, permits or orders.

Nothing in this permit shall be construed to preclude the institution of any legal action or other proceeding to enforce any applicable provision of law or rules and regulations. It is the duty of the permittee, owner and operator to comply with all applicable federal, state and local laws or regulations in the exercise of its activities authorized by this permit.

The issuance of this permit does not convey any property rights in either real or personal property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

The permittee shall construct and operate the permitted facility in accordance with the statements, representations, procedures, terms and conditions of the permit application, supporting documents and permit. This permit does not relieve the permittee from any duty to obtain any other permit or authorization that may be required by any provision of federal, state or local laws.
In carrying out its activities authorized by this permit, the permittee, owner and operator shall comply with all of the following permit conditions:

1. The applicant will provide immediate oral or written notice to the Southeast District, Water Quality Division, Herschler Building 4 West, Cheyenne, WY, 82002, Phone 307-777-7088, FAX 307-777-7610, in accordance with the provisions of Section 11, Chapter 3, Wyoming Water Quality Rules and Regulations of any changes or modifications which are not consistent with the terms and conditions of this permit.

2. Separate permits to construct will be required for the improvements necessary to the wells to supply water to a public water system.

3. The casing must extend at least 18 inches above the ground surface.

4. Within sixty days of completion of construction of the authorized facility, the applicant will submit to the Southeast District, Water Quality Division, Herschler Building 4 West, Cheyenne, WY, 82002 a certification of completion signed by the Engineer of Record or the owner. A form titled "Certificate of Completion" has been provided.

   a. Date that construction of the facility was completed; and
   b. Date that the facility was placed in operation; and
   c. Certification the facility was constructed in accordance with the terms and conditions of the permit; or
   d. Certification the facility was completed with changes or modifications. Submittal of asconstructed plans and specifications for the system as it was constructed, certified by an engineer if appropriate is required. All modifications or deviations from the authorized plans must be highlighted.
   e. As a part of the certificate of completion, the Engineer must certify that all Test Wells have been plugged and abandoned as required by Chapter 11, WQD Rules and Regulations.

5. The review and approval of this permit is based upon the items identified in the attached "Statement of Basis".

AUTHORIZED BY:

John F. Wagner
Administrator
Water Quality Division

Date of Issuance 5-11-12

John V. Corra
Director
Department of Environmental Quality

SWT/rm/12-0416
STATEMENT OF BASIS

1. Permit Number: 12-144

2. This application was reviewed for compliance with the applicable regulations;

   Chapters 3, 12

3. Does the permit comply with all applicable regulations identified above?

   Yes

4. A review to determine groundwater impacts in accordance with Section 17, Chapter 3 was not required.

   Public water supplies are exempted from review by Chapter 3, Section 17.

5. Documentation of Statement of Basis: The archive file for this permit includes adequate documentation of all sections of this Statement of Basis.

CERTIFICATION

The issuance of this permit is based upon a review of the application package submitted in accordance with the requirements of Chapter 3, Section 6, Wyoming Water Quality Rules and Regulations. This review was performed by Seth Tourney, Southeast District Engineer, Water and Wastewater Section, Wyoming Department of Environmental Quality /Water Quality Division, and completed on May 10, 2012. Permit issuance is recommended based upon statements, representations, and procedures presented in the permit application and supporting documents, permit conditions, and the items identified in this "Statement of Basis."
**WYOMING WATER QUALITY APPLICATION FORM**

Use for Construction, Groundwater Monitoring, Groundwater Remediation, Subdivisions, and Land Application of Wastewater

A complete application package must include three copies of each of the following:
Application form, investigations, design reports, plans, specifications, and any other appropriate information

**Submit to appropriate office**

<table>
<thead>
<tr>
<th>Office Name</th>
<th>Address</th>
<th>Phone</th>
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<tbody>
<tr>
<td>DEQ/Water Quality Division, 122 West 25th Street, Cheyenne, WY 82002</td>
<td>(307) 777.7781</td>
<td></td>
</tr>
<tr>
<td>DEQ/Water Quality Division, 510 Meadowview Drive, Lander, WY 82520</td>
<td>(307) 332.3144</td>
<td></td>
</tr>
<tr>
<td>DEQ/Water Quality Division, 2100 West 5th, Sheridan, WY 82801</td>
<td>(307) 673.9337</td>
<td></td>
</tr>
<tr>
<td>DEQ/Water Quality Division, 152 North Durbin Street, Ste 100, Casper, WY 82601</td>
<td>(307) 473.3465</td>
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**NAME OF PROJECT**

Burns Well Level II Project

**DESCRIPTION OF PROJECT**

Project will consist of the drilling, construction, development, and aquifer testing of one 10.75 inch diameter test well for the Town of Burns.

**LOCATION:**

<table>
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<tr>
<th>County</th>
<th>Lat:</th>
<th>Long:</th>
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<tbody>
<tr>
<td>Laramie</td>
<td>41.192691°</td>
<td>-104.368813°</td>
</tr>
</tbody>
</table>

Legal Description (1/4 Section, Section, Township, Range or Lot No. and Subdivision)

T14N, R62W, Sec. 7NWSW

All undersigned agree to comply with applicable Wyoming Statutes and Regulations and to allow the activities described in this application.

**SIGNATURES:**

Real Estate Owner

The real estate owner or the grantee of the applicable easement must sign this form.

**Wyoming Water Development Commission**

<table>
<thead>
<tr>
<th>Name: Keith Clarey</th>
<th>Title: Project Manager</th>
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</thead>
<tbody>
<tr>
<td>Address: 6920 Yellowtail Road</td>
<td>State: WY</td>
</tr>
<tr>
<td>City: Cheyenne</td>
<td>Zip Code: 82002</td>
</tr>
<tr>
<td>Phone: 307-777-7626</td>
<td>Email:</td>
</tr>
</tbody>
</table>

If the owner or easement grantee is a public entity, partnership, or corporation, a legally binding authority must sign.

Operator or Developer

If same as real estate owner, this space may be left blank.

**Wyoming Water Development Commission**

<table>
<thead>
<tr>
<th>Name: Keith Clarey</th>
<th>Title: Project Manager</th>
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</tr>
<tr>
<td>Phone: 307-777-7626</td>
<td>Email:</td>
</tr>
</tbody>
</table>

If the operator or developer is a public entity, partnership, or corporation, a legally binding authority must sign.

**Engineer or Geologist**

<table>
<thead>
<tr>
<th>Name: Mark Stacy</th>
<th>WY PE #</th>
<th>WY PG#</th>
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<tbody>
<tr>
<td>Firm Name: Lidstone and Associates, Inc.</td>
<td>3440</td>
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</tr>
<tr>
<td>Address: 4025 Automation Way, Bldg. E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City: Fort Collins</td>
<td>State: CO</td>
<td>Zip Code: 80525</td>
</tr>
<tr>
<td>Phone: 970-223-4705</td>
<td>Email: <a href="mailto:mes@lidstone.com">mes@lidstone.com</a></td>
<td></td>
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</table>

Please complete the second page or the back of this form.

http://deq.state.wy.us/wqd

Wyoming Department of Environmental Quality
Water Quality Division

Page 1 of 2
The Wyoming Environmental Quality Act, W.S. 35-11-101 and Wyoming Environmental Quality Act, Article 3, W.S. 35-11-301 mandates that permits are required for construction or modification of public water supplies, wastewater facilities, land application systems, and confined swine feeding operations. W.S. 18-5-306 requires review of the safety and adequacy of proposed sewage systems and water systems in new subdivisions by DEQ.


Specific chapters of the Wyoming Water Quality Rules and Regulations have been developed for each area that requires a permit. The regulatory chapters for types of projects that this application is to be used for are listed below. Please check all that apply to your project.

- [ ] 11 Design and construction standards for sewerage systems, treatment works, disposal system of other facilities capable of causing or contributing to pollution, includes monitoring wells and road application of wastewater.
- [X] 12 Design and construction standards for public water supplies, includes subdivision water supplies and water line extensions.
- [ ] 21 Standards for the Reuse of Treated Wastewater.
- [ ] 23 Minimum Standards for Subdivision Applications.
- [ ] 25 Design and construction standards for small wastewater systems includes septic tanks/leachfields.
- [ ] 26 Well construction standards.
- [ ] Other Describe briefly.

<table>
<thead>
<tr>
<th>Previous or Associated State of Wyoming Permits</th>
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<tbody>
<tr>
<td>WQD Permit to Construct</td>
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<tr>
<td>WQD Subdivision Recommendation to County</td>
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<tr>
<td>Air Quality</td>
</tr>
<tr>
<td>Land Quality</td>
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<tr>
<td>Oil and Gas Commission</td>
</tr>
<tr>
<td>Solid and Hazardous Waste</td>
</tr>
<tr>
<td>State Engineers Surface Water Right or Well Permit</td>
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<tr>
<td>WQD Underground Injection Control</td>
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<tr>
<td>WYPDES (discharge permit)</td>
</tr>
<tr>
<td>US EPA Public Water Supply (PWS) Number</td>
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<tr>
<td>P196738W</td>
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<tr>
<td>In process</td>
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<tr>
<td>WY5600188</td>
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</tbody>
</table>
March 16, 2012

Mr. Rich Cripe  
Southeast District Engineer  
Wyoming Department of Environmental Quality  
122 West 25th Street, 4W  
Cheyenne, WY  82002

RE: Arikaree Formation Production Test Well  
Permit to Construct Application  
Burns, Wyoming

Dear Mr. Cripe,

Introduction

Lidstone and Associates, Inc. (LA), is currently working with the Town of Burns (Town) and the Wyoming Water Development Commission (WWDC) to augment the city’s water supply under a WWDC Level II project. LA intends to drill, complete, develop, and test an approximately 225 foot deep Arikaree Formation production-sized test well for the Town. The test well will be drilled at the 1-Anderson site shown on Figure 1. With this letter, the enclosed figures, and the attached Water Quality Division permit application form, LA is applying to obtain a Permit to Construct for the test well. For your reference and review, LA will forward draft technical drilling specifications for the test well once complete.

If successfully completed, the test well will be converted into a production well for the Town. Under a future separate Level III project, a second Permit to Construct application would be submitted for the appropriate and appurtenant water system improvements, including pumping equipment, piping, electrical designs, and controls.

Test Well Design and Drilling Method

The test well will be completed with a single casing placed inside the surface casing, in general accordance with the conceptual design presented on Figure 2. The surface casing will consist of 20 inch diameter blank steel casing that is placed into a 20 foot deep, 24 inch diameter borehole. The annular space around the surface casing will be pressure cemented via tremie pipe with neat cement. LA’s proposed surface casing design prevents any loose, unconsolidated formation materials from interfering with the contractor’s ability to complete the production well.

Following the installation of the surface casing, the test well will be completed with 10.75 inch diameter casing and screen. The test well will be completed in an approximately 17.5 inch
CERTIFICATION of COMPLETION for

"PERMIT to CONSTRUCT" or "NOTIFICATION of COVERAGE" for
Facilities Requiring Design and Seal by Licensed Professional Engineer

In accordance with the condition of Application Number 12-144, located in Laramie County, requiring submittal of this Certification of Completion form within sixty(60) days of completion of the authorized facility(s), I hereby certify the following to be accurate and correct statements of the current status of the project authorized by the above referenced permit number:

1. Construction of the permitted facility(s) was completed on ____________ (DATE), and the facility(s) was placed into operation on ____________ (DATE).

2. Construction was completed in accordance with (Check appropriate option):
   - [ ] The facility(s) was constructed in compliance with all terms and conditions of the permit including the design report, plans & specifications, design data, or other pertinent information submitted in support of the application.
   - [ ] The facility(s) was constructed with minor changes or modifications in accordance with the provisions of Section 11, Chapter 3 of the Wyoming Water Quality Rules & Regulations. [Note – major changes or modifications require the notification and approval of the DEQ/Water Quality Engineer before including these changes in the plans] As-Built plans and specifications, certified by a registered Professional Engineer (certification by an engineer is not required if the original application was not certified by an engineer) are enclosed. All modifications or deviations from the authorized plans must be "highlighted".

Facility Owner’s Name/person or official (print or type)  Title(owner, president, manager, etc)

__________________________  ____________________________
Owner’s Signature                  Date

And

__________________________  ____________________________
Engineer’s Name (print or type)    License No. & State

__________________________  ____________________________
Engineer’s Signature             Date

Mail to:  Seth W. Tourney, Southeast Dist. Engineer, DEQ/WQD,
         Herschler Bldg. 4-W, 122 West 25th Street, Cheyenne, WY  82002 (307) 777-7088
Authorization to Discharge Wastewater Associated with Pump Testing of Water Wells Under the Wyoming Pollutant Discharge Elimination System

Authorization # WYG720281

In compliance with the provisions of the Federal Water Pollution Control Act and the Wyoming Environmental Quality Act,

Lidstone and Associates, Inc., Attn: Mr. Marty Jones, 4025 Automation Way, BLDG. E, Fort Collins, CO 80525

is authorized to discharge wastewater associated with pump testing of water wells from

Burns Well Level II Study

Outfall 001: SWNE Section 7, Township 14N, Range 62W, Latitude 41.195297, Longitude -104.357251, Laramie County.

Outfall 002: NWSE Section 7, Township 14N, Range 62W, Latitude 41.193024, Longitude -104.356864, Laramie County.

Outfall 003: SWSE Section 7, Township 14N, Range 62W, Latitude 41.189345, Longitude -104.354045, Laramie County.

to surface waters of the State of Wyoming in accordance with the requirements of the enclosed general permit for temporary discharges. Receiving waters: Outfalls 001 and 002: Unnamed ephemeral tributary (class 3B) to Lodgepole Creek (class 2AB), South Platte River basin.

Outfall 003: Unnamed ephemeral tributary (class 3B) to North Fork Muddy Creek (class 3B), South Platte River basin.

The wastewater discharged from this location shall be limited and monitored by the permittee as specified below.
### Effluent Limitation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Monthly Average</th>
<th>Weekly Average</th>
<th>Daily Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Dissolved Solids, mg/L</td>
<td>N/A</td>
<td>N/A</td>
<td>5,000</td>
</tr>
<tr>
<td>Total Suspended Solids, mg/L</td>
<td>30</td>
<td>45</td>
<td>90</td>
</tr>
<tr>
<td>pH, su (standard units)</td>
<td>N/A</td>
<td>N/A</td>
<td>6.5-9.0</td>
</tr>
</tbody>
</table>

### Monitoring Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow, gpm</td>
<td>Daily</td>
<td>Instantaneous or Continuous</td>
</tr>
<tr>
<td>Total Dissolved Solids, mg/L</td>
<td>Weekly</td>
<td>Grab</td>
</tr>
<tr>
<td>Total Suspended Solids, mg/L</td>
<td>Weekly</td>
<td>Grab</td>
</tr>
<tr>
<td>pH, su (standard units)</td>
<td>Daily</td>
<td>Grab</td>
</tr>
</tbody>
</table>

For outfalls 001, 002, and 003:

If the duration of the discharge is shorter than the required sample frequency, a minimum of one sample shall be taken for all parameters.

If the discharge point is more than 0.5 miles from a perennial stream but the discharge flow is greater than 0.5 cfs, permittee must use a temporary sedimentation basin and other treatment/settling units as described in the NOI.

The above mentioned measures shall be modified or augmented if ineffective in preventing sedimentation or erosion.

**REPORTING REQUIREMENTS FOR THIS AUTHORIZATION**

Reporting is required monthly, using the enclosed, DEQ provided, Discharge Monitoring Reports (DMR) to be submitted by the 28th day of the month following the completed reporting period, to WYPDES Permits Section, DEQ/WQD, Herschler Building- 4 W, 122 West 25th Street, Cheyenne, WY 82002. If no discharge occurred during the reporting period, “no discharge” shall be reported. The first report is due on September 28, 2011.
For termination of this authorization, the enclosed Termination Notice (also available at http://leg.state.wy.us/wqd/WYPDES_Permisiting/downloads/TD_NOT_2_07.doc) must be completed and submitted at the completion of the discharge, along with monitoring analytical results. Authorizations cannot be terminated until the monitoring data and all completed DMR's have been submitted to the WQD for review. Once the permittee has received a letter confirming receipt of the termination notice, the permittee does not have to submit any further DMR's.

Once this permit has been issued, the permittee will be assessed a $100.00 per-year permit fee by the Water Quality Division. The fee year runs from January 1st through December 31st. This permit fee will continue to be assessed for as long as the permit is active, regardless of whether discharge actually occurs. This fee is not pro-rated. If the permit is active during any portion of the fee year, the full fee will be billed to the permittee for that fee year.

This facility has been assigned permit number WYG720281.

Coverage under this general permit for temporary discharges shall begin upon date of signature below, and is authorized to continue no longer than December 31, 2011.

If you have any questions concerning the conditions of this general permit authorization, contact Marcia Porter, 307-777-6081, or email marcia.porter@wyo.gov.

Leah Coleman
Department of Environmental Quality
Water Quality Division
Authorization to Discharge Wastewater Associated with Pump Testing of Water Wells
Under the Wyoming Pollutant Discharge Elimination System

Authorization # WYG720316

In compliance with the provisions of the Federal Water Pollution Control Act and the Wyoming Environmental Quality Act,


is authorized to discharge wastewater associated with pump testing of water wells from:

Burns Well Level II Study, Burns, Wyoming

*Outfall 001: NWSW Quarter/Quarter of Section 7, Township 14 North, Range 62 West, latitude 41.192691 longitude -104.368813 in Laramie County*

to surface waters of the State of Wyoming in accordance with the requirements of the enclosed general permit for temporary discharges.

Receiving waters: South Platte River basin via the South Platte River (class 2AB water) via Lodgepole Creek (class 2AB water) via Muddy Creek (class 2AB water) via North Fork Muddy Creek (class 3B water) via gated irrigation pipe for dispersion of water at discharge point.

**Permittee must use a temporary sedimentation basin.**


The wastewater discharged from this location shall be limited and monitored by the permittee as specified below.
**Effluent Limitations for Pump Testing of Water Wells**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Monthly Average</th>
<th>Weekly Average</th>
<th>Daily Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Dissolved Solids, mg/L</td>
<td>N/A</td>
<td>N/A</td>
<td>5,000</td>
</tr>
<tr>
<td>Total Suspended Solids, mg/L</td>
<td>30</td>
<td>45</td>
<td>90</td>
</tr>
<tr>
<td>pH, su (standard units)</td>
<td>N/A</td>
<td>N/A</td>
<td>6.5-9.0</td>
</tr>
</tbody>
</table>

**Monitoring Requirements for Pump Testing of Water Wells**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement Frequency</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow, gpm</td>
<td>Daily</td>
<td>Instantaneous or Continuous</td>
</tr>
<tr>
<td>Total Dissolved Solids, mg/L</td>
<td>Weekly</td>
<td>Grab</td>
</tr>
<tr>
<td>Total Suspended Solids, mg/L</td>
<td>Weekly</td>
<td>Grab</td>
</tr>
<tr>
<td>pH su (standard units)</td>
<td>Daily</td>
<td>Grab</td>
</tr>
</tbody>
</table>

For all outfalls:

- If the duration of the discharge is shorter than the required sample frequency, a minimum of one sample shall be taken for all parameters.

- If the discharge point is more than 0.5 miles from a perennial stream and the discharge flow is greater than 0.5 cfs, permittee must use a temporary sedimentation basin.

- The above mentioned measures shall be modified or augmented if ineffective in preventing sedimentation or erosion.

**REPORTING REQUIREMENTS FOR THIS AUTHORIZATION**

Reporting is required monthly, using the enclosed, DEQ-provided, Discharge Monitoring Reports (DMR) to be submitted by the 28th day of the month following the completed reporting period, to WYPDES Permits Section, DEQ/WQD, Herschler Building - 4 W, 122 West 25th Street, Cheyenne, WY 82002. If no discharge occurred during the reporting period, “no discharge” shall be reported. The first report is due on May 28, 2012 for any discharges occurring in April 2012.

For termination of this authorization, the enclosed Termination Notice (also available at [http://deq.state.wy.us/wqd/WYPDES_Permitting/downloads/TD_NOT_2_07.doc](http://deq.state.wy.us/wqd/WYPDES_Permitting/downloads/TD_NOT_2_07.doc)) must be completed and submitted at the completion of the discharge, along with monitoring analytical results. Authorizations cannot be terminated until the monitoring data and all completed DMR’s have been submitted to the WQD for review. Once the permittee has received a letter confirming receipt of the termination notice, the permittee does not have to submit any further DMR’s.
Once this permit has been issued, the permittee will be assessed a $100.00 per-year permit fee by the Water Quality Division. The fee year runs from January 1st through December 31st. This permit fee will continue to be assessed for as long as the permit is active, regardless of whether discharge actually occurs. This fee is not pro-rated. If the permit is active during any portion of the fee year, the full fee will be billed to the permittee for that fee year.

This facility has been assigned permit number WYG720316.

Coverage under this general permit for temporary discharges shall begin upon date of signature below, and is authorized to continue no longer than August 31, 2012.

If you have any questions concerning the conditions of this general permit authorization, contact Rebecca Adair, 307-777-6354, or email Rebecca.adair@wyo.gov.

Leah Coleman
WYPDES Program Principal
Water Quality Division
Department of Environmental Quality

Date of Issuance: 4/8/12
December 06, 2011

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO 80525

Workorder No.: C11100228 Quote ID: C3533
Project Name: Burns Level II

Energy Laboratories, Inc. Casper WY received the following 1 sample for Lidstone and Associates on 10/6/2011 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>C11100228-001</td>
<td>Well A2</td>
<td>10/05/11 14:15</td>
<td>10/06/11</td>
<td>Aqueous</td>
<td>Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Alkalinity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>QA Calculations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bacteria, SDWA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Conductivity</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Sample Filtering</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fluoride</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E300.0 Anions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nitrogen, Ammonia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nitrogen, Nitrate + Nitrite</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Metals Preparation by EPA 200.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gross Alpha</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Radium 226 + Radium 228</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Radium 226, Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Radium 228, Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solids, Total Dissolved</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solids, Total Suspended</td>
</tr>
</tbody>
</table>

The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing. Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. Data corrected for moisture content are typically noted as dry on the report. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

If you have any questions regarding these test results, please call.

Report Approved By:  

Digitally signed by Stephanie Waldrop  
Date: 2011.12.06 15:30:14 -07:00
REVISED/SUPPLEMENTAL REPORT
The attached analytical report has been revised from a previously submitted report due to the request by Mark Stacy on December 6, 2011 to change the Sample ID to Well A2.
<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAJOR IONS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkalinity, Total as CaCO₃</td>
<td>175</td>
<td>mg/L</td>
<td>5</td>
<td></td>
<td>A2320 B</td>
<td>10/07/11 11:56 / jba</td>
<td></td>
</tr>
<tr>
<td>Carbonate as CO₃</td>
<td>ND</td>
<td>mg/L</td>
<td>5</td>
<td></td>
<td>A2320 B</td>
<td>10/07/11 11:56 / jba</td>
<td></td>
</tr>
<tr>
<td>Bicarbonate as HCO₃</td>
<td>213</td>
<td>mg/L</td>
<td>5</td>
<td></td>
<td>A2320 B</td>
<td>10/07/11 11:56 / jba</td>
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</tr>
<tr>
<td>Bromide</td>
<td>ND</td>
<td>mg/L</td>
<td>0.5</td>
<td></td>
<td>E300.0</td>
<td>10/20/11 20:54 / jli</td>
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<tr>
<td>Calcium</td>
<td>69</td>
<td>mg/L</td>
<td>1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>14</td>
<td>mg/L</td>
<td>1</td>
<td></td>
<td>E300.0</td>
<td>10/20/11 20:54 / jli</td>
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</tr>
<tr>
<td>Fluoride</td>
<td>0.6</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>A4500-F C</td>
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<tr>
<td>Magnesium</td>
<td>14</td>
<td>mg/L</td>
<td>1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
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</tr>
<tr>
<td>Nitrogen, Ammonia as N</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>A4500-NH₃ G</td>
<td>10/18/11 12:01 / dc</td>
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<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>6.8</td>
<td>mg/L</td>
<td>D</td>
<td>0.5</td>
<td>E533.2</td>
<td>10/24/11 13:05 / dc</td>
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</tr>
<tr>
<td><strong>PHYSICAL PROPERTIES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductivity @ 25 C</td>
<td>483</td>
<td>umhos/cm</td>
<td>1</td>
<td></td>
<td>A2510 B</td>
<td>10/07/11 08:36 / lmC</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.82</td>
<td>s.u.</td>
<td>0.01</td>
<td></td>
<td>A4500-H B</td>
<td>10/07/11 08:36 / lmC</td>
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<tr>
<td><strong>Solids, Total Dissolved TDS @ 180 C</strong></td>
<td>329</td>
<td>mg/L</td>
<td>10</td>
<td></td>
<td>A2540 C</td>
<td>10/07/11 13:39 / lmC</td>
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<tr>
<td><strong>Solids, Total Suspended TSS @ 105 C</strong></td>
<td>ND</td>
<td>mg/L</td>
<td>4</td>
<td></td>
<td>A2540 D</td>
<td>10/06/11 11:00 / wc</td>
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<tr>
<td><strong>METALS - DISSOLVED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.003</td>
<td>mg/L</td>
<td>0.001</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>0.1</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
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</tr>
<tr>
<td>Boron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.03</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>ND</td>
<td>mg/L</td>
<td>0.001</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Molybdenum</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>0.002</td>
<td>mg/L</td>
<td>0.001</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Uranium</td>
<td>0.0115</td>
<td>mg/L</td>
<td>0.0003</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Vanadium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>E200.8</td>
<td>11/05/11 21:10 / sml</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>0.03</td>
<td>mg/L</td>
<td>B</td>
<td>0.01</td>
<td>E200.7</td>
<td>10/14/11 20:30 / cp</td>
<td></td>
</tr>
<tr>
<td><strong>METALS - TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.0032</td>
<td>mg/L</td>
<td>0.0001</td>
<td></td>
<td>E200.8</td>
<td>10/26/11 13:33 / sml</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.03</td>
<td></td>
<td>E200.8</td>
<td>10/26/11 13:33 / sml</td>
<td></td>
</tr>
</tbody>
</table>

**Report Definitions:**
- RL - Analyte reporting limit.
- QCL - Quality control limit.
- B - The analyte was detected in the method blank.
- MCL - Maximum contaminant level.
- ND - Not detected at the reporting limit.
- D - RL increased due to sample matrix.
### LABORATORY ANALYTICAL REPORT

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Lab ID:** C11100228-001  
**Client Sample ID:** Well A2

**Prepared by Casper, WY Branch**  
**Revised Date:** 12/06/11  
**Report Date:** 11/30/11  
**Collection Date:** 10/05/11 14:15  
**Date Received:** 10/06/11  
**Matrix:** Aqueous

---

#### METALS - TOTAL

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#### RADIONUCLIDES - TOTAL

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#### DATA QUALITY

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**Report Definitions:**

- **RL** - Analyte reporting limit.  
- **QCL** - Quality control limit.  
- **MCL** - Maximum contaminant level.  
- **ND** - Not detected at the reporting limit.  
- **U** - Not detected at minimum detectable concentration.  
- **MDC** - Minimum detectable concentration.

---

---
### LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

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<td>A9223 B</td>
<td>10/06/11 10:15 / mkf</td>
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#### Comments:
The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.
The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

#### Method Reference:
- E - EPA / MCAWW Methodology
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II

**Revised Date:** 12/06/11  
**Report Date:** 11/30/11  
**Work Order:** C11100228

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**Qualifiers:**  
- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration.
Client: Lidstone and Associates

Project: Burns Level II

**QA/QC Summary Report**
Prepared by Casper, WY Branch

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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report

Client: Lidstone and Associates  
Project: Burns Level II  
Report Date: 11/30/11  
Report: Burns Level II  
Work Order: C11100228

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Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Revised Date:** 12/06/11  
**Report Date:** 11/30/11  
**Work Order:** C11100228

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

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**Sample ID: MBLK**  
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Method Blank  
0.01 mg/L  
0.008  
Run: MANTECH_111006A  
10/06/11 09:37  
Batch: R151597

**Sample ID: LCS**  
Fluoride  
Laboratory Control Sample  
2.04 mg/L  
0.10  
102  
90  
110  
Run: MANTECH_111006A  
10/06/11 09:39

**Sample ID: C11100228-001BMS**  
Fluoride  
Sample Matrix Spike  
2.57 mg/L  
0.10  
97  
80  
120  
Run: MANTECH_111006A  
10/06/11 12:13

**Sample ID: C11100228-001BMSD**  
Fluoride  
Sample Matrix Spike Duplicate  
2.61 mg/L  
0.10  
99  
80  
120  
1.5  
10  
Run: MANTECH_111006A  
10/06/11 12:20

---

**Qualifiers:**  
RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  

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**Analytical Run:** ORION555A_111007A  
**Batch:** 111007_1_PH-W_555A-1  
**Work Order:** C11100228  
**Report Date:** 11/30/11  

**Qualifiers:**  
- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration

---

**Prepared by Casper, WY Branch**
Client: Lidstone and Associates  
Project: Burns Level II  
Report Date: 11/30/11  
Work Order: C11100228

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### QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates

**Project:** Burns Level II

**Revised Date:** 12/06/11

**Report Date:** 11/30/11

**Work Order:** C11100228

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**Sample ID:** ICSA | 14 | Interference Check Sample A | | | | | | | |
| Aluminum | 525 | mg/L | 0.10 | 105 | 80 | 120 |
| Barium | 0.0190 | mg/L | 0.10 | 0 | 0 |
| Boron | -0.0262 | mg/L | 0.10 | 0 | 0 |
| Cadmium | 0.0174 | mg/L | 0.010 | 0 | 0 |
| Calcium | 458 | mg/L | 0.50 | 100 | 80 | 120 |
| Chromium | 0.00860 | mg/L | 0.050 | 0 | 0 |
| Iron | 188 | mg/L | 0.030 | 94 | 80 | 120 |
| Lead | -0.0276 | mg/L | 0.050 | 0 | 0 |
| Magnesium | 504 | mg/L | 0.50 | 101 | 80 | 120 |
| Molybdenum | -0.0139 | mg/L | 0.10 | 0 | 0 |
| Potassium | 0.00310 | mg/L | 0.50 | 0 | 0 |
| Silicon | -0.0867 | mg/L | 0.10 | 0 | 0 |
| Sodium | -0.0151 | mg/L | 0.50 | 0 | 0 |
| Zinc | 0.0138 | mg/L | 0.010 | 0 | 0 |

**Sample ID:** ICSAB | 14 | Interference Check Sample AB | | | | | | | |
| Aluminum | 524 | mg/L | 0.10 | 105 | 80 | 120 |
| Barium | 0.525 | mg/L | 0.10 | 105 | 80 | 120 |
| Boron | -0.0378 | mg/L | 0.10 | 0 | 0 |
| Cadmium | 0.995 | mg/L | 0.010 | 100 | 80 | 120 |
| Calcium | 505 | mg/L | 0.50 | 101 | 80 | 120 |
| Chromium | 0.509 | mg/L | 0.050 | 102 | 80 | 120 |
| Iron | 190 | mg/L | 0.030 | 95 | 80 | 120 |
| Lead | 0.953 | mg/L | 0.050 | 95 | 80 | 120 |
| Magnesium | 508 | mg/L | 0.50 | 102 | 80 | 120 |
| Molybdenum | -0.0137 | mg/L | 0.10 | 0 | 0 |
| Potassium | 0.00390 | mg/L | 0.50 | 0 | 0 |
| Silicon | -0.0862 | mg/L | 0.10 | 0 | 0 |
| Sodium | 0.191 | mg/L | 0.50 | 0 | 0 |

---

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# QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II

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| Method:       | E200.7|        |       |    |      |           |            |     |          |      |
| Sample ID:    | MB-111014A| 14 Method Blank | ND | mg/L | 0.01 | mg/L | 0.0006 | 0.02 | mg/L | 0.005 | mg/L | 0.05 | mg/L | 0.001 | mg/L | 0.001 | mg/L | 0.001 |

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| Aluminum      | 1.97 | mg/L   | 0.10  | 97 | 70   | 130       |            |     |          |      |
| Barium        | 2.04 | mg/L   | 0.10  | 96 | 70   | 130       |            |     |          |      |
| Boron         | 2.00 | mg/L   | 0.10  | 95 | 70   | 130       |            |     |          |      |
| Cadmium       | 1.99 | mg/L   | 0.010 | 98 | 70   | 130       |            |     |          |      |
| Calcium       | 140  | mg/L   | 1.0   | 96 | 70   | 130       |            |     |          |      |
| Chromium      | 1.98 | mg/L   | 0.050 | 97 | 70   | 130       |            |     |          |      |
| Iron          | 2.01 | mg/L   | 0.030 | 98 | 70   | 130       |            |     |          |      |
| Lead          | 1.91 | mg/L   | 0.050 | 94 | 70   | 130       |            |     |          |      |
| Magnesium     | 113  | mg/L   | 1.0   | 95 | 70   | 130       |            |     |          |      |

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**Qualifiers:**

- **RL**: Analyte reporting limit.
- **A**: The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.
- **ND**: Not detected at the reporting limit.
- **MDC**: Minimum detectable concentration.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

**Reported by:** Casper, WY Branch  
**Report Date:** 11/30/11  
**Work Order:** C11100228

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

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### Qualifiers:

- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration.
Client: Lidstone and Associates

Project: Burns Level II

QA/QC Summary Report
Prepared by Casper, WY Branch

Revised Date: 12/06/11
Report Date: 11/30/11
Work Order: C11100228

Client: Lidstone and Associates
Report Date: 11/30/11

Project: Burns Level II

Work Order: C11100228

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Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

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#### Analyte Report

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**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Revised Date:** 12/06/11  
**Report Date:** 11/30/11  
**Work Order:** C11100228

### Client: Lidstone and Associates  
**Project:** Burns Level II

### Analyte Count

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<td>5.24</td>
<td>mg/L</td>
<td>0.50</td>
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</tr>
<tr>
<td>E300.0</td>
<td>ICB102011-11</td>
<td>3</td>
<td>Method Blank</td>
<td></td>
<td>0.10</td>
<td>mg/L</td>
<td>0.06</td>
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<tr>
<td>E300.0</td>
<td>LFB102011-12</td>
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<td>Laboratory Fortified Blank</td>
<td></td>
<td>4.91</td>
<td>mg/L</td>
<td>0.50</td>
<td>96</td>
<td>90</td>
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<tr>
<td>E300.0</td>
<td>C11100412-011AMS</td>
<td>3</td>
<td>Sample Matrix Spike</td>
<td></td>
<td>48.6</td>
<td>mg/L</td>
<td>4.0</td>
<td>101</td>
<td>90</td>
<td>110</td>
<td></td>
</tr>
</tbody>
</table>
| E300.0 | C11100412-011AMSD | 3 | Sample Matrix Spike Duplicate | | 48.0 | mg/L | 4.0 | 100 | 90 | 110 | 1.3 10

- Matrix spike recoveries outside the acceptance range are considered matrix-related.

### Qualifiers:
- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **MDC** - Minimum detectable concentration.
- **S** - Spike recovery outside of advisory limits.
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/30/11  
**Work Order:** C11100228

### Table

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>RPD</th>
<th>RPDLimit</th>
<th>Qual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method:</strong> E353.2</td>
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<tr>
<td>Sample ID: MBLK-1</td>
<td>Method Blank</td>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>ND</td>
<td>mg/L</td>
<td>0.06</td>
<td>Run: TECHNICON_111024A</td>
<td>10/24/11 10:15</td>
<td>Batch: R152360</td>
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<tr>
<td>Sample ID: LCS-2</td>
<td>Laboratory Control Sample</td>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>2.33</td>
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<tr>
<td>Sample ID: LFB-3</td>
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<td>mg/L</td>
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<td>10/24/11 10:20</td>
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<tr>
<td>Sample ID: C11100170-005EMS</td>
<td>Sample Matrix Spike</td>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>1.73</td>
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<td>Run: TECHNICON_111024A</td>
<td>10/24/11 12:50</td>
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<tr>
<td>Sample ID: C11100170-005EMSD</td>
<td>Sample Matrix Spike Duplicate</td>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>1.85</td>
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<td>90</td>
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<td>Run: TECHNICON_111024A</td>
<td>10/24/11 12:53</td>
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</tbody>
</table>

### Qualifiers:

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **ND** - Not detected at the reporting limit.
- **S** - Spike recovery outside of advisory limits.
# QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Work Order:** C11100228

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
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<th>High Limit</th>
<th>RPD</th>
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<tbody>
<tr>
<td><strong>Method: E900.0</strong></td>
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</tr>
<tr>
<td>Sample ID: MB-GrAB-1202</td>
<td>3</td>
<td>Method Blank</td>
<td>Run: G5000W_111110B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Gross Alpha | 2 pCi/L | | | | | | Run: G5000W_111110B | 11/26/11 07:03  
| Gross Alpha precision (±ε) | 0.6 pCi/L | | | | | | | | | |
| Gross Alpha MDC | 0.8 pCi/L | | | | | | | | | |
| Sample ID: Th230-GrAB-1202 | | Laboratory Control Sample | | | | | | | | |
| Gross Alpha | 102 pCi/L | | | | | | Run: G5000W_111110B | 11/26/11 07:03  
| Sample ID: C11091147-001BMS | | Sample Matrix Spike | | | | | | | | |
| Gross Alpha | 4850 pCi/L | | | | | | Run: G5000W_111110B | 11/26/11 07:04  
| - Sample activity for this radionuclide is much larger than the spike activity added. Therefore the matrix spike recovery could not be calculated. The LCS and the RPD of the MS/MSD pair are acceptable; this batch is approved. |
| Sample ID: C11091147-001BMSD | | Sample Matrix Spike Duplicate | | | | | | | | |
| Gross Alpha | 519 pCi/L | | | | | | Run: G5000W_111110B | 11/26/11 21:55  
| Sample ID: C11100280-016EDUP | 3 | Sample Duplicate | Run: G5000W_111110B | | | | | | | |
| Gross Alpha | 1220 pCi/L | | | | | | | | | |
| Gross Alpha precision (±ε) | 20.8 pCi/L | | | | | | | | | |
| Gross Alpha MDC | 2.88 pCi/L | | | | | | | | | |

**Qualifiers:**

RL - Analyte reporting limit.  
MDC - Minimum detectable concentration  
ND - Not detected at the reporting limit.  
S - Spike recovery outside of advisory limits.
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Work Order:** C11100228

### Method: E903.0

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<th>%REC</th>
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<th>High Limit</th>
<th>RPD</th>
<th>RPDLimit</th>
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<tr>
<td>Radium 226</td>
<td>14</td>
<td>pCi/L</td>
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<td>70</td>
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<tr>
<td><strong>Sample ID: C11100852-001AMSD</strong></td>
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<tr>
<td>Radium 226</td>
<td>14</td>
<td>pCi/L</td>
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<td>3.5</td>
<td>23.7</td>
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<td><strong>Sample ID: MB-RA226-5689</strong></td>
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<tr>
<td>Method Blank</td>
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<td>U</td>
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<td>Radium 226 precision (±)</td>
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<td>Radium 226 MDC</td>
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<tr>
<td>Laboratory Control Sample</td>
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<td>120</td>
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</table>

### Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
- U - Not detected at minimum detectable concentration
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/30/11

### Analyte: Radium 228

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>RPD</th>
<th>RPDLimit</th>
<th>Qual</th>
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<tbody>
<tr>
<td>LCS-228-RA226-5689</td>
<td>Laboratory Control Sample</td>
<td>7.8</td>
<td>pCi/L</td>
<td>108</td>
<td>80</td>
<td>120</td>
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<td>MB-RA226-5689</td>
<td>Method Blank</td>
<td>0.8</td>
<td>pCi/L</td>
<td>1.0</td>
<td>pCi/L</td>
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<td>C11100852-003AMS</td>
<td>Sample Matrix Spike</td>
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<td>C11100852-003AMSD</td>
<td>Sample Matrix Spike Duplicate</td>
<td>12</td>
<td>pCi/L</td>
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<td>70</td>
<td>130</td>
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<td>11/02/11 12:09</td>
<td>1.6</td>
<td>36.8</td>
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### Analyte: Radium 228 Precision (t)

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<th>Sample ID</th>
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<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>RPD</th>
<th>RPDLimit</th>
<th>Qual</th>
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</thead>
<tbody>
<tr>
<td>LCS-228-RA226-5689</td>
<td>0.6</td>
<td>pCi/L</td>
<td>Run: TENNELEC-3_111026A</td>
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<td></td>
</tr>
<tr>
<td>MB-RA226-5689</td>
<td>1.0</td>
<td>pCi/L</td>
<td>Run: TENNELEC-3_111026A</td>
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</tbody>
</table>

### Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
## Workorder Receipt Checklist

**Login completed by:** Debra Williams

**Reviewed by:** BL2000\Tparke

**Reviewed Date:** 10/20/2011

**Date Received:** 10/6/2011

**Received by:** kg

**Carrier name:** FedEx

<table>
<thead>
<tr>
<th>Checkpoint</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Shipping container/cooler in good condition?</td>
<td>Yes</td>
</tr>
<tr>
<td>Custody seals intact on shipping container/cooler?</td>
<td>Yes</td>
</tr>
<tr>
<td>Custody seals intact on sample bottles?</td>
<td>Yes</td>
</tr>
<tr>
<td>Chain of custody present?</td>
<td>Yes</td>
</tr>
<tr>
<td>Chain of custody signed when relinquished and received?</td>
<td>Yes</td>
</tr>
<tr>
<td>Chain of custody agrees with sample labels?</td>
<td>Yes</td>
</tr>
<tr>
<td>Samples in proper container/bottle?</td>
<td>Yes</td>
</tr>
<tr>
<td>Sample containers intact?</td>
<td>Yes</td>
</tr>
<tr>
<td>Sufficient sample volume for indicated test?</td>
<td>Yes</td>
</tr>
<tr>
<td>All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)</td>
<td>Yes</td>
</tr>
<tr>
<td>Container/Temp Blank temperature:</td>
<td>3.2°C On Ice</td>
</tr>
<tr>
<td>Water - VOA vials have zero headspace?</td>
<td>No</td>
</tr>
<tr>
<td>Water - pH acceptable upon receipt?</td>
<td>No</td>
</tr>
</tbody>
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---

**Contact and Corrective Action Comments:**

None
# Chain of Custody and Analytical Request Record

**PLEASE PRINT** (Provide as much information as possible.)

<table>
<thead>
<tr>
<th>Company Name:</th>
<th>Project Name, PWS, Permit, Etc.</th>
<th>Sample Origin</th>
<th>EPA/State Compliance:</th>
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<tbody>
<tr>
<td>LISTONE</td>
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<td>Yes ☐ No ☑</td>
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<table>
<thead>
<tr>
<th>Report Mail Address:</th>
<th>Contact Name:</th>
<th>Phone/Fax:</th>
<th>Email:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4625 AMINATION WAY, E2 Ft. Collins, CO 80325</td>
<td>MARK STADY</td>
<td>970-223-4705/</td>
<td>MGER LAMINIG.CIM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Invoice Address:</th>
<th>Invoice Contact &amp; Phone:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANG</td>
<td>MELODY CULVER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purchase Order:</th>
<th>Quote/Bottle Order:</th>
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<tbody>
<tr>
<td>wMpa11</td>
<td>34587</td>
</tr>
</tbody>
</table>

- **Special Report/Formats:**
  - DW ☐
  - POTW/MMWTP ☐
  - EDD/EDT (Electronic Data) ☑
  - Level IV ☐
  - NELAC ☐

### ANALYSIS REQUESTED

- **RUSH**

### SAMPLE IDENTIFICATION

<table>
<thead>
<tr>
<th>Name, Location, Interval, etc.</th>
<th>Collection Date</th>
<th>Collection Time</th>
<th>MATRIX</th>
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<tbody>
<tr>
<td>WEU AZ</td>
<td>11/5/11</td>
<td>14:15</td>
<td>GW</td>
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<table>
<thead>
<tr>
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<th>Test Method</th>
<th>Bottles</th>
<th>Bottle #</th>
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<tbody>
<tr>
<td></td>
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<td></td>
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<td>34587</td>
</tr>
</tbody>
</table>

- **RUSH**

- **Comments:**

- **Cooler ID:**

- **Shipped by:**

- **Receipt Temp:**

- **On Ice:**

- **Custody Seal:**

- **Intact:**

- **Sample Disposal:**

- **Return to Client:**

- **Lab Disposal:**

---

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our website at [www.energylab.com](http://www.energylab.com) for additional information, downloadable fee schedule, forms, and links.
November 04, 2011

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO 80525

Workorder No.: C11091102 Quote ID: C3663 - Burns WQ
Project Name: Burns Level II

Energy Laboratories, Inc. Casper WY received the following 1 sample for Lidstone and Associates on 9/29/2011 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
</tr>
</thead>
</table>

The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing. All samples are reported on an as received basis unless otherwise indicated.

If you have any questions regarding these test results, please call.

Report Approved By: Stephanie Waldrop
Digitally signed by Stephanie Waldrop
Date: 2011.11.07 10:00:23 -07:00
**LABORATORY ANALYTICAL REPORT**
Prepared by Casper, WY Branch

<table>
<thead>
<tr>
<th>Client:</th>
<th>Lidstone and Associates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:</td>
<td>Burns Level II</td>
</tr>
<tr>
<td>Client Sample ID:</td>
<td>Well A3</td>
</tr>
<tr>
<td>Sampled By:</td>
<td>Mark Stacy</td>
</tr>
<tr>
<td>Lab ID:</td>
<td>C11091102-001A</td>
</tr>
</tbody>
</table>

**Report Date:** 11/04/11  
**Collection Date:** 09/28/11 12:00  
**Received Date:** 09/29/11 09:05  
**Matrix:** Aqueous

### MICROBIOLOGICAL

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<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Safe/Unsafe</th>
<th>Qualifier</th>
<th>Method</th>
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<tbody>
<tr>
<td>Bacteria, Total Coliform</td>
<td>Present</td>
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<td>UNSAFE</td>
<td>A9223 B</td>
<td>09/29/11 12:10 / mkf</td>
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<tr>
<td>Bacteria, E-Coli Coliform</td>
<td>Absent</td>
<td></td>
<td></td>
<td>A9223 B</td>
<td>09/29/11 12:10 / mkf</td>
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</table>

**Comments:**  
The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.  
The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.  

**Method Reference:**  
E - EPA / MCAWW Methodology  
A - Standard Methods 19th Ed.
**LABORATORY ANALYTICAL REPORT**
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates
**Project:** Burns Level II
**Lab ID:** C11091102-001
**Client Sample ID:** Well A3

<table>
<thead>
<tr>
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<th>Result</th>
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<th>Qualifier</th>
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<th>MCL/QLC</th>
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<td>10/07/11 22:13 / j/f</td>
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**PHYSICAL PROPERTIES**

| Conductivity @ 25 C                  | 488    | umhos/cm | 1     | A2510 B | 09/29/11 15:05 / lmc |
| pH                                   | 7.92   | s.u.     | 0.01  | A4500-HB | 09/29/11 15:05 / lmc |
| Solids, Total Dissolved TDS @ 180 C  | 343    | mg/L     | 10    | A2540 C | 09/30/11 11:27 / lmc |
| Solids, Total Suspended TSS @ 105 C  | ND     | mg/L     | 4     | A2540 D | 09/30/11 08:11 / wc |

**METALS - TOTAL**

| Aluminum                             | ND     | mg/L    | 0.1  | 0.2  | E200.8 | 10/18/11 10:57 / sml |
| Antimony                             | ND     | mg/L    | 0.001| 0.006| E200.8 | 10/18/11 10:57 / sml |
| Arsenic                              | 0.003  | mg/L    | 0.001| 0.01 | E200.8 | 10/18/11 10:57 / sml |
| Barium                               | 0.1    | mg/L    | 0.1  | 2    | E200.8 | 10/18/11 10:57 / sml |
| Beryllium                            | ND     | mg/L    | 0.001| 0.004| E200.8 | 10/18/11 10:57 / sml |
| Boron                                | 0.1    | mg/L    | 0.1  |     | E200.7 | 10/22/11 00:25 / cp |
| Cadmium                              | ND     | mg/L    | 0.001| 0.005| E200.8 | 10/18/11 10:57 / sml |
| Chromium                             | ND     | mg/L    | 0.05 | 0.1  | E200.8 | 10/18/11 10:57 / sml |
| Copper                               | ND     | mg/L    | 0.01 | 1    | E200.8 | 10/18/11 10:57 / sml |
| Iron                                 | ND     | mg/L    | 0.03 | 0.3  | E200.7 | 10/22/11 00:25 / cp |
| Lead                                 | 0.001  | mg/L    | 0.001| 0.015| E200.8 | 10/18/11 10:57 / sml |
| Manganese                            | ND     | mg/L    | 0.01 | 0.05 | E200.8 | 10/18/11 10:57 / sml |
| Mercury                              | ND     | mg/L    | 0.002| 0.002| E245.1 | 10/13/11 10:54 / ch |
| Nickel                               | ND     | mg/L    | 0.05 |      | E200.8 | 10/18/11 10:57 / sml |
| Selenium                             | 0.003  | mg/L    | 0.001| 0.05 | E200.8 | 10/18/11 10:57 / sml |
| Silver                               | ND     | mg/L    | 0.01 | 0.1  | E200.8 | 10/18/11 10:57 / sml |
| Thallium                             | ND     | mg/L    | 0.004| 0.002| E200.8 | 10/18/11 10:57 / sml |
| Uranium                              | 0.013  | mg/L    | 0.003| 0.03 | E200.8 | 10/18/11 10:57 / sml |
| Uranium, Activity                    | 8.7    | pCi/L   | 0.2  | 20   | E200.8 | 10/18/11 10:57 / sml |

**Report Definitions:**
- RL - Analyte reporting limit.
- MCL - Maximum contaminant level.
- QCL - Quality control limit.
- ND - Not detected at the reporting limit.
- D - RL increased due to sample matrix.
LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: Burns Level II
Lab ID: C11091102-001
Client Sample ID: Well A3

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DATA QUALITY

A/C Balance (±5)     4.65  %          Calculation 10/17/11 06:28 / kbh
Anions             4.66  meq/L       Calculation 10/17/11 06:28 / kbh
Cations           5.11  meq/L       Calculation 10/17/11 06:28 / kbh
Solids, Total Dissolved Calculated 328  mg/L    Calculation 10/17/11 06:28 / kbh
TDS Balance (0.80 - 1.20)  1.05  Calculation 10/17/11 06:28 / kbh

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
* - The result exceeds the MCL.
U - Not detected at minimum detectable concentration
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

### Client: Lidstone and Associates

### Project: Burns Level II

**Report Date:** 11/04/11

**Work Order:** C11091102

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**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration

**Report Date:** 11/04/11

**Work Order:** C11091102
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Report Order:** C11091102

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**Analytical Run:** ORION555A_110929B  
**Batch:** 110929_2_PH-W_555A-1

**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102

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**Sample ID:** MBLK1_110930  
**Run:** BAL-1_110930C  
**Batch:** 110930_1_SLDS-TDS-W  
**Date:** 09/30/11 11:20

**Sample ID:** LCS1_110930  
**Run:** BAL-1_110930C  
**Date:** 09/30/11 11:20

**Sample ID:** C11090489-001ADUP  
**Run:** BAL-1_110930C  
**Date:** 09/30/11 11:21

**Sample ID:** C11091093-010AMS  
**Run:** BAL-1_110930C  
**Date:** 09/30/11 11:26

---

**Qualifier Definitions:**  
- RL: Analyte reporting limit.  
- MDC: Minimum detectable concentration.  
- ND: Not detected at the reporting limit.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

**Report Date:** 11/04/11  
**Work Order:** C11091102

#### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPDLimit Qual

| Method: A2540 D | Sample ID: MBLK1_ Method Blank | Run: BAL-1_110930A | 09/30/11 08:01 |
| Solids, Total Suspended TSS @ 105 C | ND | mg/L | 2 |

| Sample ID: LCS1_ Laboratory Control Sample | Run: BAL-1_110930A | 09/30/11 13:22 |
| Solids, Total Suspended TSS @ 105 C | 156 | mg/L | 12 78 60 110 |

| Sample ID: C11091102-001BDUP Sample Duplicate | Run: BAL-1_110930A | 09/30/11 08:02 |
| Solids, Total Suspended TSS @ 105 C | ND | mg/L | 4.0 |

#### Qualifiers:
- **RL:** Analyte reporting limit.
- **MDC:** Minimum detectable concentration
- **ND:** Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102

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**Analytical Run:** ORION555A_110929B  
**Run Date:** 09/29/11 13:00

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### Qualifiers:
- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration
### QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102

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**Qualifiers:**
- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **MDC** - Minimum detectable concentration
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102

## Analyte Results

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## Qualifiers:

- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **A** - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.
- **MDC** - Minimum detectable concentration
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

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| Sample ID: LFB  | 17    | Laboratory Fortified Blank | Run: ICPMS2-C_111017A | 10/17/11 23:06 |
| Aluminum        | 0.0522| mg/L   | 0.0010  | 104  | 85  | 115 |
| Antimony        | 0.0542| mg/L   | 0.0010  | 108  | 85  | 115 |
| Arsenic         | 0.0548| mg/L   | 0.0010  | 109  | 85  | 115 |
| Barium          | 0.0543| mg/L   | 0.0010  | 109  | 85  | 115 |
| Beryllium       | 0.0530| mg/L   | 0.0010  | 106  | 85  | 115 |
| Cadmium         | 0.0543| mg/L   | 0.0010  | 109  | 85  | 115 |
| Chromium        | 0.0545| mg/L   | 0.0010  | 109  | 85  | 115 |
| Copper          | 0.0547| mg/L   | 0.0010  | 109  | 85  | 115 |
| Lead            | 0.0538| mg/L   | 0.0010  | 108  | 85  | 115 |
| Manganese       | 0.0536| mg/L   | 0.0010  | 107  | 85  | 115 |
| Nickel          | 0.0541| mg/L   | 0.0010  | 108  | 85  | 115 |
| Selenium        | 0.0550| mg/L   | 0.0010  | 110  | 85  | 115 |
| Silver          | 0.0201| mg/L   | 0.0010  | 100  | 85  | 115 |
| Thallium        | 0.0533| mg/L   | 0.0010  | 107  | 85  | 115 |
| Uranium         | 0.0538| mg/L   | 0.00030 | 108  | 85  | 115 |
| Vanadium        | 0.0536| mg/L   | 0.0010  | 107  | 85  | 115 |
| Zinc            | 0.0560| mg/L   | 0.0010  | 111  | 85  | 115 |

| Sample ID: C11100289-006AMS4 | 17 | Sample Matrix Spike | Run: ICPMS2-C_111017A | 10/18/11 12:18 |
| Aluminum        | 0.049 | mg/L | 0.0010  | 94   | 70  | 130 |
| Antimony        | 0.054 | mg/L | 0.0010  | 108  | 70  | 130 |
| Arsenic         | 0.056 | mg/L | 0.0010  | 106  | 70  | 130 |
| Barium          | 0.054 | mg/L | 0.0010  | 104  | 70  | 130 |
| Beryllium       | 0.050 | mg/L | 0.0010  | 100  | 70  | 130 |
| Cadmium         | 0.051 | mg/L | 0.0010  | 102  | 70  | 130 |
| Chromium        | 0.048 | mg/L | 0.0010  | 96   | 70  | 130 |

**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MOC - Minimum detectable concentration.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

**Environmental Analysis Laboratory**  
Helena, MT 877-472-6711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515

**www.energylab.com**

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**Method:** E200.8

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**Sample ID:** C11100289-006AMS4

**Run:** ICPMS2-C_111017A

**Low Limit:** 10/18/11 12:18

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**Sample ID:** C11100289-006AMSD

**Duplicate** Run: ICPMS2-C_111017A

**Low Limit:** 10/18/11 12:25

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- R - RPD exceeds advisory limit.

---

**Page 13 of 21**
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102  

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**Qualifiers:**  
RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
### QA/QC Summary Report
#### Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II  
**Report Date:** 11/04/11  
**Work Order:** C11091102

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report

**Prepared by Casper, WY Branch**

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<th>%REC</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>RPD</th>
<th>RPDLimit</th>
<th>Qual</th>
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<tbody>
<tr>
<td>Method: E353.2</td>
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<tr>
<td>Sample ID: MBLK-1</td>
<td>Method Blank</td>
<td>ND</td>
<td>mg/L</td>
<td>0.06</td>
<td></td>
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</tr>
<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>Run: TECHNICON_111021C</td>
<td>10/21/11 21:03</td>
<td></td>
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<tr>
<td>Sample ID: LCS-2</td>
<td>Laboratory Control Sample</td>
<td>2.47</td>
<td>mg/L</td>
<td>0.10</td>
<td>99</td>
<td>90</td>
<td>110</td>
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<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>Run: TECHNICON_111021C</td>
<td>10/21/11 21:05</td>
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<td>Sample ID: LFB-3</td>
<td>Laboratory Fortified Blank</td>
<td>2.01</td>
<td>mg/L</td>
<td>0.10</td>
<td>103</td>
<td>90</td>
<td>110</td>
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<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>Run: TECHNICON_111021C</td>
<td>10/21/11 21:08</td>
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<td>Sample ID: C11091093-011DMS</td>
<td>Sample Matrix Spike</td>
<td>2.01</td>
<td>mg/L</td>
<td>0.10</td>
<td>103</td>
<td>90</td>
<td>110</td>
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<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>Run: TECHNICON_111021C</td>
<td>10/21/11 23:00</td>
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<tr>
<td>Sample ID: C11091093-011DMSD</td>
<td>Sample Matrix Spike Duplicate</td>
<td>2.07</td>
<td>mg/L</td>
<td>0.10</td>
<td>106</td>
<td>90</td>
<td>110</td>
<td>2.9</td>
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<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>Run: TECHNICON_111021C</td>
<td>10/21/11 23:03</td>
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</tbody>
</table>

**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

**Report Date:** 11/04/11  
**Work Order:** C11091102

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPDLimit Qual

<table>
<thead>
<tr>
<th>Method: E900.0</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sample ID: MB-GrDW-0003</th>
<th>6 Method Blank</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/16/11 10:49</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha</td>
<td>3 pCi/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Alpha precision (±)</td>
<td>0.7 pCi/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Alpha MDC</td>
<td>0.5 pCi/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross Beta</td>
<td>4 pCi/L</td>
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<tr>
<td>Gross Beta precision (±)</td>
<td>1 pCi/L</td>
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<tr>
<td>Gross Beta MDC</td>
<td>1 pCi/L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MB is high but within Control Limits.

<table>
<thead>
<tr>
<th>Sample ID: Th230-GrDW-0003</th>
<th>Laboratory Control Sample</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/16/11 10:49</th>
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</thead>
<tbody>
<tr>
<td>Gross Alpha</td>
<td>110 pCi/L</td>
<td>106 80 120</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample ID: Cs137-GrDW-0003</th>
<th>Laboratory Control Sample</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/16/11 10:49</th>
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<tbody>
<tr>
<td>Gross Beta</td>
<td>81 pCi/L</td>
<td>89 80 120</td>
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<table>
<thead>
<tr>
<th>Sample ID: C11091155-001HDUP</th>
<th>6 Sample Duplicate</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/16/11 10:49</th>
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</thead>
<tbody>
<tr>
<td>Gross Alpha</td>
<td>39 pCi/L</td>
<td>73 20 R</td>
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<tr>
<td>Gross Alpha precision (±)</td>
<td>5.0 pCi/L</td>
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<tr>
<td>Gross Alpha MDC</td>
<td>2.2 pCi/L</td>
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</tr>
<tr>
<td>Gross Beta</td>
<td>72 pCi/L</td>
<td>180 20 R</td>
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<tr>
<td>Gross Beta precision (±)</td>
<td>4.5 pCi/L</td>
<td></td>
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</tr>
<tr>
<td>Gross Beta MDC</td>
<td>3.5 pCi/L</td>
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</table>

Duplicate RPD is outside of the acceptance range for this analysis indicating a possible low precision for the batch. The sample has been reanalyzed and the results for the reanalysis are shown on the Analytical Report for that sample.

<table>
<thead>
<tr>
<th>Sample ID: C11100111-001CMS</th>
<th>Sample Matrix Spike</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/18/11 03:32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha</td>
<td>120 pCi/L</td>
<td>107 70 130</td>
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<table>
<thead>
<tr>
<th>Sample ID: C11100111-001CMSD</th>
<th>Sample Matrix Spike Duplicate</th>
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<th>10/18/11 03:32</th>
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<tbody>
<tr>
<td>Gross Alpha</td>
<td>130 pCi/L</td>
<td>115 70 130</td>
<td>6.6 20</td>
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<table>
<thead>
<tr>
<th>Sample ID: C11100111-001CMS</th>
<th>Sample Matrix Spike</th>
<th>Run: TENNELEC-3_111005B</th>
<th>10/18/11 03:31</th>
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</thead>
<tbody>
<tr>
<td>Gross Beta</td>
<td>98 pCi/L</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Sample ID: C11100111-001CMSD</th>
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<th>Run: TENNELEC-3_111005B</th>
<th>10/18/11 03:31</th>
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</thead>
<tbody>
<tr>
<td>Gross Beta</td>
<td>110 pCi/L</td>
<td>117 70 130</td>
<td>11 20</td>
</tr>
</tbody>
</table>

### Qualifiers:

- **RL** - Analyte reporting limit.  
- **MDC** - Minimum detectable concentration.  
- **ND** - Not detected at the reporting limit.  
- **R** - RPD exceeds advisory limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II

### Analyte Count Result Units

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
<th>Low Limit</th>
<th>High Limit</th>
<th>RPD</th>
<th>RPD Limit</th>
<th>Qual</th>
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<tbody>
<tr>
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</tbody>
</table>

**Sample ID:** MB-R152749

- **Method Blank:**
  - Radium 226: 0.2 pCi/L
  - Radium 226 precision (±): 0.08 pCi/L
  - Radium 226 MDC: 0.06 pCi/L

**Sample ID:** LCS-R152749

- **Laboratory Control Sample:**
  - Radium 226: 6.1 pCi/L

**Sample ID:** C11091013-001ADUP

- **Sample Duplicate:**
  - Radium 226: 0.36 pCi/L
  - Radium 226 precision (±): 0.10 pCi/L
  - Radium 226 MDC: 0.050 pCi/L

**Sample ID:** C11091067-001AMS

- **Sample Matrix Spike:**
  - Radium 226: 12 pCi/L

**Sample ID:** C11091067-001AMSD

- **Sample Matrix Spike Duplicate:**
  - Radium 226: 12 pCi/L

**Method Blank:**

- Run: TENNELEC-3_111018D  
  - 10/18/11 14:00

**Laboratory Control Sample:**

- Run: TENNELEC-3_111018D  
  - 10/18/11 14:00

**Sample Duplicate:**

- Run: TENNELEC-3_111018D  
  - 10/18/11 14:00

**Sample Matrix Spike:**

- Run: TENNELEC-3_111018D  
  - 10/18/11 14:00

**Sample Matrix Spike Duplicate:**

- Run: TENNELEC-3_111018D  
  - 10/18/11 14:00

#### Qualifiers:

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
### Analyte Summary Report

**Client:** Lidstone and Associates  

**Project:** Burns Level II  

**Report Date:** 11/04/11  

**Work Order:** C11091102

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<th>%REC</th>
<th>Low Limit</th>
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<tbody>
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<td><em>Sample ID: MB-R152558</em></td>
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<td>Method Blank</td>
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<td>Run: TENNELEC-3_111011B</td>
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<td></td>
<td></td>
<td>U</td>
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<tr>
<td>Radium 228</td>
<td>3</td>
<td>-0.3</td>
<td>pCi/L</td>
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<tr>
<td>Radium 228 precision (±)</td>
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<td>0.6</td>
<td>pCi/L</td>
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<td>Radium 228 MDC</td>
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<td>0.6</td>
<td>pCi/L</td>
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<td>Laboratory Control Sample</td>
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<td>Run: TENNELEC-3_111011B</td>
<td>10/18/11 14:22</td>
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<tr>
<td>Radium 228</td>
<td>5.7</td>
<td>pCi/L</td>
<td>89</td>
<td>80</td>
<td>120</td>
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<td>Sample Duplicate</td>
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<td>Run: TENNELEC-3_111011B</td>
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<tr>
<td>Radium 228</td>
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<td>pCi/L</td>
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<td>Radium 228 precision (±)</td>
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<td>0.57</td>
<td>pCi/L</td>
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<td>Radium 228 MDC</td>
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<td>0.58</td>
<td>pCi/L</td>
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<tr>
<td><em>Sample ID: C11091090-001DMS</em></td>
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<td>Sample Matrix Spike</td>
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<td></td>
<td>Run: TENNELEC-3_111011B</td>
<td>10/18/11 14:22</td>
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<tr>
<td>Radium 228</td>
<td>12</td>
<td>pCi/L</td>
<td>88</td>
<td>70</td>
<td>130</td>
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<tr>
<td>Radium 228</td>
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<td>70</td>
<td>130</td>
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</table>

**Qualifiers:**

- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
- ND - Not detected at the reporting limit.
- R - RPD exceeds advisory limit.

---

Helena, MT 877-472-6711 • Billings, MT 803-735-4489 • Casper, WY 888-235-0515  
Gillette, WY 866-666-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-990-2218

**QA/QC Summary Report**

Prepared by Casper, WY Branch

Page 19 of 21
## Workorder Receipt Checklist

**Lidstone and Associates**

<table>
<thead>
<tr>
<th>Login completed by:</th>
<th>Edith McPike</th>
<th>Date Received:</th>
<th>9/29/2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewed by:</td>
<td>BL2000/cwagner</td>
<td>Received by:</td>
<td>ca</td>
</tr>
<tr>
<td>Reviewed Date:</td>
<td>10/6/2011</td>
<td>Carrier FedEx name:</td>
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### Checklist

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<tr>
<th>Item</th>
<th>Yes</th>
<th>No</th>
<th>Not Present</th>
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</thead>
<tbody>
<tr>
<td>Shipping container/cooler in good condition?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custody seals intact on shipping container/cooler?</td>
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<tr>
<td>Custody seals intact on sample bottles?</td>
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</tr>
<tr>
<td>Chain of custody present?</td>
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<tr>
<td>Chain of custody signed when relinquished and received?</td>
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<td>Chain of custody agrees with sample labels?</td>
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<tr>
<td>Samples in proper container/bottle?</td>
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<tr>
<td>Sample containers intact?</td>
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<tr>
<td>Sufficient sample volume for indicated test?</td>
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<tr>
<td>All samples received within holding time?</td>
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</tr>
<tr>
<td>Container/Temp Blank temperature: 3.4°C On Ice</td>
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<tr>
<td>Water - VOA vials have zero headspace?</td>
<td></td>
<td></td>
<td>Not Present</td>
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<tr>
<td>Water - pH acceptable upon receipt?</td>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

**Contact and Corrective Action Comments:**

Samples for dissolved metals were subsampled, filtered and preserved with 2 mL HNO3 in lab upon receipt to pH <2.
**Chain of Custody and Analytical Request Record**

**Company Name:** [Name of Company]

**Sample Origin State:** WY

**Report Mail Address:** 405 Automation Way, Suite E

**Contact Name:** [Contact Name]

**Phone/Fax:** 970-223-4705 / 970-223-4706

**Email:** [Email Address]

**Invoice Address:** [Invoice Address]

**Special Report/Formats:**

- [ ] DW
- [ ] POTW/WWTP
- [ ] EDD/EDT (Electronic Data)
- [x] LEVEL IV
- [ ] NELAC

**ANALYSIS REQUESTED**

- **RUSH**

**SEE ATTACHED**

- **Standard Turnaround (TAT)**

**Comments:** Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

**Contact:** [Contact Name]

**Phone/Fax:** 970-223-4705

**Email:** [Email Address]

**Purchase Order:** [Purchase Order]

**Quote/Bottle Order:** [Quote/Bottle Order]

**Sample Identification**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Collection Date</th>
<th>Collection Time</th>
<th>MATRIX</th>
<th>Number of Containers</th>
<th>Sample Type</th>
<th>Sample Design</th>
<th>TSS/Total Suspended</th>
<th>Lead/Chromium</th>
<th>Intact</th>
<th>Signature</th>
<th>Match</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>12:00</td>
<td>9/28/11</td>
<td>W X X X X</td>
<td>1 (140 SAMPLES)</td>
<td>A1W, B1W, C1W, D1W, E1W</td>
<td>[Details]</td>
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</table>

**Custody Record**

**MUST be Signed**

**Sample Disposal:** Return to Client

**Lab Disposal:** X

**Received by Laboratory:** 9/24/11 7:05

**Signature:** [Signature]

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our website at [www.energylab.com](http://www.energylab.com) for additional information, downloadable fee schedule, forms, and links.
December 01, 2011

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO  80525

Workorder No.:  C11100556  Quote ID:  C3663 - Burns WQ
Project Name:  Burns Level II Project

Energy Laboratories, Inc. Casper WY received the following 1 sample for Lidstone and Associates on 10/14/2011 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
</tr>
</thead>
</table>

The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing. Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. Data corrected for moisture content are typically noted as dry on the report. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

If you have any questions regarding these test results, please call.

Report Approved By:  Stephanie Waldrop
Digitally signed by Stephanie Waldrop
Date: 2011.12.01 11:09:04 -07:00
LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: Burns Level II Project
Client Sample ID: Well A4
Sampled By: Mark Stacy
Lab ID: C11100556-001A

Report Date: 12/01/11
Collection Date: 10/13/11 15:15
Received Date: 10/14/11 09:20

Matrix: Aqueous

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Safe/Unsafe</th>
<th>Qualifier</th>
<th>Method</th>
<th>Analysis Date / By</th>
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<tbody>
<tr>
<td>Bacteria, Total Coliform</td>
<td>Absent</td>
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<td>SAFE</td>
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<td>10/14/11 16:05 / rlo</td>
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<tr>
<td>Bacteria, E-Coli Coliform</td>
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</table>

Comments: The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.
The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

**LABORATORY ANALYTICAL REPORT**

Prepared by Casper, WY Branch

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/ OCL</th>
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<td>Chloride</td>
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<td>mg/L</td>
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<td>Nitrogen, Ammonia as N</td>
<td>ND</td>
<td>mg/L</td>
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<td>A4500-NH3 G</td>
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<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>4.8</td>
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<td>Conductivity @ 25 C</td>
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<td>7.83</td>
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<td>Aluminum</td>
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<td>Barium</td>
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<td>mg/L</td>
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<td>0.004</td>
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<td>mg/L</td>
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<td>11/18/11 15:15 / sml</td>
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<td>Copper</td>
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<td>mg/L</td>
<td>0.01</td>
<td>1.3</td>
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<td>0.015</td>
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<td>Manganese</td>
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<td>mg/L</td>
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<td>0.05</td>
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<td>Mercury</td>
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<td>mg/L</td>
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<td>0.002</td>
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<td>Nickel</td>
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<td>11/18/11 15:15 / sml</td>
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<td>11/18/11 15:15 / sml</td>
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</table>

Report Definitions:
- RL - Analyte reporting limit.
- MCL - Maximum contaminant level.
- OCL - Quality control limit.
- ND - Not detected at the reporting limit.
- D - RL increased due to sample matrix.
# LABORATORY ANALYTICAL REPORT

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Lab ID:** C11100556-001  
**Client Sample ID:** Well A4

## METALS - TOTAL

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/QCL</th>
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<th>Analysis Date / By</th>
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<tbody>
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<td>Zinc</td>
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## RADIONUCLIDES - TOTAL

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<th>RL</th>
<th>MCL/QCL</th>
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<th>Analysis Date / By</th>
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<tbody>
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<tr>
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<td>11/03/11 12:50 / pij</td>
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<td>Radium 228 precision (±)</td>
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<td>pCi/L</td>
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<td>RA-05</td>
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<tr>
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<td>pCi/L</td>
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<td>A7500-RA</td>
<td>12/01/11 08:41 / res</td>
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<td>A7500-RA</td>
<td>12/01/11 08:41 / res</td>
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## DATA QUALITY

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<tr>
<th>Qualifier</th>
<th>Result</th>
<th>Units</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
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<td>10/26/11 07:11 / kbh</td>
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**Report Definitions:**
- **RL** - Analyte reporting limit.
- **QCL** - Quality control limit.
- **MCL** - Maximum contaminant level.
- **ND** - Not detected at the reporting limit.
- **MDC** - Minimum detectable concentration
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

### Analyte Summary

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<th>Qual</th>
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**Method:** A2320 B  
**Sample ID:** MBLK  
**Method Blank**  
Alkalinity, Total as CaCO3: ND mg/L  
Carbonate as CO3: ND mg/L  
Bicarbonate as HCO3: 2 mg/L

**Sample ID:** LCS-6465  
**Laboratory Control Sample**  
Alkalinity, Total as CaCO3: 191 mg/L

**Sample ID:** C11100556-001CDUP  
**Sample Duplicate**  
Alkalinity, Total as CaCO3: 144 mg/L  
Carbonate as CO3: ND mg/L  
Bicarbonate as HCO3: 175 mg/L

**Sample ID:** C11100567-001AMS  
**Sample Matrix Spike**  
Alkalinity, Total as CaCO3: 354 mg/L

### Qualifiers:

- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556  
**Prepared by Casper, WY Branch**

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**Qualifiers:**

RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report

#### Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project

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#### Qualifiers:

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration.
- **ND** - Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

### Analyte Summary

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- Matrix spike recoveries outside the acceptance range are considered matrix-related.

### Qualifiers:

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **ND** - Not detected at the reporting limit.
- **S** - Spike recovery outside of advisory limits.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Report Date:** 12/01/11  
**Work Order:** C11100556

#### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPDLimit Qual

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#### Sample ID: ICV 5 Initial Calibration Verification Standard

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#### Sample ID: ICSA 5 Interference Check Sample A

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#### Method: E200.7

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#### Sample ID: MB-111016A 5 Method Blank

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#### Sample ID: C11100608-005BMS2 5 Sample Matrix Spike

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#### Sample ID: C11100608-005BMSD 5 Sample Matrix Spike Duplicate

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**Qualifiers:**

- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **A** - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.
- **MDC** - Minimum detectable concentration
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556  

### Analyte Summary

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### Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration

**Batch:** R152190  
**Analytical Run:** ICP2-C_111103A  

**Sample ID:** MB-111103A  
**Sample Matrix Spike:**  
**Result:**  
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**Low Limit:**  
**High Limit:**  
**RPD:**  
**RPD Limits:**  
**Qual:**  

**Sample ID:** LFB-111103A  
**Laboratory Fortified Blank:**  
**Result:**  
**Units:**  
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**%REC:**  
**Low Limit:**  
**High Limit:**  
**RPD:**  
**RPD Limits:**  
**Qual:**  

**Sample ID:** C11100556-001EMS2  
**Sample Matrix Spike:**  
**Result:**  
**Units:**  
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**%REC:**  
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**RPD Limits:**  
**Qual:**  

**Sample ID:** C11100556-001EMS2  
**Sample Matrix Spike Duplicate:**  
**Result:**  
**Units:**  
**RL:**  
**%REC:**  
**Low Limit:**  
**High Limit:**  
**RPD:**  
**RPD Limits:**  
**Qual:**  

**Report:** Page 12 of 23
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

## Analyte Summary

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### Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPDLimit Qual

#### Method: E200.8
**Sample ID:** LCB 16 Initial Calibration Verification Standard
**Analytical Run:** ICPMS2-C_111118A

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#### Method: E200.8
**Sample ID:** LRB 16 Method Blank
**Run:** ICPMS2-C_111118A

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#### Sample ID: LFB 16 Laboratory Fortified Blank
**Run:** ICPMS2-C_111118A

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
## QA/QC Summary Report

Prepared by Casper, WY Branch

### Client: Lidstone and Associates

### Project: Burns Level II Project

**Report Date:** 12/01/11  
**Work Order:** C11100556

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**Qualifiers:**

- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project  
**Report Date:** 12/01/11  
**Work Order:** C11100556

### Analyte Count Result

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- **RL:** Analyte reporting limit.
- **ND:** Not detected at the reporting limit.
- **MDC:** Minimum detectable concentration

**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration

**Analytical Run:** CVAA_C203_111026A

**Method Blank:**

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**Batch:** 31713

**Analytical Run:** CVAA_C203_111026A

**Run:** CVAA_C203_111026A

**Analysis Date:**

- Run: CVAA_C203_111026A 10/26/11 11:07
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- Run: CVAA_C203_111026A 10/26/11 11:13
- Run: CVAA_C203_111026A 10/26/11 11:14
- Run: CVAA_C203_111026A 10/26/11 11:17
- Run: CVAA_C203_111026A 10/26/11 11:18
# QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project

**Report Date:** 12/01/11  
**Work Order:** C11100556

## Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

### Method: E300.0  
**Sample ID:** ICV102111-6  
**Count:** 3  
**Initial Calibration Verification Standard**  
Chloride 9.97 mg/L 1.0 100 90 110
Fluoride 5.13 mg/L 0.10 103 90 110
Sulfate 40.6 mg/L 1.0 102 90 110

**Method:** E300.0  
**Sample ID:** ICB102111-9  
**Count:** 3  
**Method Blank**  
Chloride ND mg/L 0.10
Fluoride 0.07 mg/L 0.01
Sulfate 0.3 mg/L 0.08

**Method:** E300.0  
**Sample ID:** LFB102111-10  
**Count:** 3  
**Laboratory Fortified Blank**  
Chloride 10.1 mg/L 1.0 101 90 110
Fluoride 5.12 mg/L 0.10 101 90 110
Sulfate 41.0 mg/L 1.0 102 90 110

**Method:** E300.0  
**Sample ID:** C11100563-001AMS  
**Count:** 3  
**Sample Matrix Spike**  
Chloride 19.4 mg/L 1.0 102 90 110
Fluoride 5.72 mg/L 0.10 105 90 110
Sulfate 59.8 mg/L 1.0 103 90 110

**Method:** E300.0  
**Sample ID:** C11100563-001AMS  
**Count:** 3  
**Sample Matrix Spike Duplicate**  
Chloride 19.4 mg/L 1.0 103 90 110 0.3 10
Fluoride 5.76 mg/L 0.10 106 90 110 0.7 10
Sulfate 59.1 mg/L 1.0 104 90 110 0.6 10

**Qualifiers:**  
RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
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<tr>
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<td>Sample ID: MBLK-1</td>
<td>Method Blank</td>
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<td>Laboratory Fortified Blank</td>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>2.03</td>
<td>mg/L</td>
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Qualifiers:

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
### QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project

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<thead>
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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
- U - Not detected at minimum detectable concentration
<table>
<thead>
<tr>
<th>Analyte</th>
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<th>%REC</th>
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- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.3 is less than the limit of 2.0. This batch is approved.

| Sample ID: C11100035-001AMS | Sample Matrix Spike | | | | | | | | | |
| Radium 226 | 33 | pCi/L | | | | | | | | |

Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
- U - Not detected at minimum detectable concentration
- R - RPD exceeds advisory limit.
### QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Level II Project

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Count</th>
<th>Result</th>
<th>Units</th>
<th>RL</th>
<th>%REC</th>
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<td>Radium 226 precision (±)</td>
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- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.2 is less than the limit of 2.0. This batch is approved.

**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
- ND - Not detected at the reporting limit.
- R - RPD exceeds advisory limit.
Workorder Receipt Checklist

Login completed by: Debra Williams
Reviewed by: BL2000/emcpike
Reviewed Date: 10/17/2011

Date Received: 10/14/2011
Received by: dw

Shipping container/cooler in good condition? Yes ☑ No ☐ Not Present ☑
Custody seals intact on shipping container/cooler? Yes ☑ No ☐ Not Present ☑
Custody seals intact on sample bottles? Yes ☑ No ☐ Not Present ☑
Chain of custody present? Yes ☑ No ☐ Not Present ☑
Chain of custody signed when relinquished and received? Yes ☑ No ☐
Chain of custody agrees with sample labels? Yes ☑ No ☐
Samples in proper container/bottle? Yes ☑ No ☐
Sample containers intact? Yes ☑ No ☐
Sufficient sample volume for indicated test? Yes ☑ No ☐
All samples received within holding time? Yes ☑ No ☐
(Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)

Container/Temp Blank temperature: 4.2°C On Ice

Water - VOA vials have zero headspace? Yes ☑ No ☐ No VOA vials submitted ☑
Water - pH acceptable upon receipt? Yes ☑ No ☐ Not Applicable ☑

Contact and Corrective Action Comments:

Split for Iron and Sulfate Reducing Bacteria. Preserved extra gallon raw bottle with 6 mL of HNO3 to pH of 2.
**Chain of Custody and Analytical Request Record**

**PLEASE PRINT** (Provide as much information as possible.)

### Company Name:
**Lipsky & Associates**

### Project Name, PWS, Permit, Etc.
**BYRNS LEVEL II Project**

### Report Mail Address:
**4925 Atlantic Way, Suite E**
**Fort Collins, CO 80525**

### Invoice Address:
**Same**

### Special Report/Formats:
- [ ] DW
- [ ] POTWWTP
- [ ] State: ________
- [ ] Other: ________

### Analysis Requested

<table>
<thead>
<tr>
<th>SAMPLE IDENTIFICATION</th>
<th>Collection Date</th>
<th>Collection Time</th>
<th>MATRIX</th>
</tr>
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<tbody>
<tr>
<td>WELL A4</td>
<td>10/13/11</td>
<td>16:15</td>
<td>W X X X X X</td>
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</table>

**Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page**

- [ ] Contact
- [ ] Rush

**Comments:**

- [ ] All Metals AS
- [ ] Total - C3531.15
- [ ] PVC AND MONATE
- [ ] CALL MARK W/ ALL QUESTIONS

**Cooler #:** 5876

**Shipped by:** FEDEX

**On Ice:** [ ] Y [ ] N

**Custody Seal:**[ ] Y [ ] N

**Intact:**[ ] Y [ ] N

**Signature Match:**[ ] Y [ ] N

---

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.enerolab.com for additional information, downloadable fee schedule, forms, and links.
Samples Well A2, Well A4, and Well A5 were received on August 10, 2012.

All samples were received and analyzed within the EPA recommended holding times, except those noted in this case narrative. Samples were analyzed using the methods outlined in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition
Methods indicated with the Monday, March 12, 2007 Federal Register, 40 CFR Part 122, 136 et al.

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.
## Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525  

**Project Name:** Burns Wells  

**Laboratory ID:** S1208195-001  

**Client Sample ID:** Well A2  

**COC:** 147319  

**Date Reported:** 8/28/2012  

**Work Order:** S1208195  

**Date Received:** 8/9/2012 12:20:00 PM  

**Date Collected:** 8/9/2012 12:20:00 PM  

**Received:** 8/10/2012 11:49:00 AM  

**Matrix:** Drinking Water  

### Analyses

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<th>Analysis Type</th>
<th>Substance</th>
<th>Result</th>
<th>Units</th>
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<th>RL</th>
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<tr>
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<td>0.008</td>
<td>mg/L</td>
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These results apply only to the samples tested.

**Qualifiers:**
- * Value exceeds Maximum Contaminant Level  
- C Calculated Value  
- H Holding times for preparation or analysis exceeded  
- L Analyzed by a contract laboratory  
- ND Not Detected at the Reporting Limit  
- S Spike Recovery outside accepted recovery limits

**RL - Reporting Limit**
- B Analyte detected in the associated Method Blank  
- E Value above quantitation range  
- J Analyte detected below quantitation limits  
- M Value exceeds Monthly Ave or MCL  
- O Outside the Range of Dilutions

Reviewed by: Wade Nieuwsma, Assistant Laboratory Manager
# ANALYTICAL QC SUMMARY REPORT

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1208195  
**Project:** Burns Wells  
**Date:** 8/28/2012

**SAMPLE TYPES**

**SDWA Rad 228**  
Sample Type: MBLK  
Units: pCi/L

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<th>RL</th>
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**Sample Type: LCS**  
Units: pCi/L

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<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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<tbody>
<tr>
<td>LCS12-227</td>
<td>08/17/12 17:36</td>
<td>Radium 228</td>
<td>10</td>
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**Sample Type: MS**  
Units: pCi/L

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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1208195-002BMS</td>
<td>08/17/12 17:36</td>
<td>Radium 228</td>
<td>11</td>
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**Sample Type: DUP**  
Units: pCi/L

<table>
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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1208195-003BDUP</td>
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<td>Radium 228</td>
<td>ND</td>
<td>1</td>
<td>ND</td>
<td></td>
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**Total Recoverable Metals by EPA 200.8 - Water**  
Sample Type: MBLK  
Units: mg/L

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<th>Sample ID</th>
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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
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</thead>
<tbody>
<tr>
<td>MB-6322</td>
<td>08/14/12 15:30</td>
<td>Uranium</td>
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<td>0.001</td>
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**Sample Type: LCS**  
Units: mg/L

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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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<tbody>
<tr>
<td>LCS-6322</td>
<td>08/14/12 15:35</td>
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<td>0.001</td>
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<td>96.1</td>
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Units: mg/L

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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
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<th>Qual</th>
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<tbody>
<tr>
<td>S1208195-002AS</td>
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<td>Uranium</td>
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<td>0.2</td>
<td>0.008</td>
<td>94.8</td>
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**Sample Type: MSD**  
Units: mg/L

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<th>RL</th>
<th>Conc</th>
<th>%RPD</th>
<th>%REC</th>
<th>% RPD Limits</th>
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<tbody>
<tr>
<td>S1208195-002AMSD</td>
<td>08/14/12 16:15</td>
<td>Uranium</td>
<td>0.199</td>
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<td>0.197</td>
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**Sample Type: DUP**  
Units: mg/L

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<th>Analyte</th>
<th>Result</th>
<th>RL</th>
<th>Ref Samp</th>
<th>%RPD</th>
<th>%REC</th>
<th>% RPD Limits</th>
<th>Qual</th>
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<tr>
<td>S1208195-001AD</td>
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<td>0.008</td>
<td>0.557</td>
<td>20</td>
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**QUALIFIERS**

- **B** Analyte detected in the associated Method Blank
- **H** Holding times for preparation or analysis exceeded
- **L** Analyzed by a contract laboratory
- **O** Outside the Range of Dilutions
- **S** Spike Recovery outside accepted recovery limits
- **E** Value above quantitation range
- **J** Analyte detected below quantitation limits
- **ND** Not Detected at the Reporting Limit
- **R** RPD outside accepted recovery limits

---

Page 2 of 2
Sample Analysis Report

Company: Lidstone & Associates Inc  
4025 Automation Way  Bldg E  
Fort Collins, CO 80525

ProjectName: Burns Wells  
Lab ID: S1208195-002  
ClientSample ID: Well A4  
COC: 147319

Date Reported: 8/28/2012  
Report ID: S1208195001  
WorkOrder: S1208195  
CollectionDate: 8/9/2012 11:50:00 AM  
DateReceived: 8/10/2012 11:49:00 AM  
FieldSampler: MS  
Matrix: Drinking Water

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
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<th>Qual</th>
<th>RL</th>
<th>Method</th>
<th>Date Analyzed/Init</th>
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</thead>
<tbody>
<tr>
<td>Metals - Total Recoverable</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Uranium</td>
<td>0.008</td>
<td>mg/L</td>
<td>0.001</td>
<td>EPA</td>
<td>200.8</td>
<td>08/14/2012 1605</td>
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<tr>
<td>Radionuclides - SDWA</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Gross Alpha</td>
<td>7.0</td>
<td>pCi/L</td>
<td>2</td>
<td>SM</td>
<td>7110 B</td>
<td>08/22/2012 1746</td>
</tr>
<tr>
<td>Gross Alpha Precision (±)</td>
<td>1.1</td>
<td>pCi/L</td>
<td>SM 7110 B</td>
<td>08/22/2012 1746</td>
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<td></td>
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<tr>
<td>Radium 226</td>
<td>ND</td>
<td>pCi/L</td>
<td>0.2</td>
<td>SM</td>
<td>7500 RA_B</td>
<td>08/20/2012 1538</td>
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<tr>
<td>Radium 226 Precision (±)</td>
<td>NA</td>
<td>pCi/L</td>
<td>SM 7500 RA_B</td>
<td>08/20/2012 1538</td>
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<td></td>
</tr>
<tr>
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<td>pCi/L</td>
<td>1</td>
<td>RA-</td>
<td>05</td>
<td>08/17/2012 1736</td>
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<tr>
<td>Radium 228 Precision (±)</td>
<td>NA</td>
<td>pCi/L</td>
<td>RA-05</td>
<td>08/17/2012 1736</td>
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<td></td>
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</tbody>
</table>

These results apply only to the samples tested.

RL - Reporting Limit

B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
M Value exceeds Monthly Ave or MCL  
O Outside the Range of Dilutions

Qualifiers:  
* Value exceeds Maximum Contaminant Level  
C Calculated Value  
H Holding times for preparation or analysis exceeded  
L Analyzed by a contract laboratory  
ND Not Detected at the Reporting Limit  
S Spike Recovery outside accepted recovery limits

Reviewed by: Wade Nieuwsma, Assistant Laboratory Manager
Sample Analysis Report

Company: Lidstone & Associates Inc
4025 Automation Way Bldg E
Fort Collins, CO 80525

Date Reported: 8/28/2012
Report ID: S1208195001

WorkOrder: S1208195
Collection Date: 8/9/2012 1:00:00 PM

Project Name: Burns Wells
Lab ID: S1208195-003
Client Sample ID: Well A5
COC: 147319

Date Received: 8/10/2012 11:49:00 AM
Field Sampler: MS

Comments

<table>
<thead>
<tr>
<th>Metals - Total Recoverable</th>
<th>Result</th>
<th>Units</th>
<th>Qual</th>
<th>RL</th>
<th>Method</th>
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<tr>
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<td>mg/L</td>
<td>0.001</td>
<td>EPA 200.B</td>
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<td>MS</td>
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<td>Radionuclides - SDWA</td>
<td></td>
<td></td>
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<tr>
<td>Gross Alpha</td>
<td>9.6</td>
<td>pCi/L</td>
<td>2</td>
<td>SM 7110 B</td>
<td>08/22/2012 1746</td>
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<tr>
<td>Gross Alpha Precision (+)</td>
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<tr>
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<td>Radium 226 Precision (+)</td>
<td>NA</td>
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<td>RA-05</td>
<td>08/17/2012 1736</td>
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These results apply only to the samples tested.

RL - Reporting Limit

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<tr>
<td>C</td>
<td>Calculated Value</td>
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<tr>
<td>H</td>
<td>Holding times for preparation or analysis exceeded</td>
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<tr>
<td>L</td>
<td>Analyzed by a contract laboratory</td>
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<tr>
<td>ND</td>
<td>Not Detected at the Reporting Limit</td>
</tr>
<tr>
<td>S</td>
<td>Spike Recovery outside accepted recovery limits</td>
</tr>
<tr>
<td>B</td>
<td>Analyte detected in the associated Method Blank</td>
</tr>
<tr>
<td>E</td>
<td>Value above quantitation range</td>
</tr>
<tr>
<td>J</td>
<td>Analyte detected below quantitation limits</td>
</tr>
<tr>
<td>M</td>
<td>Value exceeds Monthly Ave or MCL</td>
</tr>
<tr>
<td>O</td>
<td>Outside the Range of Dilutions</td>
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Reviewed by: Wade Nieuwsma, Assistant Laboratory Manager
**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1208195  
**Project:** Burns Wells  
**Date:** 8/28/2012  
**Report ID:** S1208195001

### SDWA Gross Alpha, Beta by SM 7110B

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<thead>
<tr>
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<th>Units</th>
<th>Sample ID</th>
<th>RunNo</th>
<th>Analyte</th>
<th>Result</th>
<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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<tbody>
<tr>
<td>MBLK</td>
<td>pCi/L</td>
<td>MB12-234</td>
<td>08/22/12 17:46</td>
<td>Gross Alpha</td>
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<td>08/22/12 17:46</td>
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<td>107</td>
<td>80 - 120</td>
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<tr>
<td>DUP</td>
<td>pCi/L</td>
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<td>Gross Alpha</td>
<td>9</td>
<td>2</td>
<td>7</td>
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### SDWA Radium 226 by SM 7500

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<th>Units</th>
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<th>RunNo</th>
<th>Analyte</th>
<th>Result</th>
<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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</thead>
<tbody>
<tr>
<td>MBLK</td>
<td>pCi/L</td>
<td>MB12-226</td>
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<td>Radium 226</td>
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<tr>
<td>LCS</td>
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<td>LCS12-226</td>
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<td>64.7 - 128</td>
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<td>pCi/L</td>
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<td>4.8</td>
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<td>5.06</td>
<td>ND</td>
<td>95.2</td>
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<td>pCi/L</td>
<td>S1208195-003BDUP</td>
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<td>ND</td>
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<td>20</td>
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### Qualifiers:
- **B** Analyte detected in the associated Method Blank  
- **E** Value above quantitation range  
- **H** Holding times for preparation or analysis exceeded  
- **J** Analyte detected below quantitation limits  
- **L** Analyzed by a contract laboratory  
- **N** Not Detected at the Reporting Limit  
- **O** Outside the Range of Dilutions  
- **R** RPD outside accepted recovery limits  
- **S** Spike Recovery outside accepted recovery limits  

Page 1 of 2
# Chain of Custody Record

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

<table>
<thead>
<tr>
<th>Client Name</th>
<th>Project Identification</th>
<th>Reporter Name</th>
<th>Telephone #</th>
<th>Chain of Custody Record</th>
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<tbody>
<tr>
<td>Littauer and Associates</td>
<td>Burn, Wells</td>
<td>Mark Stay</td>
<td>770-223-8765</td>
<td>147319</td>
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## Analyses / Parameters

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<tr>
<th>Item</th>
<th>Lab ID</th>
<th>Date Sampled</th>
<th>Time Sampled</th>
<th>Sample Identification</th>
<th>Matrix</th>
<th>Containers</th>
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<tr>
<td>1</td>
<td>51208195</td>
<td>8/9/12</td>
<td>12:00</td>
<td>Wall A2</td>
<td>DWT</td>
<td>X, X, X, X</td>
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<tr>
<td>2</td>
<td>002</td>
<td>11/30</td>
<td>11:50</td>
<td>Wall A4</td>
<td>DWT</td>
<td>X, X, X, X</td>
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<td>13/03</td>
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<td>DWT</td>
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## Lab Comments

Match and tagged as total for drinking water analysis.

## Shipping Info

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<td>UPS</td>
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<td>US Mail</td>
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<td>Hand Carried</td>
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<td>Other</td>
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<table>
<thead>
<tr>
<th>Matrix Codes</th>
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<td>Water (WT)</td>
</tr>
<tr>
<td>Soil (SL)</td>
</tr>
<tr>
<td>Solid (SD)</td>
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<tr>
<td>Filter (FT)</td>
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<td>Other (OT)</td>
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<table>
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<td>Check desired service</td>
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<tr>
<td>Standard turnaround</td>
</tr>
<tr>
<td>RUSH - 5 Working Days</td>
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<tr>
<td>URGENT - &lt; 2 Working Days</td>
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<table>
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<th>Compliance Information</th>
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<td>Compliance Monitoring?</td>
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<tr>
<td>Program (SDWA, NPDES,...)</td>
</tr>
<tr>
<td>PWSID / Permit #</td>
</tr>
<tr>
<td>Chlorinated?</td>
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</table>

**Rush & Urgent Surcharges will be applied**

Sample Disposal: Lab Check Client

---

Inter-Mountain Labs, Inc.  www.intermountainlabs.com
Rev 4.6
Appendix C

Analytically Modeled Theis Drawdown for 1-Anderson Test Well
Pumping Test Analysis Report

Project: Burns Well Level II Study
Number: WYWDC111
Client: Wyoming Water Development Commission

Location: Burns, WY
Test Conducted by: M. Stacy
Analysis Performed by: M. Stacy
Aquifer Thickness: 158.90 ft

Calculation using Theis

<table>
<thead>
<tr>
<th>Observation Well</th>
<th>Transmissivity [U.S. gal/d-ft]</th>
<th>Hydraulic Conductivity [U.S. gal/d-ft²]</th>
<th>Storage coefficient</th>
<th>Radial Distance to PW [m]</th>
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</thead>
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<tr>
<td>1-Anderson Test Well</td>
<td>$1.64 \times 10^4$</td>
<td>$1.03 \times 10^2$</td>
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<td>0.14</td>
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</tbody>
</table>
Location: Burns, WY
Test Conducted by: M. Stacy
Analysis Performed by: M. Stacy
Aquifer Thickness: 158.90 ft

Calculation using Theis

<table>
<thead>
<tr>
<th>Observation Well</th>
<th>Transmissivity [U.S. gal/d-ft]</th>
<th>Hydraulic Conductivity [U.S. gal/d-ft^2]</th>
<th>Storage coefficient</th>
<th>Radial Distance to PW (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well A2</td>
<td>$4.08 \times 10^4$</td>
<td>$2.57 \times 10^2$</td>
<td>$1.00 \times 10^{-4}$</td>
<td>969.99</td>
</tr>
<tr>
<td>Well A4</td>
<td>$8.96 \times 10^4$</td>
<td>$5.64 \times 10^3$</td>
<td>$1.00 \times 10^{-4}$</td>
<td>938.06</td>
</tr>
<tr>
<td>Average</td>
<td>$6.52 \times 10^4$</td>
<td>$4.10 \times 10^2$</td>
<td>$1.00 \times 10^{-4}$</td>
<td></td>
</tr>
</tbody>
</table>
**Pumping Test Analysis Report**

**Project:** Burns Well Level II Study  
**Number:** WYWDC111  
**Client:** Wyoming Water Development Commission

**Location:** Burns, WY  
**Pumping Test:** Projected DD 1, 5, 10, & 20 yrs  
**Pumping Well:** 1-Anderson Test Well  
**Test Date:** 11/20/2012

**Aquifer Thickness:** 158.90 ft  
**Discharge Rate:** 150 [U.S. gal/min]

<table>
<thead>
<tr>
<th>Analysis Name</th>
<th>Analysis Performed by</th>
<th>Analysis Date</th>
<th>Method name</th>
<th>Well</th>
<th>T [U.S. gal/d-ft]</th>
<th>K [U.S. gal/d-ft²]</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Projected DD 1-Anderson</td>
<td>M. Stacy</td>
<td>11/20/2012</td>
<td>Theis</td>
<td>1-Anderson Test Well</td>
<td>$1.64 \times 10^4$</td>
<td>$1.03 \times 10^2$</td>
<td></td>
</tr>
<tr>
<td>2 Projected DD Nearby</td>
<td>W. M. Stacy</td>
<td>11/20/2012</td>
<td>Theis</td>
<td>Well A2</td>
<td>$4.08 \times 10^4$</td>
<td>$2.57 \times 10^2$</td>
<td>$1.00 \times 10^4$</td>
</tr>
<tr>
<td>3 Projected DD Nearby</td>
<td>W. M. Stacy</td>
<td>11/20/2012</td>
<td>Theis</td>
<td>Well A4</td>
<td>$8.96 \times 10^4$</td>
<td>$5.64 \times 10^2$</td>
<td>$1.00 \times 10^4$</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
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<td></td>
<td>$4.89 \times 10^4$</td>
<td>$3.08 \times 10^2$</td>
<td>$1.00 \times 10^4$</td>
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</tbody>
</table>
Appendix D

1-Anderson Test Well Water Quality Analytical Reports
ANALYTICAL SUMMARY REPORT

August 30, 2012

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO 80525

Workorder No.: C12080055          Quote ID: C3836 - WWDC
Project Name: WWDC Burns Level II

Energy Laboratories, Inc. Casper WY received the following 1 sample for Lidstone and Associates on 8/2/2012 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12080055-001</td>
<td>Anderson Test Well</td>
<td>08/01/12 9:00</td>
<td>08/02/12</td>
<td>Aqueous</td>
<td>Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Acidity, Total as CaCO3, Alkalinity, QA Calculations, Bacteria, Iron Related</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bacteria, SDWA, Cyanide, SDWA, Color, Conductivity, Mercury, Drinking Water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mercury Analysis Prep, Sample Filtering, Fluoride, Foaming Agents, E515.1 Chlorinated Herbicides</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hardness, E300.0 Anions, Langelier Index, Nitrogen, Nitrite, Nitrogen, Nitrate + Nitrite, Odor, pH, pH</td>
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<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Mercury Preparation by EPA 200.2, 504 sample microextraction, E504 Pesticides, Pesticides, Carbamates SDWA</td>
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<tr>
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<td></td>
<td>Gross Alpha, Gross Beta, Radium 226 + Radium 228, Radium 226, Total, Radium 228, Total</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solids, Total Dissolved, Solids, Total Dissolved - Calculated, Solids, Total Suspended</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>525-Semi-Volatile Organic Compounds, SDWA, Turbidity, E524.2 SDWA VOCs</td>
</tr>
</tbody>
</table>
The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these test results, please call.

Report Approved By:  

[Signature]
Reporting Supervisor

Digitally signed by
Stephanie Waldrop
Date: 2012.08.31 10:16:30 -06:00
BRANCH LABORATORY SUBCONTRACT ANALYSIS
Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.
LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: WWDC Burns Level II
Lab ID: C12080055-001
Client Sample ID: Anderson Test Well

Report Date: 08/30/12
Collection Date: 08/01/12 09:00
Date Received: 08/02/12

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<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qualifiers RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
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<tr>
<td>Bacteria, Iron Related</td>
<td>4.3</td>
<td>CFU/ml</td>
<td>1.0</td>
<td>IRB-BART</td>
<td>08/02/12 12:16 / mkf</td>
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<td>MAJOR IONS</td>
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<tr>
<td>Acidity, Total as CaCO3</td>
<td>7</td>
<td>mg/L</td>
<td>5</td>
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<tr>
<td>Alkalinity, Total as CaCO3</td>
<td>148</td>
<td>mg/L</td>
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<td>08/02/12 17:47 / jba</td>
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<tr>
<td>Carbonate as CO3</td>
<td>ND</td>
<td>mg/L</td>
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<td>Bicarbonate as HCO3</td>
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<td>1</td>
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<tr>
<td>Calcium</td>
<td>53</td>
<td>mg/L</td>
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<tr>
<td>Chloride</td>
<td>4</td>
<td>mg/L</td>
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<tr>
<td>Fluoride</td>
<td>0.6</td>
<td>mg/L</td>
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<td>A4500-F C</td>
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<td>Nitrogen, Nitrate+Nitrite as N</td>
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<td>Nitrogen, Nitrite as N</td>
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<td>Silica</td>
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<td>Sodium</td>
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<td>mg/L</td>
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<td>08/24/12 15:44 / sf</td>
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<tr>
<td>Sulfate</td>
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<td>mg/L</td>
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<tr>
<td>NON-METALS</td>
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<tr>
<td>Cyanide, Total</td>
<td>ND</td>
<td>mg/L</td>
<td>0.005</td>
<td>Kelada-01</td>
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<td>PHYSICAL PROPERTIES</td>
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<tr>
<td>Color</td>
<td>ND</td>
<td>c.u.</td>
<td>5.0</td>
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<td>08/02/12 14:32 / ab</td>
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<tr>
<td>Conductivity @ 25 C</td>
<td>354</td>
<td>umhos/cm</td>
<td>1</td>
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<tr>
<td>Hardness as CaCO3</td>
<td>156</td>
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<td>1</td>
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<td>08/06/12 21:41 / kbh</td>
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<tr>
<td>Odor</td>
<td>NOO</td>
<td>T.O.N.</td>
<td>1</td>
<td>A2150 B</td>
<td>08/02/12 14:41 / ab</td>
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<tr>
<td>pH</td>
<td>7.87</td>
<td>s.u.</td>
<td>H</td>
<td>A4500-H B</td>
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<tr>
<td>Solids, Total Dissolved TDS @ 180 C</td>
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<td>10</td>
<td>A2540 C</td>
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<tr>
<td>Solids, Total Suspended TSS @ 105 C</td>
<td>ND</td>
<td>mg/L</td>
<td>4</td>
<td>A2540 D</td>
<td>08/03/12 11:31 / jz</td>
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<tr>
<td>Turbidity</td>
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<td>NTU</td>
<td>0.1</td>
<td>A2130 B</td>
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<tr>
<td>MBAS, calculated as LAS, MW 342</td>
<td>&lt; 1.0</td>
<td>mg/L</td>
<td>1.0</td>
<td>A5540 C</td>
<td>08/02/12 13:16 / jba</td>
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<tr>
<td>- NOO = No odor observed.</td>
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<tr>
<td>- Color measured at pH 7.19.</td>
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</tr>
<tr>
<td>METALS - TOTAL</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
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<tr>
<td>Antimony</td>
<td>ND</td>
<td>mg/L</td>
<td>0.001</td>
<td>E200.8</td>
<td>08/06/12 13:59 / eli-b</td>
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<tr>
<td>Arsenic</td>
<td>0.003</td>
<td>mg/L</td>
<td>0.001</td>
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<td>08/06/12 13:59 / eli-b</td>
<td></td>
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<tr>
<td>Barium</td>
<td>ND</td>
<td>mg/L</td>
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<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
<td></td>
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<tr>
<td>Beryllium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.001</td>
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<td>08/06/12 13:59 / eli-b</td>
<td></td>
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<tr>
<td>Boron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.1</td>
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<tr>
<td>Cadmium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.001</td>
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<tr>
<td>Chromium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
<td></td>
</tr>
</tbody>
</table>

Definitions:
- RL - Analyte reporting limit.
- QCL - Quality control limit.
- H - Analysis performed past recommended holding time.
- MCL - Maximum contaminant level.
- ND - Not detected at the reporting limit.
LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: WWDC Burns Level II
Lab ID: C12080055-001
Client Sample ID: 1-Anderson Test Well

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qualifiers</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
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<tbody>
<tr>
<td>METALS - TOTAL</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01 1.3</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
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<tr>
<td>Iron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.03 0.3</td>
<td>E200.7</td>
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</tr>
<tr>
<td>Lead</td>
<td>ND</td>
<td>mg/L</td>
<td>0.001 0.015</td>
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<tr>
<td>Manganese</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01 0.05</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
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</tr>
<tr>
<td>Mercury</td>
<td>ND</td>
<td>mg/L</td>
<td>0.0001 0.002</td>
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<td>08/07/12 11:40 / eli-b</td>
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<tr>
<td>Nickel</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
<td></td>
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</tr>
<tr>
<td>Selenium</td>
<td>0.002</td>
<td>mg/L</td>
<td>0.001 0.05</td>
<td>E200.8</td>
<td>08/06/12 13:59 / eli-b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01 0.1</td>
<td>E200.7</td>
<td>08/06/12 21:41 / eli-b</td>
<td></td>
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<tr>
<td>Thallium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.0004 0.002</td>
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<td>08/06/12 13:59 / eli-b</td>
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<tr>
<td>Uranium</td>
<td>0.0067</td>
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<td>E200.8</td>
<td>08/06/12 13:59 / eli-b</td>
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</tr>
<tr>
<td>Zinc</td>
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<td>mg/L</td>
<td>0.01 5</td>
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<td>RADIONUCLIDES - TOTAL</td>
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<tr>
<td>Gross Alpha</td>
<td>6.1</td>
<td>pCi/L</td>
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<td>08/11/12 13:46 / lbh</td>
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<tr>
<td>Gross Alpha precision (±)</td>
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<td>pCi/L</td>
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<td>E900.0</td>
<td>08/11/12 13:46 / lbh</td>
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</tr>
<tr>
<td>Gross Alpha MDC</td>
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<td>E900.0</td>
<td>08/11/12 13:46 / lbh</td>
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<tr>
<td>Gross Beta</td>
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<td>pCi/L</td>
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<td>E900.0</td>
<td>08/11/12 13:46 / lbh</td>
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<tr>
<td>Gross Beta precision (±)</td>
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<td>pCi/L</td>
<td></td>
<td>E900.0</td>
<td>08/11/12 13:46 / lbh</td>
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<tr>
<td>Gross Beta MDC</td>
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<tr>
<td>Radium 226</td>
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DATA QUALITY

| A/C Balance (± 5)          | 2.73   | %     | A1030 E 08/28/12 10:18 / kbb |
| Anions                    | 3.67   | meq/L | A1030 E 08/28/12 10:18 / kbb |
| Cations                   | 3.87   | meq/L | A1030 E 08/28/12 10:18 / kbb |
| Solids, Total Dissolved Calculated | 250 | mg/L | A1030 E 08/28/12 10:18 / kbb |
| TDS Balance (0.80 - 1.20) | 1.03   |       | A1030 E 08/28/12 10:18 / kbb |

VOLATILE ORGANIC COMPOUNDS

| 1,1,1,2-Tetrachloroethane | ND | ug/L | 0.50 | E524.2 | 08/04/12 05:51 / jk |
| 1,1,1-Trichloroethane       | ND | ug/L | 0.50 200 | E524.2 | 08/04/12 05:51 / jk |
| 1,1,2,2-Tetrachloroethane   | ND | ug/L | 0.50 | E524.2 | 08/04/12 05:51 / jk |
| 1,1,2-Trichloroethane       | ND | ug/L | 0.50 5 | E524.2 | 08/04/12 05:51 / jk |
| 1,1-Dichloroethane          | ND  | ug/L | 0.50 | E524.2 | 08/04/12 05:51 / jk |
| 1,1-Dichloroethene          | ND  | ug/L | 0.50 7 | E524.2 | 08/04/12 05:51 / jk |

Report Definitions:
- RL - Analyte reporting limit.
- MCL - Maximum contaminant level.
- QCL - Quality control limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Lab ID:** C12080055-001  
**Client Sample ID:** 1-Anderson Test Well  
**Report Date:** 08/30/12  
**Collection Date:** 08/01/12 09:00  
**DateReceived:** 08/02/12  
**Matrix:** Aqueous

## VOLATILE ORGANIC COMPOUNDS

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<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qualifiers</th>
<th>RL</th>
<th>MCL/ QCL</th>
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**Report Definitions:**  
RL - Analyte reporting limit.  
QCL - Quality control limit.  
MCL - Maximum contaminant level.  
ND - Not detected at the reporting limit.
## LABORATORY ANALYTICAL REPORT

**Report Date:** 08/30/12  
**Collection Date:** 08/01/12 09:00  
**Date Received:** 08/02/12  
**Prepared by:** Casper, WY Branch

### Analyses

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Lab ID:** C12080055-001  
**Client Sample ID:** 1-Anderson Test Well

### VOLATILE ORGANIC COMPOUNDS

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<th>Compound</th>
<th>Result</th>
<th>Units</th>
<th>Qualifiers</th>
<th>RL</th>
<th>Method</th>
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### SYNTHETIC ORGANIC COMPOUNDS - PESTICIDES

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### SYNTHETIC ORGANIC COMPOUNDS - HERBICIDES

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### SEMI-VOLATILE ORGANIC COMPOUNDS

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**Report Definitions:**  
RL - Analyte reporting limit.  
MCL - Maximum contaminant level.  
QCL - Quality control limit.  
ND - Not detected at the reporting limit.
**LABORATORY ANALYTICAL REPORT**

Prepared by Casper, WY Branch

Client: Lidstone and Associates  
Project: WWDC Burns Level II  
Lab ID: C12080055-001  
Client Sample ID: 1-Anderson Test Well

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- Note: The federal MCL for total PCB's is 0.5 ug/L as Decachlorobiphenyl (DCB). PCB screening at the reporting limits given for the individual Aroclors meets or exceeds federal and state requirements for "Total PCB" monitoring if Aroclors are not detected.

**SYNTHETIC ORGANIC COMPOUNDS - PESTICIDES, CARBAMATES**

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<th>Result</th>
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</table>

**LANGELIER INDEX**

| Corrosivity | 0.31 | unitless | A2330 B | 08/28/12 10:18 / kbb |

**Report Definitions:**  
RL - Analyte reporting limit.  
MCL - Maximum contaminant level.  
QCL - Quality control limit.  
ND - Not detected at the reporting limit.
**MICROBIOLOGICAL**

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Comments: The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.

The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration

**Report Date:** 08/30/12
**Work Order:** C12080055
**Batch:** R162733

Color measured at pH 5.32.
Color measured at pH 3.76.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  

**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
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# QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

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**Report Date:** 08/30/12  
**Work Order:** C12080055
### Analyte Counts and Results

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QA/QC Summary Report
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: WWDC Burns Level II

Report Date: 08/30/12
Work Order: C12080055

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Report Date: 08/30/12
Work Order: C12080055

Page 15 of 51
### QA/QC Summary Report

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**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Report Order:** C12080055

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**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
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**Method:** E200.7

**Sample ID: MB-120824A**

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**Sample ID: LFB-120824A**

**Laboratory Fortified Blank**

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**Sample ID: C12070723-025CMS2**

**Sample Matrix Spike**

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**Sample ID: C12070723-025CMSD**

**Sample Matrix Spike Duplicate**

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**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.
- MDC - Minimum detectable concentration
**QA/QC Summary Report**

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
# QA/QC Summary Report
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: WWDC Burns Level II

Report Date: 08/30/12
Work Order: C12080055

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| **Method: E200.7** |       |        |       |    |      |           |            |     |           |      |
| **Sample ID: MB-6500DIS120806A** | Method Blank | 11 | 5.49 mg/L | 0.10 | 110 | 85 | 115 |     |           |      |
| Aluminum         |       |        |       |    |      |           |            |     |           |      |
| Barium           |       |        |       |    |      |           |            |     |           |      |
| Boron            |       |        |       |    |      |           |            |     |           |      |
| Cadmium          |       | 0.506 mg/L | 0.10 | 101 | 85 | 115 |     |           |      |
| Chromium         |       | 1.05 mg/L | 0.10 | 102 | 85 | 115 |     |           |      |
| Copper           |       | 1.06 mg/L | 0.10 | 106 | 85 | 115 |     |           |      |
| Iron             |       | 5.36 mg/L | 0.10 | 107 | 85 | 115 |     |           |      |
| Manganese        |       | 5.30 mg/L | 0.10 | 106 | 85 | 115 |     |           |      |
| Nickel           |       | 1.02 mg/L | 0.10 | 102 | 85 | 115 |     |           |      |
| Silver           |       | 0.484 mg/L | 0.10 | 99 | 85 | 115 |     |           |      |
| Zinc             |       | 1.06 mg/L | 0.10 | 106 | 85 | 115 |     |           |      |

| **Sample ID: LFB-6500DIS120806A** | Laboratory Fortified Blank | 11 | 10 mg/L | 0.041 | 102 | 70 | 130 |     |           |      |
| Aluminum         |       |        |       |    |      |           |            |     |           |      |
| Barium           |       |        |       |    |      |           |            |     |           |      |
| Boron            |       |        |       |    |      |           |            |     |           |      |
| Cadmium          |       | 0.94 mg/L | 0.0010 | 94 | 70 | 130 |     |           |      |
| Chromium         |       | 1.9 mg/L | 0.0050 | 97 | 70 | 130 |     |           |      |
| Copper           |       | 2.0 mg/L | 0.010 | 98 | 70 | 130 |     |           |      |
| Iron             |       | 10 mg/L | 0.030 | 102 | 70 | 130 |     |           |      |

Qualifiers:

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MDC - Minimum detectable concentration
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Report Date:** 08/30/12  
**Project:** WWDC Burns Level II  
**Work Order:** C12080055

---

**Analyte** | **Count** | **Result** | **Units** | **RL** | **%REC** | **Low Limit** | **High Limit** | **RPD** | **RPDLimit** | **Qual**
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
Method: E200.7 | | | | | | | | | | | Batch: B_B189606

**Sample ID:** B12080414-002AMS2  
11 Sample Matrix Spike  
Run: SUB-B189606  
08/06/12 21:52

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**Sample ID:** B12080414-002AMSD  
11 Sample Matrix Spike Duplicate  
Run: SUB-B189606  
08/06/12 21:56

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## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Report Date:** 08/30/12  
**Work Order:** C12080055

### Analyte Summary Report

**Prepared by:** Casper, WY Branch

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#### Method: E200.8

**Sample ID:** QCS  
**Initial Calibration Verification Standard**  
**Analytical Run:** SUB-B189636

- **Antimony:** 0.0518 mg/L  
- **Arsenic:** 0.0502 mg/L  
- **Beryllium:** 0.0260 mg/L  
- **Lead:** 0.0504 mg/L  
- **Selenium:** 0.0508 mg/L  
- **Thallium:** 0.0503 mg/L  
- **Uranium:** 0.0192 mg/L

**Sample ID:** LRB  
**Method Blank**  
**Run:** SUB-B189636

- **Antimony:** ND  
- **Arsenic:** 0.0005 mg/L  
- **Beryllium:** ND  
- **Lead:** ND  
- **Selenium:** 0.0009 mg/L  
- **Thallium:** ND  
- **Uranium:** ND

**Sample ID:** LFB  
**Laboratory Fortified Blank**  
**Run:** SUB-B189636

- **Antimony:** 0.0493 mg/L  
- **Arsenic:** 0.0503 mg/L  
- **Beryllium:** 0.0504 mg/L  
- **Lead:** 0.0512 mg/L  
- **Selenium:** 0.0495 mg/L  
- **Thallium:** 0.0512 mg/L  
- **Uranium:** 0.0517 mg/L

**Sample ID:** B12072150-001BMS  
**Sample Matrix Spike**  
**Run:** SUB-B189636

- **Antimony:** 0.051 mg/L  
- **Arsenic:** 0.052 mg/L  
- **Beryllium:** 0.050 mg/L  
- **Lead:** 0.053 mg/L  
- **Selenium:** 0.052 mg/L  
- **Thallium:** 0.053 mg/L  
- **Uranium:** 0.054 mg/L

**Sample ID:** B12072150-001BMSD  
**Sample Matrix Spike Duplicate**  
**Run:** SUB-B189636

- **Antimony:** 0.049 mg/L  
- **Arsenic:** 0.051 mg/L  
- **Beryllium:** 0.047 mg/L  
- **Lead:** 0.050 mg/L  
- **Selenium:** 0.050 mg/L  
- **Thallium:** 0.051 mg/L  
- **Uranium:** 0.051 mg/L

**Qualifiers:**

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## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPDLimit Qual

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### Qualifiers:
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## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  

### Analyte Summary Report

**Prepared by:** Casper, WY Branch  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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<th>%REC</th>
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<th>RPD</th>
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| **Method:** E300.0  |       |        |       |    |      |           |            |     |          |      |
| **Sample ID:** ICB-082312-11 | 2  | Method Blank |  | 0.03 | mg/L | 0.03 |     |      |      |
| Chloride           | 0.03  | mg/L   | 0.03  |    |      |           |            |     |          |      |
| Sulfate            | 0.2   | mg/L   | 0.10  |    |      |           |            |     |          |      |

| **Sample ID:** LFB-082312-13 | 2  | Laboratory Fortified Blank |  | 9.75 | mg/L | 1.0 | 97 | 90 | 110 |      |
| Chloride           | 9.75  | mg/L  | 1.0   | 97 | 90   | 110       |            |     |          |      |
| Sulfate            | 39.1  | mg/L   | 1.0   | 97 | 90   | 110       |            |     |          |      |

| **Sample ID:** LFBD-082312-14 | 2  | Laboratory Fortified Blank Duplicate |  | 9.72 | mg/L | 1.0 | 97 | 90 | 110 | 0.3 | 10  |
| Chloride           | 9.72  | mg/L  | 1.0   | 97 | 90   | 110       | 0.3        | 10 |          |      |
| Sulfate            | 39.1  | mg/L   | 1.0   | 97 | 90   | 110       |            |     |          |      |

| **Sample ID:** C12080055-001AMS | 2  | Sample Matrix Spike |  | 13.9 | mg/L | 1.0 | 99 | 90 | 110 |      |
| Chloride           | 13.9  | mg/L  | 1.0   | 99 | 90   | 110       |            |     |          |      |
| Sulfate            | 56.6  | mg/L   | 1.0   | 104| 90   | 110       |            |     |          |      |

| **Sample ID:** C12080055-001AMSD | 2  | Sample Matrix Spike Duplicate |  | 14.2 | mg/L | 1.0 | 101| 90 | 110 | 1.8 | 10  |
| Chloride           | 14.2  | mg/L  | 1.0   | 101| 90   | 110       | 1.8        | 10 |          |      |
| Sulfate            | 57.6  | mg/L   | 1.0   | 107| 90   | 110       |            |     |          |      |

### Qualifiers:

- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **MDC** - Minimum detectable concentration
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

**Analyte** | **Count** | **Result** | **Units** | **RL** | **%REC** | **Low Limit** | **High Limit** | **RPD** | **RPD Limit** | **Qual** | **Batch** | **Run** | **Date** |
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
Method: E353.2  
Sample ID: MBLK-1  
Nitrogen, Nitrate+Nitrite as N | Method Blank | ND | mg/L | 0.06 | Run: TECHNICON_120802A | 08/02/12 11:20 |  
Sample ID: LCS-2  
Nitrogen, Nitrate+Nitrite as N | Laboratory Control Sample | 2.55 | mg/L | 0.10 | 102 | 90 | 110 | Run: TECHNICON_120802A | 08/02/12 11:22 |  
Sample ID: LFB-3  
Nitrogen, Nitrate+Nitrite as N | Laboratory Fortified Blank | 2.03 | mg/L | 0.10 | 104 | 90 | 110 | Run: TECHNICON_120802A | 08/02/12 11:25 |  
Sample ID: C12080033-001CMS  
Nitrogen, Nitrate+Nitrite as N | Sample Matrix Spike | 2.41 | mg/L | 0.10 | 107 | 90 | 110 | Run: TECHNICON_120802A | 08/02/12 13:17 |  
Sample ID: C12080033-001CMSD  
Nitrogen, Nitrate+Nitrite as N | Sample Matrix Spike Duplicate | 2.40 | mg/L | 0.10 | 106 | 90 | 110 | 0.4 | 10 | Run: TECHNICON_120802A | 08/02/12 13:20 |  

**Qualifiers:**  
RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
Client: Lidstone and Associates

Project: WWDC Burns Level II

Report Date: 08/30/12

Work Order: C12080055

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Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- S - Spike recovery outside of advisory limits.
- ND - Not detected at the reporting limit.
- R - RPD exceeds advisory limit.
### Analyte Method: E515.1

#### Sample ID: MB-64373

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Surr: DCAA

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<th>Qual</th>
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### Qualifiers:

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- S - Spike recovery outside of advisory limits.
### QA/QC Summary Report
Prepared by Casper, WY Branch

Client: Lidstone and Associates  
Project: WWDC Burns Level II  
Report Date: 08/30/12  
Work Order: C12080055

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<td>Dinozep</td>
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**Sample Matrix Spike**  
Run: SUB-B189845  
08/07/12 22:47

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**Sample Matrix Spike Duplicate**  
Run: SUB-B189845  
08/07/12 23:20

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<tr>
<td>Dalapon</td>
<td>0.492 ug/L</td>
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</tr>
<tr>
<td>Dicamba</td>
<td>0.472 ug/L</td>
<td>0.25</td>
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<tr>
<td>Dichlorprop</td>
<td>0.460 ug/L</td>
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</tr>
<tr>
<td>Pentachlorophenol</td>
<td>0.470 ug/L</td>
<td>0.040</td>
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<td>Picloram</td>
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<tr>
<td>Surr: DCAA</td>
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**Continuing Calibration Verification Standard**  
08/07/12 11:44

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<tr>
<td>Surr: DCAA</td>
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**Continuing Calibration Verification Standard**  
08/07/12 18:57

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<td>Dicamba</td>
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<td>Dichlorprop</td>
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**Bracketing Continuing Calibration Verification**  
08/08/12 00:26

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**Terminal Continuing Calibration Verification**

**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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### Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
**QA/QC Summary Report**  
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

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**Qualifiers:**

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **%REC** - Relative percent recovery.
- **Low Limit** - Lower limit of detection.
- **High Limit** - Upper limit of detection.
- **RPD** - Relative percent deviation.
- **RPDLimit** - Reporting limit.
- **Qual** - Quality control.

- **ND** - Not detected at the reporting limit.
- **S** - Spike recovery outside of advisory limits.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

### Analyte Counts

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**Date:** 08/03/12 22:33

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**Qualifiers:**  
- RL: Analyte reporting limit.  
- MDC: Minimum detectable concentration  
- ND: Not detected at the reporting limit.  
- S: Spike recovery outside of advisory limits.
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#### Sample ID: C12080065-001AMSD

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#### Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration.
- ND - Not detected at the reporting limit.
- S - Spike recovery outside of advisory limits.
**QA/QC Summary Report**
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
RL - Analyte reporting limit.  
MDG - Minimum detectable concentration  
S - Spike recovery outside of advisory limits.  
ND - Not detected at the reporting limit.  
R - RPD exceeds advisory limit.
Client: Lidstone and Associates
Project: WWDC Burns Level II

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**Qualifiers:**
- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **ND** - Not detected at the reporting limit.
- **S** - Spike recovery outside of advisory limits.
**QA/QC Summary Report**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Report Date:** 08/30/12  
**Work Order:** C12080055

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**MDC:** Minimum detectable concentration  
**RL:** Analyte reporting limit  
**%REC:** % of reporting limit

**Surr:**
- 87: 70 130
- 86: 70 130
- 101: 70 130

**Qualifiers:**
- **RL:** Analyte reporting limit.
- **ND:** Not detected at the reporting limit.
- **MDC:** Minimum detectable concentration

---

Page 39 of 51
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

### Client: Lidstone and Associates

### Project: WWDC Burns Level II

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#### Qualifiers:

- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **MDC** - Minimum detectable concentration.

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Page 40 of 51
# QA/QC Summary Report

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**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
- S - Spike recovery outside of advisory limits.
# QA/QC Summary Report

Prepared by Casper, WY Branch

## Client: Lidstone and Associates

**Project:** WWDC Burns Level II

**Report Date:** 08/30/12

**Report**

**Method:** E525.2

**Sample ID:** C12080055-001K

### 23 Sample Matrix Spike

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The internal standard recoveries in the Matrix Spike Duplicate sample (MSD) were low, which resulted in a high bias of the analyte recoveries. This also caused the relative percent differences (RPD) to be outside of control limits.

### Qualifiers:

**RL** - Analyte reporting limit.

**ND** - Not detected at the reporting limit.

**MDC** - Minimum detectable concentration

**R** - RPD exceeds advisory limit.

**S** - Spike recovery outside of advisory limits.
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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

### Analyte Method: E531.1

#### Sample ID: ICV_09r

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### Analyte Method: E531.1

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### Sample ID: LFB_11r

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### Sample ID: LFBD_12r

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### Qualifiers:

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration.
QA/QC Summary Report
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Report Date: 08/30/12
Project: WWDC Burns Level II
Work Order: C12080055

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| **Sample ID**: LFBD_12r | 11 Laboratory Fortified Blank Duplicate | Run: HPLC202-C_120809A 08/09/12 20:57 |
| Methomyl | 8.6 ug/L | 0.40 | 108 | 80 | 120 | 0.2 | 20 |
| Oxamyl    | 8.4 ug/L | 0.40 | 104 | 80 | 120 | 0.8 | 20 |
| Baygon    | 8.8 ug/L | 0.40 | 110 | 80 | 120 | 2.4 | 20 |
| Surr: BDMC | | 0.40 | 126 | 70 | 130 | 0.0 | 20 |
| **Sample ID**: C12080055-001N MS | 11 Sample Matrix Spike | Run: HPLC202-C_120809A 08/09/12 21:41 |
| Aldicarb  | 9.1 ug/L | 0.40 | 114 | 80 | 120 |
| Aldicarb sulfone | 8.4 ug/L | 0.40 | 105 | 80 | 120 |
| Aldicarb sulfoxide | 9.0 ug/L | 0.41 | 113 | 80 | 120 |
| Carbaryl  | 8.9 ug/L | 0.40 | 111 | 80 | 120 |
| Carbofuran | 9.0 ug/L | 0.40 | 113 | 80 | 120 |
| 3-Hydroxycarbofuran | 9.0 ug/L | 0.40 | 113 | 80 | 120 |
| Methiocarb | 8.9 ug/L | 0.50 | 111 | 80 | 120 |
| Methomyl  | 9.0 ug/L | 0.40 | 112 | 80 | 120 |
| Oxamyl    | 8.9 ug/L | 0.40 | 112 | 80 | 120 |
| Baygon    | 8.7 ug/L | 0.40 | 109 | 80 | 120 |
| Surr: BDMC | | 0.40 | 135 | 70 | 130 | S |
| **Sample ID**: C12080055-001N MSD | 11 Sample Matrix Spike Duplicate | Run: HPLC202-C_120809A 08/09/12 22:26 |
| Aldicarb  | 9.3 ug/L | 0.40 | 116 | 80 | 120 | 2.0 | 20 |
| Aldicarb sulfone | 8.9 ug/L | 0.40 | 111 | 80 | 120 | 5.2 | 20 |
| Aldicarb sulfoxide | 8.4 ug/L | 0.41 | 104 | 80 | 120 | 7.8 | 20 |
| Carbayl   | 9.1 ug/L | 0.40 | 114 | 80 | 120 | 2.4 | 20 |
| Carbofuran | 9.2 ug/L | 0.40 | 116 | 80 | 120 | 2.5 | 20 |
| 3-Hydroxycarbofuran | 9.2 ug/L | 0.40 | 115 | 80 | 120 | 1.4 | 20 |
| Methiocarb | 9.0 ug/L | 0.50 | 112 | 80 | 120 | 1.2 | 20 |
| Methomyl  | 9.1 ug/L | 0.40 | 114 | 80 | 120 | 1.4 | 20 |
| Oxamyl    | 9.0 ug/L | 0.40 | 113 | 80 | 120 | 1.0 | 20 |
| Baygon    | 9.1 ug/L | 0.40 | 113 | 80 | 120 | 3.7 | 20 |
| Surr: BDMC | | 0.40 | 116 | 70 | 130 | 0.0 | 20 |

Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- S - Spike recovery outside of advisory limits.
# QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

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**Qualifiers:**
- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **U** - Not detected at minimum detectable concentration
- **ND** - Not detected at the reporting limit.
- **R** - RPD exceeds advisory limit.
- **RPD** - Relative Precision Deviation
- **Qual** - Qualification

Report Date: 08/30/12  
Work Order: C12080055

The RPD for the MS/MSD pair is outside the control limits indicating a possible low precision for the batch. The individual spike recoveries are acceptable, the MB is acceptable, and the LCS is acceptable. Sample non-homogeneity or matrix effects may be responsible for the MS/MSD performance. All other QC parameters for the batch and the instrument are in control therefore the batch is approved.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Report Date:** 08/30/12  
**Work Order:** C12080055

#### Analyte Count Result Units

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| Sample ID: C12080005-002ADUP | Sample Duplicate | Run: BERTHOLD 770-1_120817B | 08/23/12 06:32 |
| Radium 226 | 0.0079 | pCi/L | 310 | 20 | UR |
| Radium 226 precision (±) | 0.088 | pCi/L | |
| Radium 226 MDC | 0.10 | pCi/L | |

- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.8 is less than the limit of 2.0. This batch is approved.

| Sample ID: C12080133-001ADUP | Sample Duplicate | Run: BERTHOLD 770-1_120817B | 08/23/12 08:04 |
| Radium 226 | 0.036 | pCi/L | 13 | 20 | U |
| Radium 226 precision (±) | 0.082 | pCi/L | |
| Radium 226 MDC | 0.11 | pCi/L | |

| Sample ID: MB-RA226DW-0082 | Method Blank | Run: BERTHOLD 770-1_120817B | 08/23/12 09:39 |
| Radium 226 | 0.06 | pCi/L | U |
| Radium 226 precision (±) | 0.1 | pCi/L | |
| Radium 226 MDC | 0.1 | pCi/L | |

| Sample ID: LCS-RA226DW-0082 | Laboratory Control Sample | Run: BERTHOLD 770-1_120817B | 08/23/12 09:39 |
| Radium 226 | 12 | pCi/L | 98 | 90 | 110 |

#### Qualifiers:
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- MDC - Minimum detectable concentration
- U - Not detected at the reporting limit.
- ND - Not detected at minimum detectable concentration
- R - RPD exceeds advisory limit.
# QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sample ID:</strong> B12080314-006GMS</td>
<td>Sample Matrix Spike Duplicate</td>
<td>0.103</td>
<td>mg/L</td>
<td>0.0050</td>
<td>103</td>
<td>90</td>
<td>110</td>
<td>08/06/12 14:15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Report Date:** 08/30/12  
**Work Order:** C12080055

**Analyte** | **Count** | **Result** | **Units** | **RL** | **%REC** | **Low Limit** | **High Limit** | **RPD** | **RPD Limit** | **Qual** | **Remarks**
---|---|---|---|---|---|---|---|---|---|---|---
**Method:** RA-05  
**Sample ID:** LCS-228-RA228DW-00  
Laboratory Control Sample  
Radium 228  
Sample 10: LCS-228-RA228DW-00  
Radium 228  
Precision ±  
MDC  
**Sample ID:** MB-228-RA228DW-00  
3 Method Blank  
Radium 228  
0.6 pCi/L  
Radium 228 precision ±  
0.8 pCi/L  
Radium 228 MDC  
0.8 pCi/L  
**Sample ID:** C12080066-002CDUP  
3 Sample Duplicate  
Radium 228  
Sample 10: C12080066-002CDUP  
Radium 228  
Precision ±  
MDC  
**Sample ID:** C12080134-001BMS  
Sample Matrix Spike  
Radium 228  
Sample 10: C12080134-001BMS  
Radium 228  
Precision ±  
MDC  
**Sample ID:** C12080367-002ADUP  
3 Sample Duplicate  
Radium 228  
Sample 10: C12080367-002ADUP  
Radium 228  
Precision ±  
MDC

**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
- ND - Not detected at the reporting limit.
- R - RPD exceeds advisory limit.

---

**Report Date:** 08/30/12  
**Work Order:** C12080055

**Analyte** | **Count** | **Result** | **Units** | **RL** | **%REC** | **Low Limit** | **High Limit** | **RPD** | **RPD Limit** | **Qual** | **Remarks**
---|---|---|---|---|---|---|---|---|---|---|---
**Method:** RA-05  
**Sample ID:** LCS-228-RA228DW-00  
Laboratory Control Sample  
Radium 228  
Sample 10: LCS-228-RA228DW-00  
Radium 228  
Precision ±  
MDC  
**Sample ID:** MB-228-RA228DW-00  
3 Method Blank  
Radium 228  
0.6 pCi/L  
Radium 228 precision ±  
0.8 pCi/L  
Radium 228 MDC  
0.8 pCi/L  
**Sample ID:** C12080066-002CDUP  
3 Sample Duplicate  
Radium 228  
Sample 10: C12080066-002CDUP  
Radium 228  
Precision ±  
MDC  
**Sample ID:** C12080134-001BMS  
Sample Matrix Spike  
Radium 228  
Sample 10: C12080134-001BMS  
Radium 228  
Precision ±  
MDC  
**Sample ID:** C12080367-002ADUP  
3 Sample Duplicate  
Radium 228  
Sample 10: C12080367-002ADUP  
Radium 228  
Precision ±  
MDC

**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
- ND - Not detected at the reporting limit.
- R - RPD exceeds advisory limit.
Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/solid samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

Lidstone and Associates  C12080055

Login completed by: Timothy L. Houghteling  Date Received: 8/2/2012
Reviewed by: BL2000kmiller  Received by: th
Reviewed Date: 8/2/2012  Carrier name: FedEx

Shipping container/cooler in good condition?  Yes ☑  No ☐  Not Present ☐
Custody seals intact on shipping container/cooler?  Yes ☑  No ☐  Not Present ☐
Custody seals intact on sample bottles?  Yes ☑  No ☐  Not Present ☐
Chain of custody present?  Yes ☑  No ☐
Chain of custody signed when relinquished and received?  Yes ☑  No ☐
Chain of custody agrees with sample labels?  Yes ☑  No ☐
Samples in proper container/bottle?  Yes ☑  No ☐
Sample containers intact?  Yes ☑  No ☐
Sufficient sample volume for indicated test?  Yes ☑  No ☐
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)  Yes ☑  No ☐
Temp Blank received?  Yes ☑  No ☐  Not Applicable ☐
Container/Temp Blank temperature:  3.6°C On Ice
Water - VOA vials have zero headspace?  Yes ☑  No ☐  No VOA vials submitted ☐
Water - pH acceptable upon receipt?  Yes ☑  No ☐  Not Applicable ☐

Contact and Corrective Action Comments:

None
## Chain of Custody and Analytical Request Record

**Company Name:** Lidstone and Associates, Inc.  
**Report Mail Address:** 6015 Automation Way, N. E. Ft. Collins, CO 80525  
**Contact Name:** Mark Stry  
**Phone/Fax:** 970-223-4705/970-223-4706  
**Email:** MSaly@usstone.com  
**Sample Origin:** BLANK TEST WEL  
**Sample Origin State:** WY  
**EPA/State Compliance:** Yes ☑ No ☐  
**Sampler:** (Please Print)  

### Invoice Address:
**Company Name:**  
**Project Name:**  
**PWS, Permit, Etc.:**  
**Sample Origin EPA/State:**  
**Sample Origin State:** WY  
**Report Mail Address:**  
**Invoice Contact & Phone:**  
**Purchase Order:**  
**Quote/Bottle Order:**  

### Special Report/Formats:
- DW  
- POTW/MMTP  
- Other:  
  - EDD/EDT (Electronic Data) Format: PDF  
- Level IV  
- NELAC  

### ANALYSIS REQUESTED

**Number of Containers:**  
**Sample Type:** Air, Water, Soil, Sediment, Other  
**Vegetation:** Yes ☑ No ☐  
**Analysis Requested:** DWI, EWI  
**Sampling:** Final, Prior  
**Standard Turnaround (TAT):**  
**RUSH:** Yes ☑ No ☐  
**Contact ELI prior to Rush sample submittal for charges and scheduling - See Instruction Page  
**Comments:**  
**Shipped by:** Express  
**Cooler ID(s):**  
**Receipt Temp:**  
**On Bottle:** Yes ☑ No ☐  
**Custody Seal:** Yes ☑ No ☐  
**On Cooler:** Yes ☑ No ☐  
**Intact:** Yes ☑ No ☐  
**Signature Match:** Yes ☑ No ☐  

### SAMPLE IDENTIFICATION

<table>
<thead>
<tr>
<th>Collection Date</th>
<th>Collection Time</th>
<th>Matrix</th>
<th>RWI/DWI/NIW I</th>
<th>RUSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/1/12</td>
<td>0900</td>
<td>24</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

### Custody Record

**MUST be Signed**  
**Received by Laboratory:**  
**Date/Time:**  
**Signature:**  
**Sample Disposal:** Return to Client  
**Lab Disposal:**  
**Date/Time:**  
**Signature:**  

---

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylabs.com for additional information, downloadable fee schedules, forms, and links.
September 05, 2012

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO 80525

Workorder No.: C12070958
Project Name: WWDC Burns Level II

Energy Laboratories, Inc. Casper WY received the following 3 samples for Lidstone and Associates on 7/27/2012 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12070958-001</td>
<td>1-Anderson Test Well</td>
<td>07/26/12 8:53</td>
<td>07/27/12</td>
<td>Aqueous</td>
<td>Bacteria, SDWA</td>
</tr>
<tr>
<td></td>
<td>Burns, WY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12070958-002</td>
<td>1-Anderson Test Well</td>
<td>07/26/12 8:55</td>
<td>07/27/12</td>
<td>Aqueous</td>
<td>Bacteria, Iron Related</td>
</tr>
<tr>
<td></td>
<td>Burns, WY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C12070958-003</td>
<td>1-Anderson Test Well</td>
<td>07/26/12 8:50</td>
<td>07/27/12</td>
<td>Aqueous</td>
<td>Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water</td>
</tr>
<tr>
<td></td>
<td>Burns, WY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these test results, please call.

Report Approved By:

Stephanie Waldrop
Reporting Supervisor

Digitally signed by
Stephanie Waldrop
Date: 2012.09.05 13:45:28 -06:00
CASE NARRATIVE

The attached analytical report has been revised from a previously submitted report due to the request by Mark Stacy on August 30, 2012 for the addition of TSS and Total Alkalinity and to report Total Metals instead of Dissolved on sample -003. The project name was also corrected. The data presented here is from these changes.

PREP COMMENTS
The prep hold time for Total Mercury analysis was exceeded by 4.13 days.

BRANCH LABORATORY SUBCONTRACT ANALYSIS
Tests associated with analyist identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.
LABORATORY ANALYTICAL REPORT  
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: WWDC Burns Level II
Client Sample ID: 1-Anderson Test Well Burns, WY
Sampled By: Robert Moore
Lab ID: C12070958-001A

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Safe/Unsafe</th>
<th>Qualifier</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria, Total Coliform</td>
<td>Present</td>
<td></td>
<td>UNSAFE</td>
<td></td>
<td>A9223 B</td>
<td>07/27/12 12:00 / mkf</td>
</tr>
<tr>
<td>Bacteria, E-Coli Coliform</td>
<td>Absent</td>
<td></td>
<td></td>
<td></td>
<td>A9223 B</td>
<td>07/27/12 12:00 / mkf</td>
</tr>
</tbody>
</table>

Comments: The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.
The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

**LABORATORY ANALYTICAL REPORT**

Prepared by Casper, WY Branch

Revised Date: 09/05/12  
Report Date: 08/24/12  
Collection Date: 07/26/12 08:55  
Date Received: 07/27/12  
Matrix: Aqueous

### Analyses

<table>
<thead>
<tr>
<th>Analytes</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MICROBIOLOGICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacteria, Iron Related</td>
<td>8.6</td>
<td>CFU/ml</td>
<td>1.0</td>
<td></td>
<td>IRB-BART</td>
<td></td>
<td>07/27/12 12:00 / mkl</td>
</tr>
</tbody>
</table>

**Report Definitions:**  
RL - Analyte reporting limit.  
MCL - Maximum contaminant level.  
QCL - Quality control limit.  
ND - Not detected at the reporting limit.
### MAJOR IONS

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalinity, Total as CaCO₃</td>
<td>147 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>A2320 B</td>
<td>07/27/12 18:54 / jba</td>
<td></td>
</tr>
<tr>
<td>Carbonate as CO₃</td>
<td>ND</td>
<td>mg/L</td>
<td>5</td>
<td></td>
<td>A2320 B</td>
<td>07/27/12 18:54 / jba</td>
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</tr>
<tr>
<td>Bicarbonate as HCO₃</td>
<td>179 mg/L</td>
<td></td>
<td>5</td>
<td></td>
<td>A2320 B</td>
<td>07/27/12 18:54 / jba</td>
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<tr>
<td>Calcium</td>
<td>44 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>E200.7</td>
<td>07/30/12 13:36 / sf</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>4 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>E300.0</td>
<td>07/31/12 07:55 / wc</td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.6 mg/L</td>
<td></td>
<td>0.1</td>
<td></td>
<td>A4500-F C</td>
<td>07/30/12 10:44 / jba</td>
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</tr>
<tr>
<td>Magnesium</td>
<td>9 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>E200.7</td>
<td>07/30/12 13:36 / sf</td>
<td></td>
</tr>
<tr>
<td>Nitrogen, Ammonia as N</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>A4500-NH₃ G</td>
<td>07/30/12 14:38 / lr</td>
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<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
<td>3.4 mg/L</td>
<td></td>
<td>D 0.5</td>
<td></td>
<td>E353.2</td>
<td>07/27/12 19:18 / jll</td>
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<tr>
<td>Potassium</td>
<td>4 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>E200.7</td>
<td>08/01/12 15:47 / sf</td>
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<tr>
<td>Sodium</td>
<td>10 mg/L</td>
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<td>1</td>
<td></td>
<td>E200.7</td>
<td>07/30/12 13:36 / sf</td>
<td></td>
</tr>
<tr>
<td>Sulfate</td>
<td>17 mg/L</td>
<td></td>
<td>1</td>
<td></td>
<td>E300.0</td>
<td>07/31/12 07:55 / wc</td>
<td></td>
</tr>
</tbody>
</table>

### PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity @ 25 C</td>
<td>318 umhos/cm</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>pH</td>
<td>7.89</td>
<td>s.u.</td>
<td>H 0.01</td>
</tr>
<tr>
<td>Solids, Total Dissolved TDS @ 180 C</td>
<td>244 mg/L</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Solids, Total Suspended TSS @ 105 C</td>
<td>ND mg/L</td>
<td>DH 6</td>
<td>A2540 D 08/29/12 14:57 / jz</td>
</tr>
</tbody>
</table>

### METALS - TOTAL

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>ND</td>
<td>mg/L</td>
<td>0.03</td>
<td>0.2</td>
<td>E200.6</td>
<td>08/06/12 13:26 / el-b</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.003 mg/L</td>
<td></td>
<td>0.01</td>
<td>0.01</td>
<td>E200.6</td>
<td>08/06/12 13:26 / el-b</td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>0.08 mg/L</td>
<td></td>
<td>0.05</td>
<td>2</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Boron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td>0.005</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>ND</td>
<td>mg/L</td>
<td>0.005</td>
<td>0.1</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>0.044 mg/L</td>
<td></td>
<td>0.005</td>
<td>1.3</td>
<td>E200.6</td>
<td>08/06/12 13:26 / el-b</td>
<td></td>
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<tr>
<td>Iron</td>
<td>ND</td>
<td>mg/L</td>
<td>0.03</td>
<td>0.3</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>0.003 mg/L</td>
<td></td>
<td>0.01</td>
<td>0.015</td>
<td>E200.8</td>
<td>08/06/12 13:26 / el-b</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td>0.05</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>ND</td>
<td>mg/L</td>
<td>0.0001</td>
<td>0.002</td>
<td>E245.1</td>
<td>08/28/12 12:37 / jm</td>
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</tr>
<tr>
<td>Molybdenum</td>
<td>ND</td>
<td>mg/L</td>
<td>0.005</td>
<td></td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
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<tr>
<td>Nickel</td>
<td>ND</td>
<td>mg/L</td>
<td>0.01</td>
<td>0.1</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
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<tr>
<td>Selenium</td>
<td>0.002 mg/L</td>
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<td>0.001</td>
<td>0.05</td>
<td>E200.8</td>
<td>08/06/12 13:26 / el-b</td>
<td></td>
</tr>
<tr>
<td>Silica</td>
<td>52 mg/L</td>
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<td>0.2</td>
<td></td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Uranium</td>
<td>0.0066 mg/L</td>
<td></td>
<td>0.0003</td>
<td>0.03</td>
<td>E200.8</td>
<td>08/06/12 13:26 / el-b</td>
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<tr>
<td>Vanadium</td>
<td>0.01 mg/L</td>
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<td>0.01</td>
<td>0.1</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>0.04 mg/L</td>
<td></td>
<td>0.01</td>
<td>5</td>
<td>E200.7</td>
<td>08/06/12 21:17 / el-b</td>
<td></td>
</tr>
</tbody>
</table>

### RADIONUCLIDES - TOTAL

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>Units</th>
<th>Qualifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha</td>
<td>9.8 pCi/L</td>
<td>15</td>
<td>E900.0</td>
</tr>
<tr>
<td>Gross Alpha precision (±)</td>
<td>1.5 pCi/L</td>
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Report Definitions:
- RL - Analyte reporting limit.
- MCL - Maximum contaminant level.
- QCL - Quality control limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
- D - RL increased due to sample matrix.
- H - Analysis performed past recommended holding time.
- U - Not detected at minimum detectable concentration
# LABORATORY ANALYTICAL REPORT

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Lab ID:** C12070958-003  
**Client Sample ID:** 1-Anderson Test Well Burns, WY

<table>
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<tr>
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<th>MCL/ QCL</th>
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**DATA QUALITY**

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**Report Definitions:**

- **RL** - Analyte reporting limit.  
- **QCL** - Quality control limit.  
- **MDC** - Minimum detectable concentration  
- **MCL** - Maximum contaminant level.  
- **ND** - Not detected at the reporting limit.  
- **U** - Not detected at minimum detectable concentration
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## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Prepared by:** Casper, WY Branch  
**Revised Date:** 09/05/12  
**Report Date:** 08/24/12  
**Work Order:** C12070958

### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

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### Qualifiers:
- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration

---

**Analytical Run:** PHSC_101-C_120730A  
**Batch:** R162483  
**Run:** PHSC_101-C_120730A  
**Run:** PHSC_101-C_120730A  
**Run:** PHSC_101-C_120730A  
**Run:** PHSC_101-C_120730A  
**Run:** PHSC_101-C_120730A  
**Run:** PHSC_101-C_120730A

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Page 8 of 26
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Qualifiers:
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
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#### Analyte Details

- **Method:** A2540 D
- **Client:** Lidstone and Associates
- **Project:** WWDC Burns Level II
- **Report Date:** 08/24/12
- **Work Order:** C12070958
- **Revised Date:** 09/05/12

#### Sample ID Details

- **Sample ID:** MBLK1
  - **Solid, Total Suspended TSS @ 105°C:** ND mg/L
  - **Run:** BAL-1_120829B
  - **Batch:** R163991
- **Sample ID:** LCS1
  - **Solid, Total Suspended TSS @ 105°C:** 191 mg/L
  - **Run:** BAL-1_120829B
- **Sample ID:** C1208137-ADUP
  - **Solid, Total Suspended TSS @ 105°C:** ND mg/L

#### Qualifiers

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **ND** - Not detected at the reporting limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Prepared by:** Casper, WY Branch  
**Revised Date:** 09/05/12  
**Report Date:** 08/24/12  
**Work Order:** C12070958

### Method: A4500-F

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### Qualifiers:

- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration
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| **Method:** A4500-H B | **Sample ID:** pH 6.86 | Initial Calibration Verification Standard | 6.84 | s.u. | 0.010 | 100 | 98 | 102 | |<br/>**Analytical Run:** PHSC_101-C_120730A
07/30/12 08:55 |
| **Method:** A4500-H B | **Sample ID:** C12070860-001ADUP | Sample Duplicate | 7.62 | s.u. | 0.010 | 0.0 | 3 | |<br/>**Run:** PHSC_101-C_120730A
07/30/12 09:44 |

**Qualifiers:**
- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration.
- **ND** - Not detected at the reporting limit.
### QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Work Order:** C12070958  
**Report Date:** 08/24/12

#### Analyte

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#### Qualifiers:
- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration.
**QA/QC Summary Report**

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Revised Date:** 09/05/12  
**Report Date:** 08/24/12  
**Work Order:** C12070958

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**Qualifiers:**

RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

### Client:
Lidstone and Associates

### Project:
WWDC Burns Level II

### Revised Date:
09/05/12

### Report Date:
08/24/12

### Work Order:
C12070958

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### Method:
E200.7

### Analytical Run:
ICP4-C_120801A

### Batch:
R162689

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### Qualifiers:

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*Page 15 of 26*
### QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Lidstone and Associates

Project: WWDC Burns Level II

Revised Date: 09/05/12

Report Date: 08/24/12

Work Order: C12070958

### Analyte Summary

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### Qualifiers:
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
## Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

### Method: E200.7

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**Qualifiers:**
- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Revised Date:** 09/05/12  
**Report Date:** 08/24/12  
**Work Order:** C12070958

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**Method:** E200.8  
**Sample ID:** QCS  
**Sample:** Initial Calibration Verification Standard

- **Aluminum:** 0.238 mg/L  
- **Arsenic:** 0.0502 mg/L  
- **Copper:** 0.0532 mg/L  
- **Lead:** 0.0504 mg/L  
- **Selenium:** 0.0508 mg/L  
- **Uranium:** 0.0192 mg/L

---

**Method:** E200.8  
**Sample ID:** LRB  
**Sample:** Method Blank

- **Aluminum:** ND mg/L  
- **Arsenic:** 0.000455 mg/L  
- **Copper:** ND mg/L  
- **Lead:** ND mg/L  
- **Selenium:** 0.000665 mg/L  
- **Uranium:** ND mg/L

---

**Method:** E200.8  
**Sample ID:** LFB  
**Sample:** Laboratory Fortified Blank

- **Aluminum:** 0.0504 mg/L  
- **Arsenic:** 0.0503 mg/L  
- **Copper:** 0.0502 mg/L  
- **Lead:** 0.0512 mg/L  
- **Selenium:** 0.0495 mg/L  
- **Uranium:** 0.0517 mg/L

---

**Sample ID:** B12080438-001AMS  
**Sample:** Sample Matrix Spike

- **Aluminum:** 0.075 mg/L  
- **Arsenic:** 0.061 mg/L  
- **Copper:** 0.071 mg/L  
- **Lead:** 0.052 mg/L  
- **Selenium:** 0.053 mg/L  
- **Uranium:** 0.051 mg/L

---

**Sample ID:** B12080438-001AMSD  
**Sample:** Sample Matrix Spike Duplicate

- **Aluminum:** 0.075 mg/L  
- **Arsenic:** 0.061 mg/L  
- **Copper:** 0.072 mg/L  
- **Lead:** 0.053 mg/L  
- **Selenium:** 0.053 mg/L  
- **Uranium:** 0.052 mg/L

---

**Qualifiers:**

- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration.
# QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Work Order:** C12070958  
**Revised Date:** 09/05/12  
**Report Date:** 08/24/12

## Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

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**Qualifiers:**  
RL - Analyte reporting limit.  
ND - Not detected at the reporting limit.  
MDC - Minimum detectable concentration

---

Page 19 of 26
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II  
**Revised Date:** 09/05/12  
**Report Date:** 08/24/12  
**Work Order:** C12070958

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### Method: E300.0

#### Sample ID: ICV-073012-10
- **Initial Calibration Verification Standard**  
  - Chloride: 10.2 mg/L  
  - Sulfate: 41.2 mg/L

#### Sample ID: ICB-073012-11
- **Method Blank**  
  - Chloride: 0.04 mg/L  
  - Sulfate: 0.6 mg/L

#### Sample ID: LFB-073012-12
- **Laboratory Fortified Blank**  
  - Chloride: 10.6 mg/L  
  - Sulfate: 42.4 mg/L

#### Sample ID: C12070913-001AMS
- **Sample Matrix Spike**  
  - Chloride: 447 mg/L  
  - Sulfate: 1580 mg/L

#### Sample ID: C12070913-001AMSD
- **Sample Matrix Spike Duplicate**  
  - Chloride: 449 mg/L  
  - Sulfate: 1580 mg/L

#### Sample ID: C12070971-004AMS
- **Sample Matrix Spike**  
  - Chloride: 27.9 mg/L  
  - Sulfate: 326 mg/L

#### Sample ID: C12070971-004AMSD
- **Sample Matrix Spike Duplicate**  
  - Chloride: 28.6 mg/L  
  - Sulfate: 327 mg/L

#### Sample ID: LFBD
- **Laboratory Fortified Blank Duplicate**  
  - Chloride: 10.2 mg/L  
  - Sulfate: 41.3 mg/L

### Qualifiers:
- **RL** - Analyte reporting limit.  
- **ND** - Not detected at the reporting limit.  
- **MDC** - Minimum detectable concentration.  
- **S** - Spike recovery outside of advisory limits.

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**Page 20 of 26**
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Qualifiers:
- **RL** - Analyte reporting limit.
- **ND** - Not detected at the reporting limit.
- **MOC** - Minimum detectable concentration.

---

**QA/QC Summary Report**

Prepared by Casper, WY Branch

Client: Lidstone and Associates

Project: WWDC Burns Level II

Revised Date: 09/05/12

Report Date: 08/24/12

Work Order: C12070958

Page 21 of 26
Client: Lidstone and Associates  
Project: WWDC Burns Level II  

**QA/QC Summary Report**  
Prepared by Casper, WY Branch  
Revised Date: 09/05/12  
Report Date: 08/24/12  
Work Order: C12070958

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<th>%REC</th>
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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- U - Not detected at minimum detectable concentration
- ND - Not detected at the reporting limit.
- S - Spike recovery outside of advisory limits.
## QA/QC Summary Report

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

---

### Analyte Results

<table>
<thead>
<tr>
<th>Method</th>
<th>Count</th>
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<th>Units</th>
<th>RL</th>
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<th>High Limit</th>
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<tr>
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**Sample ID: C12070762-001BDUP**

- **Sample Duplicate**
- **Radium 226**
- **Result:** -0.059 pCi/L
- **Run:** BERTHOLD 770-2_120803A
- **RL:** 27
- **%REC:** 20
- **Low Limit:** 0.086 pCi/L
- **High Limit:** pCi/L
- **RPD:** UR

- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.5 is less than the limit of 2.0. This batch is approved.

**Sample ID: C12070832-001AMS**

- **Sample Matrix Spike**
- **Radium 226**
- **Result:** 25 pCi/L
- **Run:** BERTHOLD 770-2_120803A
- **RL:** 98
- **%REC:** 80
- **Low Limit:** 80 pCi/L
- **High Limit:** 120 pCi/L
- **RPD:** R

- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.5 is equal to the limit of 2.0. This batch is approved.

**Sample ID: MB-RA226D0W-0079**

- **Method Blank**
- **Radium 226**
- **Result:** -0.08 pCi/L
- **Run:** BERTHOLD 770-2_120803A
- **RL:** U
- **%REC:**
- **Low Limit:** 0 pCi/L
- **High Limit:** pCi/L
- **RPD:**

**Sample ID: LCS-RA226DW-0079**

- **Laboratory Control Sample**
- **Radium 226**
- **Result:** 12 pCi/L
- **Run:** BERTHOLD 770-2_120803A
- **RL:**
- **%REC:**
- **Low Limit:** 99 pCi/L
- **High Limit:** 110 pCi/L
- **RPD:**

---

**Qualifiers:**

- **RL** - Analyte reporting limit.
- **MDC** - Minimum detectable concentration
- **U** - Not detected at minimum detectable concentration
- **ND** - Not detected at the reporting limit.
- **R** - RPD exceeds advisory limit.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** WWDC Burns Level II

**Report Date:** 08/24/12  
**Revised Date:** 09/05/12

### Analyte Count Result Units

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### Qualifiers:
- **RL** - Analyte reporting limit.  
- **MDC** - Minimum detectable concentration  
- **U** - Not detected at minimum detectable concentration  
- **ND** - Not detected at the reporting limit.  
- **R** - RPD exceeds advisory limit.
Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as -dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

---

Workorder Receipt Checklist

**Lidstone and Associates**

**C12070958**

<table>
<thead>
<tr>
<th>Login completed by:</th>
<th>Timothy L. Houghteling</th>
<th>Date Received: 7/27/2012</th>
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<tr>
<td>Reviewed by:</td>
<td>BL2000\tparke</td>
<td>Received by: th</td>
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<tr>
<td>Reviewed Date:</td>
<td>8/6/2012</td>
<td>Carrier FedEx name:</td>
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| Shipping container/coolers in good condition? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Custody seals intact on shipping container/coolers? | Yes ☑️ | No ☐️ | Not Present ☑️ |
| Custody seals intact on sample bottles? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Chain of custody present? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Chain of custody signed when relinquished and received? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Chain of custody agrees with sample labels? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Samples in proper container/bottle? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Sample containers intact? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Sufficient sample volume for indicated test? | Yes ☑️ | No ☐️ | Not Present ☐️ |
| All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res CI, Sulfite, Ferrous Iron, etc.) | Yes ☑️ | No ☐️ | Not Present ☐️ |
| Temp Blank received? | Yes ☑️ | No ☐️ | Not Applicable ☐️ |
| Container/Temp Blank temperature: | 1.4°C On Ice |
| Water - VOA vials have zero headspace? | Yes ☑️ | No ☐️ | No VOA vials submitted ☑️ |
| Water - pH acceptable upon receipt? | Yes ☑️ | No ☐️ | Not Applicable ☐️ |

Contact and Corrective Action Comments:

Samples for dissolved metals were subsampled, filtered and preserved with 2 mLs HNO3 in lab upon receipt to pH <2.
**Chain of Custody and Analytical Request Record**

**Company Name:** Lidstone & Associates  
**Address:** 4225 Automation Way, Bldg E, Fort Collins, CO 80525
**Invoice Address:** Same as above  
**Report Title:** 1-Anderson Test Well

**Contact Name:** Mark Stacy  
**Phone/Fax:** 970-223-4725
**Email:** mcs@lidstone.com

**Sample Origin:** WWDC/III

**EPA/State Compliance:**
- State: WY
- Yes
- No

**Invoice Contact & Phone:**
- Mark Stacy  
- 970-223-4725

**Sample Origin:** EPA/State Compliance: Yes/No
- Yes
- No

**Special Report/Formats:**
- DW
- POTW/WWTP
- Other:
  - EDD/EDT (Electronic Data)
  - Format: GAP

**Sample ID:**

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<th>Collection Date</th>
<th>Collection Time</th>
<th>Matrix</th>
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**ANALYSIS REQUESTED**

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<th>Standard Turnaround (TAT)</th>
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<tbody>
<tr>
<td>Rush</td>
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</table>

**Comments:**
- Contact ELI prior to Rush sample submission for charges and scheduling – See Instruction Page
- Coolers:
  - FedEx
  - 3420
- Receipt Temp: 14°C
- On Ice: On Bottle: On Cooler
- Intact: Intact
- Signature: N
- Custody Seal: N
- Sample Disposal: Return to Client

**Laboratory Use Only**

**MUST be Signed:**

- Received by (print): Robert C. Moore  
- Date/Time: 7-26-12 10:43am
- Signature: 

- Rehandled by (print): Robert C. Moore  
- Date/Time: 7-26-12 10:43am
- Signature: 

- Received by Laboratory: 7-27-12/955

**In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.**
Sample 1-Anderson Test Well was received on July 27, 2012.

All samples were received and analyzed within the EPA recommended holding times, except those noted in this case narrative. Samples were analyzed using the methods outlined in the following references:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition
Methods indicated with the Monday, March 12, 2007 Federal Register, 40 CFR Part 122, 136 et al.

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.
**Inter-Mountain Labs**  
Sheridan, WY and Gillette, WY

### Chain of Custody Record

All shaded fields must be completed. This is a legal document; any misrepresentation may be construed as fraud.

<table>
<thead>
<tr>
<th>Client Name</th>
<th>Project Identification</th>
<th>Sampler (Signature/Attestation of Authenticity)</th>
</tr>
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<tbody>
<tr>
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<td>First C. Moore</td>
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### Analyses/Parameters

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<th>Time Sampled</th>
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<td>7/26/2022</td>
<td>8:20 am</td>
<td>1-Anderson Test Well</td>
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<td>1</td>
</tr>
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</table>

### Lab Comments

Received By (Signature/Printed): First C. Moore  
Date: 7/27/2022  Time: 11:21

### Shipping Info

- **UPS**  
  - Water: WT
- **Fed Express**  
  - Soil: SL
- **US Mail**  
  - Solid: SD
- **Hand Carried**  
  - Filter: FT
- **Other**  
  - Other: OT

### Turnaround Times

- Check desired service
- Standard turnaround
- Rush - 5 Working Days

### Compliance Information

- Compliance Monitoring?
- Program (SDWA, NPDES,...)
- PWSID / Permit #
- Chlorinated?

### Additional Remarks

Rush & Urgent Surcharges will be applied

Sample Disposal: Lab X Client

---

Inter-Mountain Labs, Inc.
www.intermountainlabs.com  
Rev 4.6
# Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525

**Date Reported:** 8/27/2012  
**Report ID:** S1207438002  
(Replaces S1207438001)

**Project Name:** LQD Guideline 8  
**Lab ID:** S1207438-001  
**Client Sample ID:** Anderson Test Well  
**COC:** 147151

## Comments

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qual</th>
<th>RL</th>
<th>Method</th>
<th>Date Analyzed/Init</th>
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<tbody>
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<tr>
<td>Alkalinity, Total (As CaCO3)</td>
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<td>Alkalinity, Bicarbonate as HCO3</td>
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<td>Nitrogen, Nitrate-Nitrite (as N)</td>
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<td>Magnesium</td>
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<td>s.u.</td>
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<tr>
<td>Total Dissolved Solids (180)</td>
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<td>Cation Sum</td>
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<td>Cation-Anion Balance (± 5%)</td>
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<td>Solids, Total Dissolved (Calc)</td>
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<td>mg/L</td>
<td>10</td>
<td>SM 1030E</td>
<td>08/24/2012 1533</td>
<td>KO</td>
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</tbody>
</table>

These results apply only to the samples tested.

**RL - Reporting Limit**

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

**Qualifiers:**

- * Value exceeds Maximum Contaminant Level
- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Reviewed by:  

Wade Nieuwsma, Assistant Laboratory Manager
### Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525

**-date reported:** 8/27/2012  
**Report ID:** S1207438002  
(Replaces S1207438001)

**Project Name:** LQD Guideline 8  
**Lab ID:** S1207438-001  
**Client Sample ID:** 1-Anderson Test Well  
**COC:** 147151

**Collection Date:** 7/26/2012 8:32:00 AM  
**Date Received:** 7/27/2012 11:21:00 AM  
**Field Sampler:** RM  
**Matrix:** Water

---

### Metals - Total

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<th>Qual</th>
<th>RL</th>
<th>Method</th>
<th>Date Analyzed/Init</th>
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<tbody>
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**Radionuclides - Dissolved**

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<th>RL</th>
<th>Method</th>
<th>Date Analyzed/Init</th>
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<tr>
<td>Gross Alpha</td>
<td>8.7</td>
<td>pCi/L</td>
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<td>SM</td>
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<td>Gross Beta Precision (±)</td>
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These results apply only to the samples tested.  
**RL - Reporting Limit**

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<th>Description</th>
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<tr>
<td>C</td>
<td>Calculated Value</td>
</tr>
<tr>
<td>E</td>
<td>Value above quantification range</td>
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<tr>
<td>J</td>
<td>Analyte detected below quantitation limits</td>
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<tr>
<td>M</td>
<td>Value exceeds Monthly Ave or MCL</td>
</tr>
<tr>
<td>O</td>
<td>Outside the Range of Dilutions</td>
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<tr>
<td>ND</td>
<td>Not Detected at the Reporting Limit</td>
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<tr>
<td>L</td>
<td>Analyzed by a contract laboratory</td>
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<tr>
<td>H</td>
<td>Holding times for preparation or analysis exceeded</td>
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<tr>
<td>S</td>
<td>Spike Recovery outside accepted recovery limits</td>
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</tbody>
</table>

Reviewed by: Wade Nieuwsma, Assistant Laboratory Manager  
Page 2 of 2
## ANALYTICAL QC SUMMARY REPORT

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1207438  
**Project:** LQD Guideline 8  
**Date:** 8/24/2012  
**Report ID:** S1207438001

### Alkalinity

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### Conductivity

<table>
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<th>Sample Type</th>
<th>Units: µmhos/cm</th>
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<td>RunNo: 85391</td>
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</tbody>
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### Sample Qualifiers:

- **B**: Analyte detected in the associated Method Blank
- **H**: Holding times for preparation or analysis exceeded
- **L**: Analyzed by a contract laboratory
- **D**: Outside the Range of Dilutions
- **S**: Spike Recovery outside accepted recovery limits

---

**Report:** This report summarizes the analytical results obtained from samples, including Alkalinity and Conductivity measurements. Each sample is identified by its ID and run number, with results categorized by whether the analyte was detected within the quantitation limits or outside those limits. The report also indicates any holding times that were exceeded or any analytes that were outside the acceptable recovery limits.
**ANALYTICAL QC SUMMARY REPORT**

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1207438  
**Project:** LQD Guideline 8  
**Date:** 8/24/2012  
**Report ID:** S1207438001

### Fluoride by SM 4500

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<table>
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### Gross Alpha, Beta by SM 7110B

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<td>MB12-229</td>
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<table>
<thead>
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**Qualifiers:**

- **B**: Analyte detected in the associated Method Blank
- **H**: Holding times for preparation or analysis exceeded
- **L**: Analyzed by a contract laboratory
- **O**: Outside the Range of Dilutions
- **S**: Spike Recovery outside accepted recovery limits
- **E**: Value above quantitation range
- **J**: Analyte detected below quantitation limits
- **ND**: Not Detected at the Reporting Limit
- **R**: RPD outside accepted recovery limits
## Analytical QC Summary Report

**Client:** Lidstone & Associates Inc  
**Work Order:** S1207438  
**Project:** LQD Guideline 8  
**Date:** 8/24/2012  
**Report ID:** S1207438001

### Sample Type: MBLK  
**Units:** mg/L  
**Sample Type:** MBLK  
**Run No:** 85474

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<th>%REC</th>
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**Sample Type:** LCS  
**Run No:** 85474

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### Sample Type: MS  
**Units:** mg/L  
**Sample Type:** MS  
**Run No:** 85474

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<th>RL</th>
<th>Spike Ref Samp</th>
<th>%REC</th>
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**Units:** mg/L  
**Sample Type:** DUP  
**Run No:** 85474

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<th>%RPD</th>
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- **S:** Spike Recovery outside accepted recovery limits
## Analytical QC Summary Report

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1207438  
**Project:** LQD Guideline 8  

**Date:** 8/24/2012  
**Report ID:** S1207438001

### Cations by ICP (Method 200.7)

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- **S**: Spike Recovery outside accepted recovery limits
# ANALYTICAL QC SUMMARY REPORT

## CLIENT:
Lidstone & Associates Inc

## Work Order:
S1207438

## Project:
LQD Guideline 8

### Nitrogen, Ammonia (as N)

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### Nitrogen, Nitrate-Nitrite (as N)

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- S: Spike Recovery outside accepted recovery limits
### Radium 226 by SM 7500

<table>
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**Sample Type: MBLK**

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<th>%REC</th>
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**Sample Type: LCS**

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<th>RL</th>
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<th>Ref Samp</th>
<th>%REC</th>
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**Sample Type: MS**

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## Silica as SiO2

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## Solids By SM 2540

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## Solids By SM 2540

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## Total Mercury by EPA 245.1 - Water

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## Total Mercury by EPA 245.1 - Water

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## Total Mercury by EPA 245.1 - Water

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## Total Mercury by EPA 245.1 - Water

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## Total Mercury by EPA 245.1 - Water

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### Qualifiers:

- **B** Analyte detected in the associated Method Blank
- **E** Value above quantitation range
- **H** Holding times for preparation or analysis exceeded
- **J** Analyte detected below quantitation limits
- **L** Analyzed by a contract laboratory
- **ND** Not Detected at the Reporting Limit
- **O** Outside the Range of Dilutions
- **R** RPD outside accepted recovery limits
- **S** Spike Recovery outside accepted recovery limits
- **T** Total mercury by EPA 245.1 - Water

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**Page 7 of 10**
## ANALYTICAL QC SUMMARY REPORT

**CLIENT:** Lidstone & Associates Inc  | **Date:** 8/24/2012

**Work Order:** S1207438  | **Report ID:** S1207438001

**Project:** LQD Guideline 8

---

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**Qualifiers:**

- **B** Analyte detected in the associated Method Blank above quantitation range
- **H** Holding times for preparation or analysis exceeded
- **L** Analyzed by a contract laboratory
- **O** Outside the Range of Dilutions
- **S** Spike Recovery outside accepted recovery limits
- **E** Value above quantitation range
- **J** Analyte detected below quantitation limits
- **ND** Not Detected at the Reporting Limit
- **R** RPD outside accepted recovery limits
## Analytical QC Summary Report

**Client:** Lidstone & Associates Inc  
**Work Order:** S1207438  
**Project:** LQD Guideline 8  
**Date:** 8/24/2012  
**Report ID:** S1207438001

### Total (200.2) Metals by EPA 200.8 - Water

#### Sample Type: MBLK  
**Units:** mg/L

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**Units:** mg/L

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### Qualifiers
- **B**: Analyte detected in the associated Method Blank
- **E**: Value above quantitation range
- **H**: Holding times for preparation or analysis exceeded
- **J**: Analyte detected below quantitation limits
- **L**: Analyzed by a contract laboratory
- **ND**: Not Detected at the Reporting Limit
- **O**: Outside the Range of Dilutions
- **R**: RPD outside accepted recovery limits
- **S**: Spike Recovery outside accepted recovery limits
**Total (200.2) Metals by EPA 200.8 - Water**

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<th>Result</th>
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**pH Water**

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<td>ATQC</td>
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<td>pH</td>
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<td>90 - 110</td>
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</table>

**Analyte detected in the associated Method Blank**

- **B**: Analyte detected in the associated Method Blank
- **E**: Value above quantitation range
- **J**: Analyte detected below quantitation limits
- **L**: Analyzed by a contract laboratory
- **ND**: Not Detected at the Reporting Limit
- **O**: Outside the Range of Dilutions
- **R**: RPD outside accepted recovery limits
- **S**: Spike Recovery outside accepted recovery limits
MEMORANDUM

To: Ted Kilner, Mayor Judy Johnstone, Jim Clark, Town of Burns
From: Marty Jones and Chris Lidstone
Date: June 20, 2012
Subject: Well Water Quality Testing

We have reviewed the radiometric water quality data that the Town has collected for their municipal supply wells. During the recent utility board meeting, the Town indicated that there is a water quality issue for Well A6 and the well has exceeded the MCL for gross alpha. Additionally, the Town has received a letter from the EPA indicating that the well should be shut down or the Town shall propose a treatment plan. The radiometric water quality is shown Table 1. Gross alpha is a water quality screening parameter that essentially summarizes the alpha particle emissions from radioactive elements. Gross alpha laboratory analysis is somewhat complicated and calculating the adjusted gross alpha value for Safe Drinking Water Act MCL compliance becomes more complicated (adjusted gross alpha equals gross alpha minus contributions to gross alpha from uranium and radon). Although Energy Labs is an EPA certified lab, certain aspects of the analysis and their reporting of the limits are questionable, specifically the sudden elevation of gross alpha and uranium in the last two samples and the reporting of negative values. Furthermore, upon review of the data, it does not appear that gross alpha values reported by the lab included the conversion for reporting adjusted gross alpha. Table 1 demonstrates an adjusted gross alpha, which includes this conversion. When this correction is made Wells A2 and A4 are below the MCL for gross alpha; Well A6 did exceed the MCL.

The EPA recommends additional testing “when the uranium concentration in a sample is near the proposed MCL (U: MCL = 30 ug/L)”.¹ The additional testing is recommended in near-MCL situations because the conversion of uranium from micrograms to picocuries may be biased low, resulting in a larger net gross alpha. The uranium concentrations were near the MCL (24 and 23 ug/L, respectively) in both 2010 and 2011 for Well A6. Again there is some concern about lab error, given the timing of this sudden increase. With that said, we believe it is premature to discuss water treatment or funding for water treatment, although Chris and I are happy to discuss those options.

At this time we recommend that we split water samples from Wells A2, A4 and A6 and send them to two different laboratories. This will allow us to confirm that we have a real problem versus possible lab error. Based on our knowledge of the problem, we would recommend sending samples to both Energy Laboratories (Casper) and Inter-Mountain Labs (Sheridan). Each sample should be tested for uranium, radium 226, and Gross Alpha. We will check with Keith Clarey, WWDC to see if this testing could be included as part of the ongoing WWDC Level II study since this effort relates to the need for an alternate water supply source. We also need to review our budget within the WWDC project to ensure that we have the available funding to accomplish this work. In the event that we are short or should Keith deny

¹ National Primary Drinking Water Regulations; Radionuclides; Final Rule, 2000:

K:\OPEN\WWDC110\Well Water Quality Testing-Memo.docx

Lidstone and Associates, Inc.
4025 Automation Way, Bldg E. – Fort Collins, CO 80525
(Phone) 970-223-4705 / (Fax) 970-223-4706
our use of project funds, the laboratory analysis will be less than $1,000. Do you have the funding to address these additional laboratory costs? Thanks and we look forward to hearing from you.

Table 1  Town of Burns Gross Alpha and Uranium Water Quality Data, 2007-2011

<table>
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<tr>
<th>Year</th>
<th>Method</th>
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<tr>
<td></td>
<td>A-2</td>
<td>A-4</td>
</tr>
<tr>
<td></td>
<td>4 4 5 9 8</td>
<td>4 1 5 10 11</td>
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<tr>
<td>Gross Alpha (pCi/L)</td>
<td>E900.0</td>
<td>7.3 9.9 13.2 8.1 14.8</td>
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<td>Uranium (ug/L)</td>
<td>E200.8</td>
<td>NT 10 NT NT 9</td>
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<tr>
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<td>30 30 30 30 30</td>
</tr>
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<td>Near Compliance Level</td>
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<td>N N N N N</td>
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<td>Adjusted Gross Alpha* (pCi/L)</td>
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<td>&lt;12.2 1.9 &lt;6.9 &lt;11.2 11.2</td>
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<tr>
<td>Apparent Compliance</td>
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<td>Y Y Y Y Y</td>
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</table>

NT = Not Tested

* Adjusted Gross Alpha = Gross Alpha - Uranium - Radon. Adjusted Gross Alpha is only calculated for samples with both Gross Alpha and Uranium data available. All other values are simply reported as less than Gross Alpha.
Appendix F

2013 Sampling Water Quality Analytical Reports
Samples Anderson Well, Well A2, and Wisroth Well were received on March 4, 2013.

All samples were received and analyzed within the EPA recommended holding times, except those noted in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Qualifiers by sample

TAP WATER MS - Radiochemistry (SDWA)/Radium 226 - Spike Recovery outside accepted recovery limits
S1303015-001 - Radiochemistry (SDWA)/Gross Alpha - RPD outside accepted recovery limits
Sample Analysis Report

Company: Lidstone & Associates Inc
4025 Automation Way Bldg E
Fort Collins, CO 80525

Date Reported: 3/28/2013
Report ID: S1303015001

Project Name: Burns Water Well
Lab ID: S1303015-001
Client Sample ID: Well A2
COC: 149710

Collection Date: 2/27/2013 12:30:00 PM
Date Received: 3/4/2013 7:49:00 AM

Matrix: Drinking Water

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<th>Analyses</th>
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<th>Qual</th>
<th>RL Method</th>
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Radionuclides - SDWA

- Gross Alpha | 13.2 | pCi/L | 2 | SM 7110 B | 03/22/2013 2129 SH |
- Gross Beta | 1.4 | pCi/L | 3 | SM 7110 B | 03/22/2013 2129 SH |
- Gross Beta Precision (±) | 5.6 | pCi/L | SM 7110 B | 03/22/2013 2129 SH |
- Radium 226 | ND | pCi/L | 0.2 | SM 7500 RA_B | 03/18/2013 1040 SH |
- Radium 226 Precision (±) | NA | pCi/L | SM 7500 RA_B | 03/18/2013 1040 SH |
- Radium 228 | ND | pCi/L | 1 | RA-05 | 03/27/2013 1716 SH |
- Radium 228 Precision (±) | NA | pCi/L | RA-05 | 03/27/2013 1716 SH |

These results apply only to the samples tested.

RL - Reporting Limit

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Lacey Ketron, Water Lab Supervisor
## Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525

**Date Reported:** 3/28/2013  
**Report ID:** S1303015001

**Project Name:** Burns Water Well  
**Lab ID:** S1303015-002  
**Client Sample ID:** Anderson Well  
**COC:** 149710

**Work Order:** S1303015  
**Collection Date:** 2/27/2013 11:25:00 AM  
**Date Received:** 3/4/2013 7:49:00 AM  
**Field Sampler:** MS  
**Matrix:** Drinking Water

### Analyses

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<td>Gross Beta Precision (±)</td>
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<td>pCi/L</td>
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### Comments

**These results apply only to the samples tested.**  
**RL - Reporting Limit**  
B Analyte detected in the associated Method Blank  
E Value above quantitation range  
J Analyte detected below quantitation limits  
M Value exceeds Monthly Ave or MCL  
O Outside the Range of Dilutions

**Qualifiers:**

- ' Value exceeds Maximum Contaminant Level  
- C Calculated Value  
- H Holding times for preparation or analysis exceeded  
- L Analyzed by a contract laboratory  
- ND Not Detected at the Reporting Limit  
- S Spike Recovery outside accepted recovery limits

Reviewed by: Lacey Ketron, Water Lab Supervisor
Sample Analysis Report

Company: Lidstone & Associates Inc
4025 Automation Way Bldg E
Fort Collins, CO 80525

Date Reported: 3/28/2013
Report ID: S1303015001

Project Name: Burns Water Well
Lab ID: S1303015-003
Client Sample ID: Wisroth Well
COC: 149710

Work Order: S1303015
Collection Date: 2/27/2013 10:40:00 AM
Date Received: 3/4/2013 7:49:00 AM
Field Sampler: MS
Matrix: Drinking Water

## Analyses

<table>
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<tr>
<th>Analyses</th>
<th>Result</th>
<th>Units</th>
<th>Qual</th>
<th>RL</th>
<th>Method</th>
<th>Date Analyzed/Init</th>
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<tr>
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These results apply only to the samples tested.

Qualifiers: * Value exceeds Maximum Contaminant Level
C Calculated Value
H Holding times for preparation or analysis exceeded
L Analyzed by a contract laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits

RL - Reporting Limit

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL
O Outside the Range of Dilutions

Reviewed by: Lacey Ketron, Water Lab Supervisor

Page 3 of 3
## ANALYTICAL QC SUMMARY REPORT

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1303015  
**Project:** Burns Water Well  
**Date:** 3/28/2013  
**Report ID:** S1303015001

### Nitrogen, Nitrate-Nitrite (as N)

<table>
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<tr>
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<th>Sample ID</th>
<th>RunNo: 92714</th>
<th>Analyte</th>
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<td>0.7</td>
<td>101</td>
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### SDWA Gross Alpha, Beta by SM 7110B

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<td>80 - 120</td>
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**Qualifiers:**  
- **B** Analyte detected in the associated Method Blank  
- **E** Value above quantitation range  
- **H** Holding times for preparation or analysis exceeded  
- **J** Analyte detected below quantitation limits  
- **L** Analyzed by a contract laboratory  
- **ND** Not Detected at the Reporting Limit  
- **O** Outside the Range of Dilutions  
- **R** RPD outside accepted recovery limits  
- **S** Spike Recovery outside accepted recovery limits
**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1303015  
**Project:** Burns Water Well

**ANALYTICAL QC SUMMARY REPORT**

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1303015  
**Project:** Burns Water Well  
**Date:** 3/28/2013  
**Report ID:** S1303015001

**SDWA Radium 226 by SM 7500**

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<td>MB13-065</td>
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<tr>
<td>LCS</td>
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<td>Radium 226</td>
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<td>MS</td>
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**SDWA Rad 228**

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**Qualifiers:**

- **B**: Analyte detected in the associated Method Blank
- **E**: Value above quantitation range
- **H**: Holding times for preparation or analysis exceeded
- **J**: Analyte detected below quantitation limits
- **L**: Analyzed by a contract laboratory
- **ND**: Not Detected at the Reporting Limit
- **O**: Outside the Range of Dilutions
- **R**: RPD outside accepted recovery limits
- **S**: Spike Recovery outside accepted recovery limits
## ANALYTICAL QC SUMMARY REPORT

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1303015  
**Project:** Burns Water Well

Date: 3/28/2013  
Report ID: S1303015001

**Total (200.2) Metals by EPA 200.8 - Water**

### Sample Type MBK  
Units: mg/L

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Units: mg/L

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<th>Ref Samp</th>
<th>%REC</th>
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<td>0.0003</td>
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### Sample Type MSD  
Units: mg/L

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<th>%RPD</th>
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**Qualifiers:**

- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- O Outside the Range of Dilutions
- S Spike Recovery outside accepted recovery limits
- E Value above quantitation range
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- R RPD outside accepted recovery limits
# Chain of Custody Record

**All shaded fields must be completed.**

This is a legal document: any misrepresentation may be construed as fraud.

<table>
<thead>
<tr>
<th>Item</th>
<th>Lab ID (Lab Use Only)</th>
<th>Date Sampled</th>
<th>Time Sampled</th>
<th>Sample Identification</th>
<th>Matrix</th>
<th># of Containers</th>
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<td>A1303015</td>
<td>2/27/2013</td>
<td>12:00</td>
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<td>Water 4</td>
<td>X X X X</td>
</tr>
<tr>
<td>2</td>
<td>002</td>
<td>2/27/2013</td>
<td>11:25</td>
<td>Anderson Well</td>
<td>Water 4</td>
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<td>3</td>
<td>003</td>
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<td>Ninth Well</td>
<td>Water 4</td>
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**Remarks:**

- Analyses requested
- Samples for PWS
- Monitor SDWA, NPDES...

**Shipping Info:**

- UPS: Water (WT)
- Fed Express: Soil (SL)
- US Mail: Solid (SD)
- Hand Carried: Filter (FT)
- Other...

**Turnaround Times:**

- Check desired service
- Standard turnaround
- Rush - 5 Working Days
- URGENT - < 2 Working Days

**Compliance Information:**

- Compliance Monitoring: Y/N
- Program (SDWA, NPDES...): EPA
- PWSID / Permit #: WHSC00188
- Chlorinated?: Y/N

**Sample Disposal:** Lab X Client

**Additional Remarks:**

- Rush & Urgent Surcharges will be applied

---

Inter-Mountain Labs, Inc. www.intermountainlabs.com

Rev 4.6
Samples 1-Anderson Test Well, Well A-4, Well A-5, and Well A6 were received on March 4, 2013.

All samples were received and analyzed within the EPA recommended holding times, except those noted in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Qualifiers by sample

TAP WATER MS - Radiochemistry (SDWA)/Radium 226 - Spike Recovery outside accepted recovery limits
S1303015-001 - Radiochemistry (SDWA)/Gross Alpha - RPD outside accepted recovery limits

Reviewed by: Lacey Ketron, Water Lab Supervisor
**Sample Analysis Report**

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525

**Date Reported:** 3/28/2013  
**Report ID:** S1303016001

**Project Name:** Burns Water Well  
**Lab ID:** S1303016-001

**Client Sample ID:** 1-Anderson Test Well  
**COC:** 149711

**Collection Date:** 2/27/2013 11:00:00 AM  
**Date Received:** 3/4/2013 7:49:00 AM  
**Field Sampler:** MS  
**Matrix:** Drinking Water

### Analyses

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<tr>
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<th>Result</th>
<th>Units</th>
<th>Qual</th>
<th>RL</th>
<th>Method</th>
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These results apply only to the samples tested.

**RL - Reporting Limit**

- **B** Analyte detected in the associated Method Blank  
- **E** Value above quantitation range  
- **J** Analyte detected below quantitation limits  
- **M** Value exceeds Monthly Ave or MCL  
- **O** Outside the Range of Dilutions  

**Qualifiers:**  
- **C** Calculated Value  
- **H** Holding times for preparation or analysis exceeded  
- **L** Analyzed by a contract laboratory  
- **ND** Not Detected at the Reporting Limit  
- **S** Spike Recovery outside accepted recovery limits

**Reviewed by:**  
Lacey Ketron, Water Lab Supervisor

Page 1 of 4
### Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way Bldg E  
Fort Collins, CO 80525

**Project Name:** Burns Water Well  
**Lab ID:** S1303016-002  
**Client Sample ID:** Well A6  
**COC:** 149711

**Date Reported:** 3/28/2013  
**Report ID:** S1303016001

**Work Order:** S1303016  
**Collection Date:** 2/27/2013 3:00:00 PM  
**Date Received:** 3/4/2013 7:49:00 AM  
**Field Sampler:** MS  
**Matrix:** Drinking Water

### Analyses

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**These results apply only to the samples tested.**

**Qualifiers:**

- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

**RL - Reporting Limit**

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by:  
Lacey Ketron, Water Lab Supervisor
# Sample Analysis Report

**Company:** Lidstone & Associates Inc  
4025 Automation Way  Bldg E  
Fort Collins, CO 80525

**Date Reported:** 3/28/2013  
**Report ID:** S1303016001

**Project Name:** Burns Water Well  
**Lab ID:** S1303016-003  
**Client Sample ID:** Well A-5  
**COC:** 149711

**Collection Date:** 2/27/2013 1:40:00 PM  
**Date Received:** 3/4/2013 7:49:00 AM

**Field Sampler:** MS  
**Matrix:** Drinking Water

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<th>RL</th>
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These results apply only to the samples tested.

### Qualifiers:
- * Value exceeds Maximum Contaminant Level  
- C Calculated Value  
- H Holding times for preparation or analysis exceeded  
- L Analyzed by a contract laboratory  
- ND Not Detected at the Reporting Limit  
- S Spike Recovery outside accepted recovery limits

### RL - Reporting Limit:
- B Analyte detected in the associated Method Blank  
- E Value above quantitation range  
- J Analyte detected below quantitation limits  
- M Value exceeds Monthly Ave or MCL  
- O Outside the Range of Dilutions

Reviewed by: Lacey Ketron, Water Lab Supervisor
Sample Analysis Report

Company: Lidstone & Associates Inc
4025 Automation Way Bldg E
Fort Collins, CO 80525

Date Reported: 3/28/2013
Report ID: S1303016001

Project Name: Burns Water Well
Lab ID: S1303016-004
Client Sample ID: Well A-4
COC: 149711

Work Order: S1303016
Collection Date: 2/27/2013 1:10:00 PM
Date Received: 3/4/2013 7:49:00 AM
Field Sampler: MS
Matrix: Drinking Water

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These results apply only to the samples tested.

Qualifiers:
- * Value exceeds Maximum Contaminant Level
- C Calculated Value
- H Holding times for preparation or analysis exceeded
- L Analyzed by a contract laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

RL - Reporting Limit
- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- M Value exceeds Monthly Ave or MCL
- O Outside the Range of Dilutions

Reviewed by: Lacey Ketron, Water Lab Supervisor

Page 4 of 4
**ANALYTICAL QC SUMMARY REPORT**

**CLIENT:** Lidstone & Associates Inc  
**Work Order:** S1303016  
**Project:** Burns Water Well

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**Nitrogen, Nitrate-Nitrite (as N)**

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**Sample Type** LCS

| Sample ID | **RunNo:** 92714 | **Analyte** | **Result** | **RL** | **Spike** | **Ref Samp** | **%REC** | **% Rec Limits** | **Qual** |
| QC | 03/06/13 11:27 | Nitrogen, Nitrate-Nitrite (as N) | 20.2 | 0.1 | 19.3 | 105 | 90 - 110 |

**Sample Type** MS

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**Sample Type** DUP

| Sample ID | **RunNo:** 92714 | **Analyte** | **Result** | **RL** | **Spike** | **Ref Samp** | **%REC** | **% Rec Limits** | **Qual** |
| S1303016-002A | 03/06/13 12:55 | Nitrogen, Nitrate-Nitrite (as N) | 6.9 | 0.1 | 6.9 | 0.607 | 20 |

**SDWA Gross Alpha, Beta by SM 7110B**

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**Sample Type** LCS

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| LCS13-079 | 03/27/13 12:33 | Gross Alpha | 63 | 2 | 70 | 90.0 | 80 - 120 |
| Gross Beta | 122 | 3 | 126 | 96.9 | 80 - 120 |

**Sample Type** MS

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**Sample Type** DUP

| Sample ID | **RunNo:** 93438 | **Analyte** | **Result** | **RL** | **Spike** | **Ref Samp** | **%REC** | **% Rec Limits** | **Qual** |
| S1303015-001CDUP | 03/22/13 21:29 | Gross Alpha | 9 | 2 | 13 | 34.5 | 20 | R |
| Gross Beta | 5 | 3 | 6 | 5.08 | 20 |

**Qualifiers:**
- **B**: Analyte detected in the associated Method Blank
- **E**: Value above quantitation range
- **H**: Holding times for preparation or analysis exceeded
- **J**: Analyte detected below quantitation limits
- **L**: Analyzed by a contract laboratory
- **ND**: Not Detected at the Reporting Limit
- **O**: Outside the Range of Dilutions
- **R**: RPD outside accepted recovery limits
- **S**: Spike Recovery outside accepted recovery limits
### CLIENT:
Lidstone & Associates Inc

### Work Order:
S1303016

### Project:
Burns Water Well

#### SDWA Radium 226 by SM 7500

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<tr>
<td>MS</td>
<td>pCi/L</td>
<td>TAP WATER MS</td>
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<td>80 - 120</td>
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<td>TAP WATER MSD</td>
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#### SDWA Rad 228

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<th>Run No</th>
<th>Analyte</th>
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<th>RL</th>
<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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<tbody>
<tr>
<td>MBLK</td>
<td>pCi/L</td>
<td>MB13-060</td>
<td>03/27/13 19:17</td>
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<td>LCS13-080</td>
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### Qualifiers:
- **B**: Analyte detected in the associated Method Blank
- **E**: Value above quantitation range
- **H**: Holding times for preparation or analysis exceeded
- **J**: Analyte detected below quantitation limits
- **L**: Analyzed by a contract laboratory
- **ND**: Not Detected at the Reporting Limit
- **O**: Outside the Range of Dilutions
- **R**: RPD outside accepted recovery limits
- **S**: Spike Recovery outside accepted recovery limits

---

Page 2 of 3
### Total (200.2) Metals by EPA 200.8 - Water

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<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
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<th>Spike</th>
<th>Ref Samp</th>
<th>%REC</th>
<th>% Rec Limits</th>
<th>Qual</th>
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<td>Uranium</td>
<td>0.211</td>
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<th>%RPD</th>
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<th>% RPD Limits</th>
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<td>0.212</td>
<td>0.0003</td>
<td>0.211</td>
<td>0.395</td>
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<th>Ref Samp</th>
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#### Qualifiers:
- **B**: Analyte detected in the associated Method Blank
- **H**: Holding times for preparation or analysis exceeded
- **L**: Analyzed by a contract laboratory
- **O**: Outside the Range of Dilutions
- **S**: Spike Recovery outside accepted recovery limits
- **E**: Value above quantitation range
- **J**: Analyte detected below quantitation limits
- **ND**: Not Detected at the Reporting Limit
- **R**: RPD outside accepted recovery limits
**Inter-Mountain Labs**
Sheridan, WY and Gillette, WY

---

**SHIPPING INFO**
- **Matrix Codes**
  - Water: WT
  - Soil: SL
  - Solid: SD
  - Filter: FT
  - Other: OT

**TURNAROUND TIMES**
- Check desired service:
  - Standard turnaround
  - Rush - 5 Working Days
  - URGENT - < 2 Working Days

**COMPLIANCE INFORMATION**
- Compliance Monitoring?: (Y/N)
- Program (SDWA, NPDES,...)
- PWSID / Permit #
- Chlorinated?: (Y/N)

**ADDITIONAL REMARKS**
- Rush & Urgent Surcharges will be applied
- Sample Disposal: Lab X Client

---

**ANALYSES / PARAMETERS**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>LAB ID (Lab Use Only)</th>
<th>DATE</th>
<th>TIME</th>
<th>SAMPLE IDENTIFICATION</th>
<th>Matrix</th>
<th># of Containers</th>
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<tbody>
<tr>
<td>1</td>
<td>G320316-B201</td>
<td>2/27/13</td>
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<td>Anderson Testwell</td>
<td>Water</td>
<td>X X X X</td>
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<td>2</td>
<td>G320316-B212</td>
<td>2/27/13</td>
<td>15:00</td>
<td>Well A-6</td>
<td>Water</td>
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<td>3</td>
<td>G320316-B213</td>
<td>2/27/13</td>
<td>13:40</td>
<td>Well A-5</td>
<td>Water</td>
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<td>4</td>
<td>G320316-B214</td>
<td>2/27/13</td>
<td>13:10</td>
<td>Well A-4</td>
<td>Water</td>
<td>4</td>
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---

**LAB COMMENTS**
- Relinquished By: Scott Blakely
- Received By: Kathy Bar

---

**REMARKS**
- Analyze sample for compliance monitoring
- Water compliance

---

# 149711
March 28, 2013

Lidstone and Associates
4025 Automation Way Unit E
Fort Collins, CO 80525

Workorder No.: C13030028 Quote ID: C3922 - Drinking Water
Project Name: Burns Water System

Energy Laboratories, Inc. Casper WY received the following 2 samples for Lidstone and Associates on 3/1/2013 for analysis.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Client Sample ID</th>
<th>Collect Date</th>
<th>Receive Date</th>
<th>Matrix</th>
<th>Test</th>
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<tbody>
<tr>
<td>C13030028-001</td>
<td>Well A2</td>
<td>02/27/13 12:30</td>
<td>03/01/13</td>
<td>Drinking Water</td>
<td>Total Uranium, Nitrogen, Nitrate + Nitrite</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Metals Preparation by EPA 200.2 Gross Alpha, Gross Beta</td>
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<tr>
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<td></td>
<td>Radium 226 + Radium 228 Radium 226, Total</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Radium 228, Total</td>
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<tr>
<td>C13030028-002</td>
<td>Well A6</td>
<td>02/27/13 15:00</td>
<td>03/01/13</td>
<td>Drinking Water</td>
<td>Same As Above</td>
</tr>
</tbody>
</table>

The results as reported relate only to the item(s) submitted for testing. The analyses presented in this report were performed at Energy Laboratories, Inc., 2393 Salt Creek Hwy., Casper, WY 82601, unless otherwise noted. Radiochemistry analyses were performed at Energy Laboratories, Inc., 2325 Kerzell Lane, Casper, WY 82601, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

If you have any questions regarding these test results, please call.

Report Approved By:  
Digitally signed by Sheri M. Mead  
Date: 2013.03.28 12:51:28 -06:00
COMBINED RA226+RA228 CALCULATION
The result for the combined Ra226/228 calculation is performed by adding the Ra226 activity to the Ra228 activity. If one or both of these activities is negative or less than the 40CFR_DL, one half the 40CFR_DL is substituted for the respective value below the 40CFR_DL. This may produce a value for the combined radium activities larger than the sum of the two original activities. This method of calculating the sum of the activities for these two radionuclides is in accordance with the guidance in 40CFR141.26(a)(4).
# LABORATORY ANALYTICAL REPORT

**Prepared by Casper, WY Branch**

**Client:** Lidstone and Associates

**Project:** Burns Water System

**Lab ID:** C13030028-001

**Client Sample ID:** Well A2

---

### Analyses

**Result Units**

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<th>MCL/ QCL</th>
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<tr>
<td>Nitrogen, Nitrate+Nitrite as N</td>
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<td>mg/L</td>
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<td>pCi/L</td>
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<tr>
<td><strong>RADIONUCLIDES - TOTAL</strong></td>
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<td></td>
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<td>Gross Beta MDC</td>
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<td>03/28/13 10:37 / res</td>
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</tbody>
</table>

- See case narrative regarding combined Ra226+Ra228 calculation.

---

**Report Definitions:**

- RL - Analyte reporting limit.
- QCL - Quality control limit.
- MCL - Maximum contaminant level.
- ND - Not detected at the reporting limit.
- D - RL increased due to sample matrix.
- U - Not detected at minimum detectable concentration.
LABORATORY ANALYTICAL REPORT
Prepared by Casper, WY Branch

Client: Lidstone and Associates
Project: Burns Water System
Lab ID: C13030028-002
Client Sample ID: Well A6

Report Date: 03/28/13
Collection Date: 02/27/13 15:00
Date Received: 03/01/13
Matrix: Drinking Water

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<th>Result</th>
<th>Units</th>
<th>Qualifiers</th>
<th>RL</th>
<th>MCL/ QCL</th>
<th>Method</th>
<th>Analysis Date / By</th>
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<tr>
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<td></td>
<td>15</td>
<td>E900.0</td>
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<td>03/15/13 10:10 / lbb</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>6.0</td>
<td>pCi/L</td>
<td></td>
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<td>E900.0</td>
<td></td>
<td>03/15/13 10:10 / lbb</td>
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<tr>
<td>Gross Beta precision (±)</td>
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<td>pCi/L</td>
<td></td>
<td>15</td>
<td>E900.0</td>
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<td>03/15/13 10:10 / lbb</td>
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- See case narrative regarding combined Ra226+Ra228 calculation.

Report Definitions:
- RL - Analyte reporting limit.
- MCL - Maximum contaminant level.
- QCL - Quality control limit.
- ND - Not detected at the reporting limit.
- * - The result exceeds the MCL.
- D - RL increased due to sample matrix.
- U - Not detected at minimum detectable concentration.
## QA/QC Summary Report

**Client:** Lidstone and Associates  
**Project:** Burns Water System  
**Report Date:** 03/28/13  
**Report Date:** 03/28/13  
**Work Order:** C13030028

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**Qualifiers:**  
- RL - Analyte reporting limit.  
- ND - Not detected at the reporting limit.  
- MDC - Minimum detectable concentration
# QA/QC Summary Report

**Prepared by Casper, WY Branch**

Client: Lidstone and Associates

Project: Burns Water System

Report Date: 03/28/13

Work Order: C13030028

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| Method: E353.2 | | | | | | | | | |
| Sample ID: MBLK-1 | Method Blank | 0.005 mg/L | 0.003 | Run: TECHNICON_130306B | 03/06/13 14:10 | |
| Nitrogen, Nitrate+Nitrite as N | | | | | | | | | |
| Sample ID: LCS-2 | Laboratory Control Sample | 2.54 mg/L | 0.10 101 90 110 | Run: TECHNICON_130306B | 03/06/13 14:13 | |
| Nitrogen, Nitrate+Nitrite as N | | | | | | | | | |
| Sample ID: LFB-3 | Laboratory Fortified Blank | 1.95 mg/L | 0.10 99 90 110 | Run: TECHNICON_130306B | 03/06/13 14:15 | |
| Nitrogen, Nitrate+Nitrite as N | | | | | | | | | |
| Sample ID: C13030028-001BMS | Sample Matrix Spike | 26.5 mg/L | 1.0 108 90 110 | Run: TECHNICON_130306B | 03/06/13 14:50 | |
| Nitrogen, Nitrate+Nitrite as N | | | | | | | | | |
| Sample ID: C13030028-001BMSD | Sample Matrix Spike Duplicate | 26.5 mg/L | 1.0 108 90 110 | Run: TECHNICON_130306B | 03/06/13 14:53 | |
| Nitrogen, Nitrate+Nitrite as N | | | | | | | | | |

**Qualifiers:**

- RL - Analyte reporting limit.
- ND - Not detected at the reporting limit.
- MDC - Minimum detectable concentration
### QA/QC Summary Report
Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Water System

#### Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qual

**Method:** E900.0  
**Sample ID:** Th230-GrDW-0358  
**Lab Control Sample**  
Gross Alpha | 110 pCi/L | 108 | 80 | 120 | 03/15/13 10:10  
**Sample ID:** Sr90-GrDW-0358  
**Lab Control Sample**  
Gross Beta | 170 pCi/L | 91 | 80 | 120 | 03/15/13 10:10  
**Sample ID:** MB-GrDW-0358  
6 **Method Blank**  
Gross Alpha | 1 pCi/L |  |  |  |  |  | U  
Gross Beta | -2 pCi/L |  |  |  |  |  |  
Gross Beta precision (±) | 1 pCi/L |  |  |  |  |  |  
Gross Beta MDC | 2 pCi/L |  |  |  |  |  |  

**Sample ID:** C13030019-001AMS  
**Sample Matrix Spike**  
Gross Alpha | 80 pCi/L | 72 | 70 | 130 | 03/15/13 10:10  
**Sample ID:** C13030019-001AMSD  
**Sample Matrix Spike Duplicate**  
Gross Alpha | 82 pCi/L | 75 | 70 | 130 | 03/15/13 10:10  
**Sample ID:** C13030019-001AMS  
**Sample Matrix Spike**  
Gross Beta | 190 pCi/L | 103 | 70 | 130 | 03/15/13 10:10  
**Sample ID:** C13030019-001AMSD  
**Sample Matrix Spike Duplicate**  
Gross Beta | 160 pCi/L | 91 | 70 | 130 | 13 | 20 | 03/15/13 10:10

#### Qualifiers:
- **RL** - Analyte reporting limit.  
- **MDC** - Minimum detectable concentration  
- **ND** - Not detected at the reporting limit.  
- **U** - Not detected at minimum detectable concentration
## QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Water System

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**Qualifiers:**
- RL - Analyte reporting limit.
- MDC - Minimum detectable concentration
- ND - Not detected at the reporting limit.
# QA/QC Summary Report

Prepared by Casper, WY Branch

**Client:** Lidstone and Associates  
**Project:** Burns Water System

## Analyte Count Result Units RL %REC Low Limit High Limit RPD RPD Limit Qualifiers:

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| Sample ID: LCS-228-RA228DW-0 | Laboratory Control Sample | Run: TENNELEC-3_130304B | 03/19/13 13:31 |
| Radium 228 | 4.6 | pCi/L | 114 | 80 | 120 | |

| Sample ID: C13020698-001BDUP | 3 | Sample Duplicate | Run: TENNELEC-3_130304B | 03/19/13 13:31 |
| Radium 228 | -0.46 | pCi/L | 75 | 20 | UR |
| Radium 228 precision (±) | 0.71 | pCi/L | |
| Radium 228 MDC | 0.77 | pCi/L | |

- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 0.5 is less than the limit of 2.0. This batch is approved.

| Sample ID: C13020753-001AMS | Sample Matrix Spike | Run: TENNELEC-3_130304B | 03/19/13 13:31 |
| Radium 228 | 10 | pCi/L | 110 | 70 | 130 | |

| Sample ID: C13030028-001CDUP | 3 | Sample Duplicate | Run: TENNELEC-3_130304B | 03/19/13 13:31 |
| Radium 228 | -0.52 | pCi/L | 690 | 20 | UR |
| Radium 228 precision (±) | 0.81 | pCi/L | |
| Radium 228 MDC | 0.88 | pCi/L | |

- Duplicate RPD is outside of the acceptance range for this analysis; however, the RER of 1.4 is less than the limit of 2.0. This batch is approved.

| Sample ID: MB-228-RA228DW-01 | 3 | Method Blank | Run: TENNELEC-3_130304B | 03/19/13 13:31 |
| Radium 228 | -0.6 | pCi/L | U |
| Radium 228 precision (±) | 0.8 | pCi/L | |
| Radium 228 MDC | 0.9 | pCi/L | |

**Qualifiers:**

- **RL** - Analyte reporting limit.  
- **MDC** - Minimum detectable concentration  
- **U** - Not detected at minimum detectable concentration  
- **ND** - Not detected at reporting limit.  
- **R** - RPD exceeds advisory limit.
Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/solid samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as -dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

Lidstone and Associates  C13030028

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<th>Login completed by:</th>
<th>Timothy I. Houghteling</th>
<th>Reviewed by:</th>
<th>BL2000/cwagner</th>
<th>Reviewed Date:</th>
<th>3/5/2013</th>
<th>Date Received:</th>
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<tr>
<td>Custody seals intact on sample bottles?</td>
<td>Yes ✔</td>
<td>No □</td>
<td>Not Present □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain of custody present?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain of custody signed when relinquished and received?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain of custody agrees with sample labels?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Samples in proper container/bottle?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample containers intact?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sufficient sample volume for indicated test?</td>
<td>Yes ✔</td>
<td>No □</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| All samples received within holding time? | Yes ✔ | No □ | | | | | | | | | (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)
| Temp Blank received? | Yes ✔ | No □ | Not Applicable □ | | | | | | | | |
| Container/Temp Blank temperature: | 5.2°C Melted Ice | | | | | | | | | |
| Water - VOA vials have zero headspace? | Yes ✔ | No □ | No VOA vials submitted ✔ | | | | | | | | |
| Water - pH acceptable upon receipt? | Yes ✔ | No □ | Not Applicable □ | | | | | | | | |

Contact and Corrective Action Comments:

None
# Chain of Custody and Analytical Request Record

**Company Name:** Liostone and Associates, Inc.  
**Report Mail Address (Required):**  
Your Attention: Main, Bldg E  
Fr. Calvins, Co 80625  
**Contact Name:**  
MARK STACY  
**Phone/Fax:**  
970-223-4725 / 970-223-4706

**Project Name, PWS, Permit, Etc.:** Blaine Water System  
**State:** WY  
**Sample Origin:**  
**EPA/State Compliance:** Yes [x] No [ ]  
**Sampler:** (Please Print)  
MARK STACY

**Invoice Contact & Phone:**  
MARK STACY 970-223-4706

**Date Time:**  
**Sample Disposal:** Return to Client  
**Lab Disposal:** [x]

**Analysis Requested:**  
**RUSH Sample submission for charges and scheduling – See Instruction Page**

**Comments:**

**Custody Seal:** X  
**On Bottle:** Y  
**On Cooler:** Y  
**Intact:** X  
**Signature:** X

**Shipped by:** FE - [x]  
**Cooler ID(s):** [ ]

**Sample Disposal:** Return to Client  
**Lab Disposal:** [x]

**Sample Origin:**  
**Sample Collection: DW**  
**Sample Matrix:** 3.0W

**Special Report/Formats:**

- [ ] DW  
- [ ] POTW/WWTP  
- [ ] Other: NELAC

**Sample Identification: (Name, Location, Interval, etc.)**

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>Collection Date</th>
<th>Collection Time</th>
<th>Collection Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well A-2</td>
<td>2/27/13</td>
<td>12:50</td>
<td>DW</td>
</tr>
<tr>
<td>Well A-6</td>
<td>2/27/13</td>
<td>15:00</td>
<td>DW</td>
</tr>
</tbody>
</table>

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Appendix G

Pump Sizing Spreadsheets
### Well Site Minor Losses

<table>
<thead>
<tr>
<th>H</th>
<th>Number of Items</th>
<th>K</th>
<th>Q</th>
<th>V</th>
<th>A</th>
<th>D</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.62</td>
<td>1</td>
<td>1.00</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.45</td>
<td>1</td>
<td>0.28</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>32.29</td>
<td>2</td>
<td>10.00</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.32</td>
<td>1</td>
<td>0.28</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>1.81</td>
<td>1</td>
<td>0.28</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.65</td>
<td>2</td>
<td>0.50</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>15.20</td>
<td>1</td>
<td>10.00</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.92</td>
<td>1</td>
<td>1.00</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
</tbody>
</table>

**TOTAL FLOW = 1190**

### Transmission Line Minor Losses

<table>
<thead>
<tr>
<th>H</th>
<th>Number of Items</th>
<th>K</th>
<th>Q</th>
<th>V</th>
<th>A</th>
<th>D</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.32</td>
<td>1</td>
<td>0.28</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.11</td>
<td>2</td>
<td>0.50</td>
<td>0.99</td>
<td>10.21</td>
<td>0.09</td>
<td>4.00</td>
<td>0.33</td>
</tr>
<tr>
<td>0.55</td>
<td>3</td>
<td>1.00</td>
<td>0.99</td>
<td>2.55</td>
<td>0.35</td>
<td>8.00</td>
<td>0.67</td>
</tr>
<tr>
<td>0.10</td>
<td>1</td>
<td>1.00</td>
<td>0.99</td>
<td>2.55</td>
<td>0.35</td>
<td>8.00</td>
<td>0.67</td>
</tr>
</tbody>
</table>

**1.09 = Sum**

### Column Pipe to Well House

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge G (gpm)</th>
<th>Discharge Q (ft³/s)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₂ (ft)</th>
<th>Head Loss h₃ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.067</td>
<td>180</td>
<td>400</td>
<td>0.9</td>
<td>10.2</td>
<td>140</td>
<td>57.45</td>
<td>15</td>
<td>73</td>
</tr>
<tr>
<td>0.33</td>
<td>0.067</td>
<td>20</td>
<td>400</td>
<td>0.9</td>
<td>10.2</td>
<td>130</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>0.67</td>
<td>0.345</td>
<td>120</td>
<td>400</td>
<td>0.9</td>
<td>2.6</td>
<td>140</td>
<td>0.36</td>
<td>0.35</td>
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</tr>
</tbody>
</table>

### Well House Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge G (gpm)</th>
<th>Discharge Q (ft³/s)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₂ (ft)</th>
<th>Head Loss h₃ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.067</td>
<td>180</td>
<td>400</td>
<td>0.9</td>
<td>10.2</td>
<td>140</td>
<td>57.45</td>
<td>15</td>
<td>73</td>
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<tr>
<td>0.33</td>
<td>0.067</td>
<td>20</td>
<td>400</td>
<td>0.9</td>
<td>10.2</td>
<td>130</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>0.67</td>
<td>0.345</td>
<td>120</td>
<td>400</td>
<td>0.9</td>
<td>2.6</td>
<td>140</td>
<td>0.36</td>
<td>0.35</td>
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</table>

### Isolated Transmission Line

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge G (gpm)</th>
<th>Discharge Q (ft³/s)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₂ (ft)</th>
<th>Head Loss h₃ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.345</td>
<td>1,600</td>
<td>400</td>
<td>0.9</td>
<td>2.6</td>
<td>140</td>
<td>6</td>
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### Tank Inlet Riser Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge G (gpm)</th>
<th>Discharge Q (ft³/s)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₂ (ft)</th>
<th>Head Loss h₃ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.61</td>
<td>0.345</td>
<td>130</td>
<td>1,120</td>
<td>2.6</td>
<td>7.3</td>
<td>130</td>
<td>3.27</td>
<td>0.57</td>
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</tbody>
</table>

### Total Length = 150

**Total Headloss = 84.83**

### Notes:
- Danfoss Series 50 DI Check Valves have min and max flow requirements of 3 and 10 fps respectively.
- Suitable well water depth (ft) = 118.31
- Drafted Well (ft) @ 400 gpm = 19
- Well Drafted Well Water Depth (ft) @ 400 gpm = 137.31
- Discharge Elevation at Storage Tank = 5513
- Well A2 Elevation = 5513
- Ground Elev = 134.50
- Total Headloss = 27.31
- Use
### Well Sizet Losses

**LEG 1 TOTAL FLOW = 1150**

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of Items</th>
<th>K (ft/l)</th>
<th>Q (ft³/ln)</th>
<th>V (ft/ln)</th>
<th>A (ft²)</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3° Entrance</td>
<td>1.28</td>
<td>1</td>
<td>1.00</td>
<td>0.45</td>
<td>9.08</td>
<td>0.06</td>
</tr>
<tr>
<td>3° 90 degree elbow</td>
<td>0.36</td>
<td>1</td>
<td>0.26</td>
<td>2.45</td>
<td>9.08</td>
<td>0.05</td>
</tr>
<tr>
<td>Danfoss Flowmatic 3° Drop Pipe</td>
<td>12.80</td>
<td>1</td>
<td>0.02</td>
<td>2.45</td>
<td>9.08</td>
<td>0.05</td>
</tr>
<tr>
<td>3° x 4° Reducer</td>
<td>0.02</td>
<td>1</td>
<td>0.20</td>
<td>2.45</td>
<td>9.08</td>
<td>0.05</td>
</tr>
<tr>
<td>4° 90 degree elbow</td>
<td>0.45</td>
<td>4</td>
<td>0.25</td>
<td>2.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4° Gate Valve</td>
<td>0.18</td>
<td>2</td>
<td>0.25</td>
<td>2.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4° Mueller Swing Check Valve</td>
<td>8.16</td>
<td>2</td>
<td>0.25</td>
<td>2.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4° Tee</td>
<td>2.18</td>
<td>3</td>
<td>1.00</td>
<td>2.58</td>
<td>7.34</td>
<td>0.35</td>
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</table>

Transmission Line Minor Losses

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of Items</th>
<th>K (ft/l)</th>
<th>Q (ft³/ln)</th>
<th>V (ft/ln)</th>
<th>A (ft²)</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6° x 2° Reducer</td>
<td>0.29</td>
<td>1</td>
<td>0.20</td>
<td>2.45</td>
<td>9.08</td>
<td>0.05</td>
</tr>
<tr>
<td>6° 90 degree elbow</td>
<td>0.02</td>
<td>1</td>
<td>0.25</td>
<td>2.45</td>
<td>2.97</td>
<td>0.20</td>
</tr>
<tr>
<td>8° x 6° Reducer</td>
<td>0.02</td>
<td>1</td>
<td>0.20</td>
<td>2.45</td>
<td>2.97</td>
<td>0.20</td>
</tr>
<tr>
<td>8° Tee</td>
<td>0.02</td>
<td>1</td>
<td>0.20</td>
<td>2.45</td>
<td>2.97</td>
<td>0.20</td>
</tr>
<tr>
<td>8° Entrance</td>
<td>0.04</td>
<td>1</td>
<td>1.00</td>
<td>2.58</td>
<td>7.34</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Note: Danfoss Series 80 DI Check Valves have min and max flow requirements of 3 and 10 fps respectively.

### Drop Pipe to Well House

Piping with 4" PVC

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/l)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₜ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>180</td>
<td>200</td>
<td>0.4</td>
<td>5.1</td>
<td>130</td>
<td>30.44</td>
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Well House Piping

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<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/l)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₜ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>220</td>
<td>200</td>
<td>0.4</td>
<td>5.1</td>
<td>130</td>
<td>1</td>
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</table>

Site Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/l)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₜ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>120</td>
<td>200</td>
<td>0.4</td>
<td>5.1</td>
<td>130</td>
<td>2.85</td>
<td>2.85</td>
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### Isolated Transmission Line

<table>
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<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/l)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₜ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.198</td>
<td>1,240</td>
<td>922</td>
<td>0.4</td>
<td>8.3</td>
<td>130</td>
<td>4</td>
<td>4</td>
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</tr>
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</table>

### Tank Inlet Riser Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/l)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₜ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.87</td>
<td>0.349</td>
<td>192</td>
<td>1,130</td>
<td>0.8</td>
<td>7.3</td>
<td>130</td>
<td>3.27</td>
<td>3.27</td>
<td></td>
</tr>
</tbody>
</table>

**Total Length = 150**

**Total Headloss = 45.79**

### Static Evaluations

- **Static Well Water Depth (feet) = 101.9**
- **Drawdown (feet) = 200 gpm = 96**
- **Well Water Depth = 927/11**
- **Estimated Per Constant Rate Test 927/11**
- **Discharge Elevation at Storage Tank = 5562 Per Burns Water Storage Tank Project Drawings**
- **Estimated Per Constant Rate Test 927/11**
- **Well A3 Elevation = 5418**
- **Ground Elevation**
- **DIFF In Elev between Max Tank Elev. and Well Elev = 134.00**
- **Calculated**
- **Static Head = 284.00**

### Design Calculations

<table>
<thead>
<tr>
<th>Flow, Q (gpm)</th>
<th>Total Head Loss h₁ (ft)</th>
<th>Static Head h₀ (ft)</th>
<th>Total Dynamic Head THD (ft)</th>
<th>BHP Assuming 75% Eff.</th>
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<tbody>
<tr>
<td>200</td>
<td>45.79</td>
<td>284.00</td>
<td>330</td>
<td>22.8</td>
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**Rums - Level II Well Project**

For Sizing Wall 44 Pump with all wells at proposed maximum capacity (1,150 gpm)

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Well Capacity (GPM)</th>
<th>Well in Service</th>
<th>Well Capacity (GPM)</th>
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<tbody>
<tr>
<td></td>
<td>Feed</td>
<td>Fb</td>
<td>Feed</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>A</td>
<td>200</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>B</td>
<td>400</td>
<td>300</td>
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<tr>
<td>C</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>Y</td>
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TOTAL FLOW = 1150

<table>
<thead>
<tr>
<th>Well Site Mine Losses</th>
<th>H0</th>
<th>Number of Items</th>
<th>K</th>
<th>Q (gpm)</th>
<th>V (ft/sec)</th>
<th>A</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

5.37 ← Sum

<table>
<thead>
<tr>
<th>Transmission Line Mine Losses</th>
<th>H0</th>
<th>Number of Items</th>
<th>K</th>
<th>Q (gpm)</th>
<th>V (ft/sec)</th>
<th>A</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

Note: Danfoss Series 81 Di Check Valve have min and max flow requirements of 3 and 16.7 gpm respectively.

<table>
<thead>
<tr>
<th>Column Pipe to Wall House Piping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Diameter (in)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>4 PVC</th>
</tr>
</thead>
<tbody>
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<td>Diameter (in)</td>
<td>4 PVC</td>
</tr>
<tr>
<td>Length of Pipe (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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</table>

<table>
<thead>
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<td>Pipe Diameter (in)</td>
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<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
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</thead>
<tbody>
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<td>Diameter (in)</td>
<td>4 PVC</td>
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<tr>
<td>Length of Pipe (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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<tr>
<td>Head Loss (ft)</td>
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<table>
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<th>Site Piping</th>
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<tbody>
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<td>Pipe Diameter (in)</td>
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<table>
<thead>
<tr>
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</thead>
<tbody>
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<td>6 PVC</td>
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<tr>
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<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
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<tr>
<td>Head Loss (ft)</td>
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<tr>
<td>Head Loss (ft)</td>
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<table>
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<tr>
<th>Pipe Diameter (in)</th>
<th>6 PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (in)</td>
<td>6 PVC</td>
</tr>
<tr>
<td>Length of Pipe (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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<table>
<thead>
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<th>Isolated Transmission Line</th>
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</thead>
<tbody>
<tr>
<td>Pipe Diameter (in)</td>
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</table>

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>8 PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (in)</td>
<td>8 PVC</td>
</tr>
<tr>
<td>Length of Pipe (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Tank Inter River Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Diameter (in)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>6 PVC</th>
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</thead>
<tbody>
<tr>
<td>Diameter (in)</td>
<td>6 PVC</td>
</tr>
<tr>
<td>Length of Pipe (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
</tr>
<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
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<table>
<thead>
<tr>
<th>Tank Inter River Pipe</th>
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</thead>
<tbody>
<tr>
<td>Pipe Diameter (in)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>8 PVC</th>
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</thead>
<tbody>
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<td>Length of Pipe (ft)</td>
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</tr>
<tr>
<td>Discharge Q (gpm)</td>
<td>100</td>
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<tr>
<td>Discharge Q (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge V (ft³/s)</td>
<td>100</td>
</tr>
<tr>
<td>Resistance Coefficient Cₓ</td>
<td>100</td>
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<tr>
<td>Sum of Mine Losses (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Head Loss (ft)</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Headloss</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Head Water Depth (ft)</td>
<td>72.6</td>
</tr>
<tr>
<td>Drawdown (ft)</td>
<td>42.9</td>
</tr>
<tr>
<td>Static Head (ft)</td>
<td>94.9</td>
</tr>
<tr>
<td>Well Water Head (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Discharge Elevation at Storage Tank</td>
<td>100</td>
</tr>
<tr>
<td>Well 44 Elevation (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Ground Elevation (ft)</td>
<td>100</td>
</tr>
<tr>
<td>Total Headloss</td>
<td>130</td>
</tr>
</tbody>
</table>

Note: Danfoss Series 81 Di Check Valve have min and max flow requirements of 3 and 16.7 gpm respectively.
Appendix H

1-Anderson Test Well Transmission Line Alignment Photos
Photo 6.1: Test Well Transmission Line Alignment – 1st Street East View.

Photo 6.2: Test Well Transmission Line Alignment – 1st Street East View.
30% Design Isolated Water Transmission Line
Burns, Wyoming

Client:
Wyoming Water Development Commission

Engineer:
Lindstone and Associates, Inc.
4025 Automation Way, Bldg. E
Fort Collins, CO 80525

Engineer:
A.V.I., P.C.
1103 Old Town Lane, Ste. 101
Cheyenne, WY 82009
307.637.6017

Notes:
1. Utility information indicated is based on information provided by others and represents approximate locations. The contractor shall be required to perform utility detection of indicated locations. The contractor shall also be required to maintain records of any utility location alterations. The contractor shall be required to consult any available plans prior to any utility location verification activities.

2. All construction shown on accompanying maps shall be in accordance with City of Cheyenne and Board of Public Utilities construction standards and specifications and amendments to same.

3. All trenching shall follow federal and state OSHA requirements.

4. Full-size scales are based on a standard drawing sheet size of 24" X 36". Map sheet scales shown are based on a standard drawing size of 11" X 17". If any portion of drawings are plotted on other than these standard sizes, they shall adjust scales accordingly. If bar scales do not measure 1" then the standards are not to scale.

Before You Dig
Call 1-800-849-2478
### Anticipated Annual Electrical Costs with Recommended Alternatives Constructed

<table>
<thead>
<tr>
<th>Total Gal. Produced Annually</th>
<th>40,000,000</th>
<th>(ENTER)</th>
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<tbody>
<tr>
<td>Ave Day Demand (GPD)</td>
<td>109,589</td>
<td>(Calc)</td>
</tr>
<tr>
<td>Normal Production Rate (GPM)</td>
<td>350</td>
<td>(ENTER)</td>
</tr>
<tr>
<td>Run Time Per Day (minutes)</td>
<td>313.11</td>
<td>(Calc)</td>
</tr>
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</table>

#### Estimated Annual Electrical Use

<table>
<thead>
<tr>
<th>Well</th>
<th>PUMP RATE</th>
<th>(') HEAD</th>
<th>PUMP EFF.</th>
<th>MOTOR HORSE-POWER</th>
<th>POWER RATE</th>
<th>Annual PUMPED FLOW</th>
<th>PUMP RUN TIME</th>
<th>Annual ENERGY USE</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>GPM</td>
<td>FT</td>
<td>Assumed</td>
<td>HP</td>
<td>KW</td>
<td>Gal/Yr</td>
<td>Hrs/Yr</td>
<td>KWh/Yr</td>
</tr>
<tr>
<td>A2</td>
<td>200</td>
<td>(CALC)</td>
<td>(ENTER)</td>
<td>(CALC)</td>
<td>(CALC)</td>
<td>14.2</td>
<td>8,571,429</td>
<td>952</td>
</tr>
<tr>
<td>A3</td>
<td>150</td>
<td>282</td>
<td>75.0%</td>
<td>17</td>
<td>12.5</td>
<td>8,571,429</td>
<td>952</td>
<td>11,879</td>
</tr>
<tr>
<td>A4</td>
<td>200</td>
<td>331</td>
<td>75.0%</td>
<td>20</td>
<td>14.7</td>
<td>8,571,429</td>
<td>952</td>
<td>14,067</td>
</tr>
<tr>
<td>Test Well</td>
<td>150</td>
<td>312</td>
<td>75.0%</td>
<td>16</td>
<td>11.7</td>
<td>8,571,429</td>
<td>952</td>
<td>11,188</td>
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<tr>
<td>Total</td>
<td></td>
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<td></td>
<td></td>
<td>14,2</td>
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#### Estimated Annual Electrical Costs

<table>
<thead>
<tr>
<th>Well</th>
<th>FACILITY CHARGE</th>
<th>ENERGY CHARGE (1st 50 kWh)</th>
<th>ENERGY CHARGE (Next 100 kWh)</th>
<th>ENERGY CHARGE (Excess per kWh)</th>
<th>Annual ENERGY COSTS</th>
<th>DEMAND CHARGE</th>
<th>Annual DEMAND COSTS</th>
<th>PUMP NAMEPLATE HP (Excess per kWh)</th>
<th>TRANSFORMER KVA CHARGE</th>
<th>¹Annual Operating Costs</th>
<th>²Annual Operating Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$/Yr</td>
<td>$/kWh</td>
<td>$/kWh</td>
<td>$/kWh</td>
<td>$/Yr</td>
<td>$/Yr</td>
<td>$/Yr</td>
<td>$/Yr</td>
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<td>$/Yr</td>
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<tr>
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<td>(ENTER)</td>
<td>(ENTER)</td>
<td>(ENTER)</td>
<td>(ENTER)</td>
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<td>(ENTER)</td>
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<tr>
<td>A3</td>
<td>$420.00</td>
<td>$0.08869</td>
<td>$0.06043</td>
<td>$0.04734</td>
<td>$0.04229</td>
<td>$375</td>
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<td>$5,523</td>
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<td>$420.00</td>
<td>$0.08869</td>
<td>$0.06043</td>
<td>$0.04734</td>
<td>$0.04229</td>
<td>$307</td>
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<td>$2,111</td>
<td>780.00</td>
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<td>$5,168</td>
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<td>$0.06043</td>
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<td>$0.04229</td>
<td>$478</td>
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<td>$1,988</td>
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<td>900.00</td>
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<td>$2,157</td>
<td>$8,284</td>
<td>$2,540</td>
<td>$4,950</td>
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Total² $21,024

Notes:
1. Based on current (as of April 2013) electrical rates and charges per High West Energy
2. High West Energy will be raising rates June 2013, but the increase has not been determined to date; therefore a 3% increase has been added to anticipate the additional costs.
### Bums - Level II Well Project
**For Calculating Well A2 TDH Under Normal Operating Conditions (350 GPM)**

<table>
<thead>
<tr>
<th>Well No</th>
<th>Well Capacity (GPM)</th>
<th>Well In Service (Y or N)</th>
<th>Well Capacity (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>200</td>
<td>Y</td>
<td>200</td>
</tr>
<tr>
<td>A3</td>
<td>150</td>
<td>Y</td>
<td>150</td>
</tr>
<tr>
<td>A4</td>
<td>400</td>
<td>N</td>
<td>0</td>
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<tr>
<td>Test Well</td>
<td>150</td>
<td>N</td>
<td>0</td>
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</table>

**TOTAL FLOW = 350**

### Well Site Minor Losses

<table>
<thead>
<tr>
<th>H(I)</th>
<th>Number of items</th>
<th>K</th>
<th>Q (ft²)</th>
<th>V (ft/sec)</th>
<th>A</th>
<th>D</th>
<th>D (ft)</th>
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<tbody>
<tr>
<td>4”</td>
<td>1</td>
<td>1</td>
<td>0.70</td>
<td>6.25</td>
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<td>5.78</td>
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### Transmission Line Minor Losses

<table>
<thead>
<tr>
<th>H(I)</th>
<th>Number of items</th>
<th>K</th>
<th>Q (ft²)</th>
<th>V (ft/sec)</th>
<th>A</th>
<th>D</th>
<th>D (ft)</th>
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<tbody>
<tr>
<td>8”</td>
<td>1</td>
<td>1</td>
<td>0.20</td>
<td>6.84</td>
<td>0.33</td>
<td>4.00</td>
<td>0.33</td>
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### Column Pipe to Well House Piping with 4” PVC

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/hr)</th>
<th>Pipe Velocity V (ft/sec)</th>
<th>Resitance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h + (ft)</th>
<th>Head Loss h - (ft)</th>
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<tbody>
<tr>
<td>0.33</td>
<td>0.058</td>
<td>180</td>
<td>200</td>
<td>0.4</td>
<td>5.1</td>
<td>140</td>
<td>14.92</td>
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<td>19</td>
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### Well House Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/hr)</th>
<th>Pipe Velocity V (ft/sec)</th>
<th>Resitance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h + (ft)</th>
<th>Head Loss h - (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.058</td>
<td>20</td>
<td>200</td>
<td>0.4</td>
<td>5.1</td>
<td>130</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Site Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/hr)</th>
<th>Pipe Velocity V (ft/sec)</th>
<th>Resitance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h + (ft)</th>
<th>Head Loss h - (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>120</td>
<td>200</td>
<td>0.4</td>
<td>1.3</td>
<td>140</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

* Added 100 for tank side piping

### Isolated Transmission Line

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/hr)</th>
<th>Pipe Velocity V (ft/sec)</th>
<th>Resitance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h + (ft)</th>
<th>Head Loss h - (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>1,990</td>
<td>200</td>
<td>0.4</td>
<td>1.3</td>
<td>140</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### Tank Inlet Riser Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter D (in)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (ft³/hr)</th>
<th>Pipe Velocity V (ft/sec)</th>
<th>Resitance Coefficient C</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h + (ft)</th>
<th>Head Loss h - (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>190</td>
<td>350</td>
<td>0.8</td>
<td>2.2</td>
<td>130</td>
<td>0.39</td>
<td>0.39</td>
<td>0.39</td>
</tr>
</tbody>
</table>

**Total Headloss = 21.87**

- **Static Well Water Depth (feet) = 118.31** Per Constant Rate Test 10/4/11
- **Drawdown (feet) @ 200 gpm = 8** Per Constant Rate Test 10/4/11
- **Well Water Depth (feet) @ 200 gpm = 128.31** Per Constant Rate Test 10/4/11
- **Discharge Elevation at Storage Tank = 5552** Per Bums Water Storage Tank Project Drawings
- **Well A2 Elevation = 5515** Per Bums Water Storage Tank Project Drawings
- **Total Headloss = 21.87** Calculated

**Note:** Danfoss Series 80 DI Check Valves have min and max flow requirements of 3 and 10 fps respectively.
### Level II Well Project

#### For Calculating Well A3 TDH Under Normal Operating Conditions (350 GPM)

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Well Capacity GPM</th>
<th>Well in Service Y or N</th>
<th>Well Capacity GPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
<tr>
<td>A2</td>
<td>Y</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>A3</td>
<td>Y</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>A4</td>
<td>N</td>
<td>400</td>
<td>0</td>
</tr>
<tr>
<td>Test Well</td>
<td>N</td>
<td>150</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Leg 1 TOTAL FLOW = 350 GPM

### Well Site Minor Losses

<table>
<thead>
<tr>
<th>H (ft)</th>
<th>Number of Items</th>
<th>K (ft/sec)</th>
<th>Q (gpm)</th>
<th>A (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' Entrance</td>
<td>0.72</td>
<td>1</td>
<td>1.00</td>
<td>0.33</td>
</tr>
<tr>
<td>3' x 3' Reducer</td>
<td>0.20</td>
<td>1</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>3' x 4' Reducer</td>
<td>0.14</td>
<td>0.25</td>
<td>0.33</td>
<td>6.81</td>
</tr>
<tr>
<td>4' 90 degree elbow</td>
<td>0.26</td>
<td>4</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>4' Gate Valve</td>
<td>0.09</td>
<td>2</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>4' Mueller Swing Check Valve</td>
<td>4.56</td>
<td>2</td>
<td>1.00</td>
<td>0.33</td>
</tr>
<tr>
<td>4' Tee</td>
<td>1.23</td>
<td>3</td>
<td>1.80</td>
<td>0.33</td>
</tr>
</tbody>
</table>

#### Transmission Line Minor Losses

<table>
<thead>
<tr>
<th>H (ft)</th>
<th>Number of Items</th>
<th>K (ft/sec)</th>
<th>Q (gpm)</th>
<th>A (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6' x 3' Reducer</td>
<td>0.14</td>
<td>0.25</td>
<td>0.33</td>
<td>6.81</td>
</tr>
<tr>
<td>6' 90 degree elbow</td>
<td>0.01</td>
<td>1</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>6' x 6' Reducer</td>
<td>0.01</td>
<td>1</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>9' x 4' Tee</td>
<td>0.28</td>
<td>2</td>
<td>1.00</td>
<td>0.78</td>
</tr>
<tr>
<td>9' 90 degree elbow</td>
<td>0.07</td>
<td>2</td>
<td>0.25</td>
<td>0.33</td>
</tr>
<tr>
<td>9' Entrance</td>
<td>0.08</td>
<td>1</td>
<td>1.00</td>
<td>0.78</td>
</tr>
</tbody>
</table>

#### Drop Pipe to Well House Piping with 4" PVC

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge D (ft²/s)</th>
<th>Pipe Velocily V (ft/sec)</th>
<th>Resistance Coefficient Cn</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h (ft)</th>
<th>Head Loss h% (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>180</td>
<td>150</td>
<td>0.3</td>
<td>3.8</td>
<td>140</td>
<td>14.98</td>
<td>3</td>
<td>17</td>
</tr>
</tbody>
</table>

#### Well House Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge D (ft²/s)</th>
<th>Pipe Velocily V (ft/sec)</th>
<th>Resistance Coefficient Cn</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h (ft)</th>
<th>Head Loss h% (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>20</td>
<td>150</td>
<td>0.3</td>
<td>3.8</td>
<td>130</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Site Piping

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge D (ft²/s)</th>
<th>Pipe Velocily V (ft/sec)</th>
<th>Resistance Coefficient Cn</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h (ft)</th>
<th>Head Loss h% (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>120</td>
<td>150</td>
<td>0.3</td>
<td>3.8</td>
<td>140</td>
<td>1.68</td>
<td>1.68</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Danfoss Series 80 DI Check Valves have min and max flow requirements of 3 and 10 gpm respectively.

#### Isolated Transmission Line

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge D (ft²/s)</th>
<th>Pipe Velocily V (ft/sec)</th>
<th>Resistance Coefficient Cn</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h (ft)</th>
<th>Head Loss h% (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.195</td>
<td>1,240</td>
<td>150</td>
<td>0.3</td>
<td>1.7</td>
<td>140</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Tank Inlet Wiper Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (ft²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge D (ft²/s)</th>
<th>Pipe Velocily V (ft/sec)</th>
<th>Resistance Coefficient Cn</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h (ft)</th>
<th>Head Loss h% (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>150</td>
<td>350</td>
<td>0.8</td>
<td>2.2</td>
<td>150</td>
<td>0.90</td>
<td>0.90</td>
<td></td>
</tr>
</tbody>
</table>

### Total Headloss = 22.30

#### Static Well Water Depth (feet) = 101.9
#### Drawdown (feet) @ 150 gpm = 70
#### Well Water Depth @ 150 gpm = 171.90
#### Discharge Elevation at Storage Tank = 545.7 ft
#### Well A3 Elevation = 555 ft
#### Diff In Elev between Max Tank Elev. And Well Elev = 127 ft

**Total Headloss:**

- **Static Head (ft) = 101.9**
- **Head TDH = 350 ft**
- **Static Head Transfer (ft) = 101.9**
- **Head TDH ( ft) = 101.9 73% Eff.**
- **TDH = 73% Eff.**
- **Operating Head = 350 ft**
- **Max Design Flow (gpm) = 300**
- **Total Head Loss (ft) = 22.30**
<table>
<thead>
<tr>
<th>Wall No.</th>
<th>Wall Capacity (GPM)</th>
<th>Wall in Service (Y or N)</th>
<th>Wall Capacity (GPM)</th>
<th>Wall in Service (Y or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>400</td>
<td>Y</td>
<td>B1</td>
<td>Fixed</td>
</tr>
<tr>
<td>A2</td>
<td>N</td>
<td>N</td>
<td>C1</td>
<td>Fixed</td>
</tr>
<tr>
<td>A3</td>
<td>200</td>
<td>N</td>
<td>C2</td>
<td>Fixed</td>
</tr>
<tr>
<td>A4</td>
<td>200</td>
<td>Y</td>
<td>D1</td>
<td>Fixed</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>Y</td>
<td>D2</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

**TOTAL FLOW = 350**

**Well Site Minor Losses**

<table>
<thead>
<tr>
<th>(ft)</th>
<th>Number of Items</th>
<th>K</th>
<th>Q (gpm)</th>
<th>V (fps)</th>
<th>D</th>
<th>Head Loss h (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>1</td>
<td>0.60</td>
<td>0.65</td>
<td>5.11</td>
<td>0.09</td>
<td>4.50</td>
</tr>
<tr>
<td>4&quot; 90 degree elbow</td>
<td>0.11</td>
<td>1</td>
<td>0.38</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>Danfoss Pneumatic 3&quot; Drop Pipe</td>
<td>8.10</td>
<td>2</td>
<td>10.00</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4&quot; 90 Reducer</td>
<td>0.08</td>
<td>1</td>
<td>0.60</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4&quot; 90 degree elbow</td>
<td>0.45</td>
<td>1</td>
<td>0.38</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4&quot; Data Valve</td>
<td>0.16</td>
<td>2</td>
<td>0.20</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>Mueller Swing Valve</td>
<td>4.05</td>
<td>1</td>
<td>10.00</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
<tr>
<td>4&quot; Tee</td>
<td>0.73</td>
<td>1</td>
<td>0.60</td>
<td>0.45</td>
<td>5.11</td>
<td>0.09</td>
</tr>
</tbody>
</table>

**Pipe Diameter**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>100</td>
<td>200</td>
<td>4.1</td>
<td>5.1</td>
<td>160</td>
<td>14.65</td>
<td>4</td>
<td>81</td>
</tr>
</tbody>
</table>

**Well House Piping**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>100</td>
<td>200</td>
<td>4.1</td>
<td>5.1</td>
<td>160</td>
<td>14.65</td>
<td>4</td>
<td>81</td>
</tr>
</tbody>
</table>

**Site Piping**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.136</td>
<td>200</td>
<td>200</td>
<td>2.4</td>
<td>3.1</td>
<td>120</td>
<td>4</td>
<td>14</td>
<td>90</td>
</tr>
</tbody>
</table>

**Isolated Transmission Line**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.136</td>
<td>1,110</td>
<td>200</td>
<td>2.4</td>
<td>3.1</td>
<td>120</td>
<td>4</td>
<td>14</td>
<td>90</td>
</tr>
</tbody>
</table>

**Isolated Transmission Line**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.57</td>
<td>0.346</td>
<td>2,090</td>
<td>350</td>
<td>0.3</td>
<td>2.2</td>
<td>120</td>
<td>4</td>
<td>14</td>
<td>90</td>
</tr>
</tbody>
</table>

**Tank Inlet Rising Pipe**

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in)²</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (cfs)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient C₀</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss h₁ (ft)</th>
<th>Head Loss h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>950</td>
<td>200</td>
<td>3.4</td>
<td>3.3</td>
<td>120</td>
<td>4</td>
<td>14</td>
<td>90</td>
</tr>
</tbody>
</table>

| Static Well Water Depth (feet) | 72.6 |
| Drawdown (feet) | 100 ppm |
| Well Water Depth (feet) | 82.00 |
| Discharge Elevation at Storage Tank | 5430 |
| Well A4 Elevation | 200 |
| Dill In Elevation between Max Tank Elevation and Well Elevation | 0.00 |
| Static Head | 294.60 |

**Flow Projected for Well House**

<table>
<thead>
<tr>
<th>Max Design Flow, Q (gpm)</th>
<th>Total Head Loss h₁ (ft)</th>
<th>Static Head h₂ (ft)</th>
<th>Dynamic Head TDC (ft)</th>
<th>BHP (Assuming 75% Eff.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>28.29</td>
<td>28.60</td>
<td>293</td>
<td>19.7</td>
</tr>
</tbody>
</table>

Note: Danfoss Series 80 Di Check Valves have min and max flow requirements of 3 and 10 fps respectively.
### WELL SITE MINOR LOSSES

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of Items</th>
<th>K (ft)</th>
<th>Q (gpm)</th>
<th>V (fps)</th>
<th>A (ft²)</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3° Entrance</td>
<td>0.72</td>
<td>1</td>
<td>1.00</td>
<td>0.33</td>
<td>8.81</td>
<td>0.05</td>
</tr>
<tr>
<td>3° Flow elbow</td>
<td>0.20</td>
<td>1</td>
<td>0.28</td>
<td>0.33</td>
<td>6.81</td>
<td>0.05</td>
</tr>
<tr>
<td>Flow elbow</td>
<td>0.14</td>
<td>1</td>
<td>0.20</td>
<td>0.33</td>
<td>6.81</td>
<td>0.05</td>
</tr>
<tr>
<td>4° Reducer</td>
<td>0.26</td>
<td>1</td>
<td>0.15</td>
<td>0.33</td>
<td>8.82</td>
<td>0.09</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>0.09</td>
<td>2</td>
<td>0.20</td>
<td>0.33</td>
<td>8.82</td>
<td>0.09</td>
</tr>
<tr>
<td>Mueller Swing Check Valve</td>
<td>4.56</td>
<td>2</td>
<td>10.00</td>
<td>0.33</td>
<td>8.80</td>
<td>0.09</td>
</tr>
<tr>
<td>4° Tee</td>
<td>1.23</td>
<td>3</td>
<td>1.50</td>
<td>0.33</td>
<td>8.80</td>
<td>0.09</td>
</tr>
</tbody>
</table>

**TOTAL FLOW = 350**

### TRANSMISSION LINE MINOR LOSSES

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of Items</th>
<th>K (ft)</th>
<th>Q (gpm)</th>
<th>V (fps)</th>
<th>A (ft²)</th>
<th>D (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4° x 6° Reducer</td>
<td>0.06</td>
<td>1</td>
<td>0.20</td>
<td>0.33</td>
<td>8.82</td>
<td>0.09</td>
</tr>
<tr>
<td>6° Reducer</td>
<td>0.07</td>
<td>1</td>
<td>0.50</td>
<td>0.33</td>
<td>8.82</td>
<td>0.09</td>
</tr>
<tr>
<td>6 x 8° Tee</td>
<td>0.30</td>
<td>2</td>
<td>1.50</td>
<td>0.75</td>
<td>8.20</td>
<td>0.35</td>
</tr>
<tr>
<td>6° 90° elbow</td>
<td>0.06</td>
<td>1</td>
<td>1.00</td>
<td>0.75</td>
<td>8.20</td>
<td>0.35</td>
</tr>
</tbody>
</table>

**TOTAL MINOR LOSSES**

### COLUMN PIPE TO WELL HOUSE PIPING

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (gpm²)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₚ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss in Pipe h₁ (ft)</th>
<th>Head Loss in Pipe h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.049</td>
<td>59.0</td>
<td>190</td>
<td>0.3</td>
<td>6.6</td>
<td>149</td>
<td>15.02</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

### WELL HOUSE PIPING

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (gpm²)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₚ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss in Pipe h₁ (ft)</th>
<th>Head Loss in Pipe h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33</td>
<td>0.087</td>
<td>59.0</td>
<td>190</td>
<td>0.3</td>
<td>6.6</td>
<td>149</td>
<td>15.02</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

### TRANSMISSION LINE

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (gpm²)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₚ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss in Pipe h₁ (ft)</th>
<th>Head Loss in Pipe h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.349</td>
<td>300</td>
<td>150</td>
<td>0.3</td>
<td>7.7</td>
<td>148</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### ISOLATED TRANSMISSION LINE

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (gpm²)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₚ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss in Pipe h₁ (ft)</th>
<th>Head Loss in Pipe h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>2090</td>
<td>350</td>
<td>0.8</td>
<td>2.2</td>
<td>148</td>
<td>5</td>
<td>5</td>
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</tbody>
</table>

### TANK INLET PIPE

<table>
<thead>
<tr>
<th>Pipe Diameter D (ft)</th>
<th>Pipe Area A (in²)</th>
<th>Length Of Pipe L (ft)</th>
<th>Discharge Q (gpm)</th>
<th>Discharge Q (gpm²)</th>
<th>Pipe Velocity V (fps)</th>
<th>Resistance Coefficient Cₚ</th>
<th>Sum of Minor Losses (ft)</th>
<th>Head Loss in Pipe h₁ (ft)</th>
<th>Head Loss in Pipe h₂ (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.67</td>
<td>0.349</td>
<td>150</td>
<td>350</td>
<td>0.8</td>
<td>2.2</td>
<td>130</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Note: Danfoss Series 80 DI Check Valves have min and max flow requirements of 3 and 18 gpm respectively.
THE PUBLIC SERVICE COMMISSION OF WYOMING

NAME: High West Energy, Inc.  
ADDRESS: P.O. Box 519  
          Pine Bluffs, WY 82082

LARGE POWER SERVICE

Schedule LP - Code 081, 082, 083, 091, 092, 093, 421, 422, 423, 501, 502, 503, 521, 522, 523, 541, 542, 543

Applicable
Throughout the Company's service area, subject to the rules and regulations of the Company and of the regulatory authorities.

Available
To all consumers located adjacent to the Company's three-phase lines for all types of usage having an installed transformer capacity in excess of 37.5 kVA, except irrigation.

Type of Service
Three-phase or single-phase, 60 hertz, at available secondary or primary voltage.

Monthly Rate

<table>
<thead>
<tr>
<th>Facility Charge:</th>
<th>$35.00/Monthly</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Demand Charge:</th>
<th>$14.10</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Energy Charge:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First 50 kWh/kW</td>
<td>$0.08869 per kWh</td>
</tr>
<tr>
<td>Next 100 kWh/kW</td>
<td>$0.06043 per kWh</td>
</tr>
<tr>
<td>Next 100 kWh/kW</td>
<td>$0.04734 per kWh</td>
</tr>
<tr>
<td>Excess, per kWh</td>
<td>$0.04229</td>
</tr>
</tbody>
</table>

Tariff Rate Rider
This rate schedule is subject to the Tariff Rate Rider set forth on Sheet No. 6 & 6a

Minimum Monthly Charge

The minimum charge shall be the highest one of the following charges:
1. The minimum charge specified in the contract for service.
2. A charge of $0.75 per kVA of installed transformer capacity.
3. A charge of $35.00.
4. A charge of $5.00 in addition to $1.00 per nameplate horsepower for oil well or other pumping installations.

Date Issued: December 1, 2009  
By: Don Brunner  
Title: Manager

Date Effective: January 1, 2010