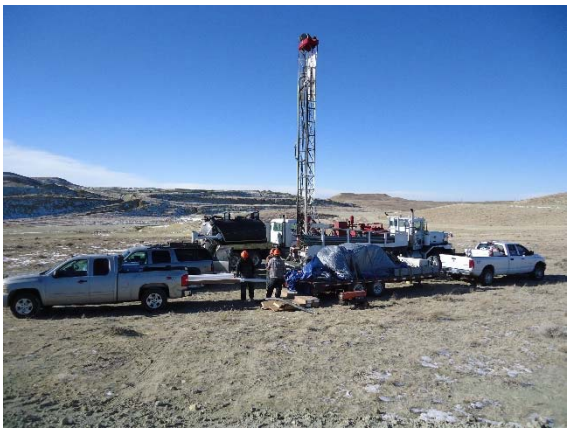
April 2016

AML Project 16M: DRAFT Post-Reclamation Water Quality Monitoring Report



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Executive Summary

Over the last 30 years, the Wyoming Abandoned Mine Land Program (AML) has completed numerous uranium mine reclamation projects in the Gas Hills and Shirley Basin. The following report provides an overview of the current and historic post-reclamation water quality monitoring in these reclamation areas, provides an evaluation of the successes and trends associated with AML reclamation, and proposes recommendations for future monitoring efforts. Reclamation areas of focus in this report include Day Loma, West Gas Hills, Central Gas Hills, East Gas Hills, and the Shirley Basin. As part of this study, Lidstone & Associates, a Wenck Company (LA) conducted biannual sampling from 2013 to 2015 on existing groundwater monitoring wells and surface water sites; permitted and constructed new monitoring wells to support additional data collection; completed repairs on compromised wells; and, installed staff gages to monitor reservoir water levels. Water quality data from the 1980s through the current monitoring period were also compiled and analyzed. These data and the trends established by these data provide a historical setting and provide AML guidance that will benefit future planning. The purpose and need for this study is to address the impacts of AML reclamation on the groundwater resources in the mining and reclaimed areas and to allow predictions of the long term recovery of the water quality and water quantity of these radically disturbed areas.

The Wind River Formation is the uranium host and principal aquifer subject of this report. Water quality and water level data collected since the early 1980s through the recent sampling efforts suggest that water levels in the vicinity of reclaimed disturbances continue to recover and in some areas may be fully recovered. Prior to AML reclamation in the area, the mining industry directly backfilled some groundwater fed mine pits and left inadequately reclaimed spoils and pre-law mine processing facilities (IX facilities as well as surface or shallow buried uranium heap leaches). Where no backfill took place, there remained abandoned mine pit reservoirs characterized by acidic water as well as high levels of metals and radionculides. Much of this degraded landscape was a product of a time when there were no or inadequate reclamation laws. Beginning in 1986 AML initiated extensive data collection programs, predictive geochemical modeling and commenced mine reclamation. AML's reclamation approach was different than that practiced by industry and included identification of unsuitable, toxic and acid forming waste and isolation of this waste from the post-reclamation water table. Highwalls and unsuitable impoundments were eliminated. Toxic and acid forming materials were geomorphically isolated from both the groundwater table as well as surface stream entrenchment. AML invested in laboratory testing and predictive modeling to address the potential impacts of AML reclamation on the groundwater of the State.

This Study addresses post-reclamation water quality evolution in the Gas Hills and Shirley Basin Mining Districts. The water quality across the monitoring network had regular and frequent exceedances of Class III livestock standards, particularly with gross alpha. Predicted deterioration in groundwater quality due to the backfill of mine pits has occurred. This was predicted in numerous column leach studies and geochemical modeling efforts performed by LA under contract with AML. Discretization of aquifer water quality in company reclamation areas versus AML reclamation areas is complex but generally suggests that AML's approach to protect the groundwater quality is justified and was successful on an overall basis. The downgradient changes to reclamation water quality are not well defined

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since full groundwater recovery is in its infancy. Continued monitoring is recommended until water levels have fully recovered, water movement through native aquifers occurs and the opportunity for such natural processes as advection, dispersion and dilution has taken place. Backfill and select down gradient monitoring should continue on a biannual basis while up gradient sampling should be reduced to an annual program. Given the extensive data base in the East Gas Hills, AML has an opportunity to revisit both groundwater and geochemical modeling efforts. The following paragraphs detail conclusions and recommendations specific to each study area and Tables 3-1 through 3-5 outline site-by-site recommendations.

Results of recent water quality monitoring in the Day Loma area reflects variability in parameter concentrations across the monitoring wells and a lack of a broad improvement of water quality toward up-gradient quality levels, suggesting that conditions throughout the mining area have not yet reached stability. As water levels continue to rise toward more stable levels and earthwork reclamation activities continue in the Clyde Pit area, changes in water levels and quality will also continue. As water levels rise into oxidized backfill materials, migration of contaminant fronts seen through parameter variability down-gradient from the Clyde Pit are expected to expand and intensify. Water levels in the vicinity of the historic (currently dry) Coyote Creek Springs are experiencing the greatest rise, currently within approximately 12 feet of the expected springs outflow. It is recommended that continued seasonal groundwater and surface water data are collected through the period of active reclamation in order to evaluate effects of reclamation and characterize the observed contaminant fronts as they migrate through the site. Biannual sampling in backfill wells, downgradient wells, and surface water sites will provide the data to ascertain ongoing changes and characterize livestock and wildlife water supply quality. Annual sampling in the remaining upgradient and Wind River wells will provide for long term baseline water quality characterization.

In the West Gas Hills Area, AML backfill and reclamation of the Sagebrush/Tablestakes (SATA) Pit has been followed by significant recovery of groundwater levels in the northern half of the area. Groundwater levels around the southern Sunset Pit area have remained stable, matching equilibrium levels achieved prior to AML reclamation. Groundwater levels around the SATA Pit do not exhibit stable conditions but rather exhibit different trends depending on the individual wells. In summary there is a slight cone of depression around the SATA Pit. Company backfill efforts that occurred prior to AML reclamation in the area and the limited number and spatial distribution of wells may contribute to the differences in water level recovery trends. Continued water level rise is anticipated to continue around the SATA Pit. Groundwater quality data, as seen in a review of Total Dissolved Solids (TDS) and sulfate concentrations, indicates continued degradation of backfill water quality on a local basis. With the exception of the Johnny Potatoes South well, significant impacts on water quality from AML reclamation activities have not been observed in the downgradient Wind River Formation wells. Increases in TDS, sulfate, iron, manganese and radium 226 concentrations have been observed in some of the monitoring wells completed in native material, but these changes vary by the water quality parameter and the well location. Water quality in backfill wells should not be expected to improve until groundwater levels have stabilized and a flow through condition is established. This was predicted in the column leach modeling efforts and is a reflective of the first Pore Volume. Water quality improvements were anticipated in the later pore volumes. It is recommended that monitoring and analyses continues in order to help determine when water levels reach equilibrium. Continued seasonal sampling in backfill and select downgradient wells will

allow for comparison of backfill material water quality versus Wind River Aquifer water quality.

The Johnny Potatoes South well data is somewhat problematical. The Johnny Potatoes South well is a down gradient multiple sand well completion in the Wind River Aquifer that was used for a public water supply for the ANC man-camp. It is now used by AML for dust control water. The water quality of this well has remained relatively steady over a 30 year period, but a rapidly deteriorating condition was identified in 2013. It is not clear if this deterioration of water quality is more local in nature or reflects a regional change due to the composite mine reclamation efforts in the West Gas Hills. The predictive modeling effort suggests that water quality deterioration will occur in down gradient Wind River wells and the deteriorating water quality of the Johnny Potatoes South well may be a reflection of that. LA recommends continued monitoring in the West Gas Hills on a biannual basis to ensure that trends are recognized as they occur. Monitoring and sampling will also allow for evaluation and analysis of the presence and migration of contaminant fronts, improvement in water quality in backfill materials following water level stabilization and pore flow-through cycles, and the long term water quality impacts on the Wind River Aquifer. LA recommends that AML investigate the mechanical integrity of the Johnny Potatoes South well (video and MIT) and perform aquifer testing to characterize the groundwater movement. Finally, LA recommends the construction of two additional deep nested groundwater monitoring wells near the Johnny Potatoes South well, each selectively screened over different Wind River sands to provide valuable monitoring points and better understand the behavior of contaminant plumes migrating from the reclamation backfill. LA also recommends continued seasonal surface water sampling to address not only pit water quality (2RS) changes over time, but also surface water impoundments that are subject to surface water runoff and evaporative concentration.

In the Central Gas Hills, groundwater elevation changes in the H&I well, 5F-1 Pit, and 4R Pit show rising water levels at rates around 1.5 to 3 ft/yr, with the up gradient 4R Pit at the top of that range. These changes indicate that saturation of backfill materials and dissolution of minerals are actively occurring, particularly at the up gradient end of the area. It is anticipated that water levels will continue to rise toward final recovery and equilibrium. As water levels stabilize in and around the pits, evaporative effects will result in increases in TDS, sulfate, and other ions. Acidic groundwater in the H&I well (average pH of 6.1 s.u.) exacerbates dissolution of trace metals into the groundwater. High gross alpha concentrations were also observed in the H&I well, suggesting that selective handling of radionuclides may not have been successful. Though the limited data set shows little evidence of deteriorating water quality, changes observed in water levels and water characteristics are expected to continue. LA anticipates that degradation of groundwater quality in the Central Gas Hills will occur until the first pore volume has been flushed. For these reasons, it is recommended that continued seasonal groundwater and surface water data are collected to monitor the changing conditions in the area.

In the East Gas Hills, groundwater elevation data suggest that water levels are approaching an equilibrium state in up gradient and down gradient wells. This is the "oldest" AML reclamation area. However, variable water levels in monitoring wells within reclamation areas including LA-3, LA-8, LA-9, LA-10, and MW-3A indicate that a stable potentiometric surface has not been reached. Water levels in the A-8 Pit area are 57 feet higher than predicted during reclamation, saturating backfill materials that were meant to be isolated from the recovered ground water table. As predicted by the AML 1994 (Lidstone & Anderson, 1994) modeling effort, down gradient water quality deterioration has occurred

but in an inconsistent (pulse) fashion. Water quality is better in up gradient baseline wells and poorer with variability in wells within reclamation areas and down gradient. The influence of up gradient Umetco disturbances including the A-Pits (A-7 and A-9), the B-1 and B-5 Pits and several of the C-Pits has not been defined. Due to a lack of outflow, water quality in the groundwater fed Buss and PC Pits and surface water-sourced Veca Pit show long term trends of rising TDS and sulfate concentrations due to evaporative concentration effects. In the Buss Pit, the recovered water table encountered an oxidized sulfide zone and is now acidic. Water quality of the Buss Pit has reached a geochemical equilibrium with pH and metals. With observations of variable groundwater quality conditions, trends in changing groundwater level elevations, possible contaminant plumes, and deteriorating water quality at some monitoring sites, continued monitoring in the East Gas Hills is recommended. It is anticipated that changes in water levels and water quality characteristics will continue. Surface and groundwater quality sampling should continue in order to further clarify down gradient reclamation water quality and elevation effects as well as livestock consumption risks from surface water impoundments and pits. Given the extensive long term data base in the East Gas Hills and the regional approach towards equilibrium (flow through water levels), LA recommends the construction of an updated groundwater model to address both groundwater flow and geochemistry. Twenty years of data and new modeling techniques offer a great opportunity.

Water level elevations in monitoring wells and groundwater-fed pits in the Shirley Basin were stable during the most recent sampling period. A significant cone of depression or groundwater sink surrounds the Walker Jenkins and Sullivan Pits. As such, up gradient groundwater and surface water from the Little Medicine Bow River must pass through backfill and will introduce dissolved minerals and salts into the reclamation impoundments. Evaporation in the mine pit reservoirs has concentrated dissolved salts and manifested in an increase in TDS, sulfate and chloride. Water quality in backfill wells is poorer than water quality in the Wind River Formation wells. Radium 226 levels in the backfill wells 3-NW and 4-SW is increasing. These wells are good references for monitoring backfill water quality improvement. A lack of clear and obvious water quality degradation trends, contaminant plumes, constituent concentration spikes, or drastic water level changes indicates that water quality in the Shirley Basin is generally stable. With that said groundwater movement is "towards the pits" and full recovery of the water table is not anticipated. AML reclamation efforts were successful in addressing public health and safety and environmental degradation and the hydrogeochemistry will continue to recover through natural processes over time. Given the long term existence of a cone of depression and the presence of saturated backfill, LA anticipates that the reclamation impoundments will continue to see moderate water quality deterioration through time.

LA recommends continued biannual monitoring of backfill groundwater wells, pits, and select river sites to observe regional and local trends. It is particularly important to monitor the increase in reservoir dissolved solids due to evaporation. The Walker Jenkins Reservoir is a fishery and as such not only do livestock and wildlife, but also aquatic standards apply. Biannual sampling at Little Medicine Bow River sites SW-1 and SW-6 should be continued to address the overall impact of AML reclamation on the Little Medicine Bow Watershed. The intermediate sampling sites (SW2-SW5) can be discontinued.

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1.0 Introduction

The Wyoming Department of Environmental Quality (WDEQ), Abandoned Mine Land Division (AML) has completed numerous mine reclamation projects in Central Wyoming to remediate the adverse impacts including health and safety hazards and environmental degradation resulting from historic open pit and underground uranium mining practices. Safety hazards included unstable highwalls, open portals and adits, open pits, unstable structures, erosive and geomorphically unstable streams and ephemeral washes, highly acidic or toxic waters, potential or impending subsidence, and extreme radioactivity. These AML projects have included an estimated $250M of mine reclamation activities including site investigation, design and construction. Much of the AML work effort has been adjacent to or within a complex of mining company (Company) reclamation, which was regulated under either federal law (Open Cut and Reclamation Act 1969) or State of Wyoming law (Environmental Quality Act of 1973). As regulations evolved over time, the nature and quality of Company reclamation evolved.

Over the course of 30 years of AML reclamation, the program has also undertaken great effort to monitor and analyze post-reclamation water quality, geomorphology and surface water stability with the goal of restoring areas to their pre-mining condition primarily suitable for livestock grazing and wildlife use. It is important to note that the AML, through their professional services consultants invested considerable project funds into: extensive drilling programs designed to identify unsuitable materials; laboratory analyses of these proposed backfill materials; predictive modeling including column leach and batch testing and more importantly full time construction administration designed to ensure that the previously identified unsuitable materials were placed above the post-reclamation recovery of the water table. This effort is in contrast to the standard company (non-AML) effort, which was designed to meet mine reclamation obligations under the above mentioned state and federal governing laws. Although groundwater protection is addressed the principal reclamation concerns can be summarized as follows: (1) mine pit backfill; (2) construction of a post-mining water impoundment; (3) regrade mine spoils and place topsoil on the regraded surface; and (4) revegetate the topsoiled reclaimed disturbances. While backfilling spoils into the groundwater-flooded mine pit, the nearest spoils (upper layer of the waste dump) was the first material placed in the bottom of the pit. In many cases the upper strata of the waste dump was the lowest strata of the mine pit and as such was the most mineralized portion (ore zone halo or gangue) of the uranium bearing formation. This well-intentioned backfilling effort resulted in contamination of the groundwater table and has remained a source of contamination over the years.

The AML has completed reclamation projects to reduce safety hazards and mitigate environmental degradation from past uranium mining operations. The first large multiphase AML uranium reclamation project was completed in Shirley Basin. Substantial AML reclamation has also been completed in the Gas Hills Mining District in the East (EGH), Central (CGH), and West Gas Hills (WGH), and Day Loma project areas (**Figure 1-1**). The Wind River Formation is the uranium host and principal aquifer at all of these five project locations and is the principal subject of this report.

Lidstone and Associates – A Wenck Company (LA) has been tasked with monitoring the impacts of AML reclamation on the local and regional surface and groundwater quality in the

Gas Hills and Shirley Basin. This work effort has included data collection (water levels and water quality) at both AML and Company post reclamation reservoirs (surface and groundwater-fed), surface water monitoring along the Little Medicine Bow River (not a subject of this report) as well as sampling water quality and water level recovery associated with AML reclamation. The following document provides an overview of the current and historic monitoring of these reclamation sites, evaluation of the successes and trends associated with AML reclamation, and proposes recommendations for future monitoring effort. To the extent data allows, this report attempts to review AML reclamation in the context of Company reclamation.

1.1 AML Water Quality Monitoring

Historic uranium mining in Central Wyoming was accomplished using both conventional and in-situ recovery (ISR) methods. Reclamation of conventional mine disturbances has occurred contemporaneously with AML reclamation. Sampling and monitoring of the Wind River Aquifer has occurred intermittently over the last 30 years in conjunction with various AML reclamation projects as well as part of baseline data collection for in-situ mine permitting efforts. The impacts of this mining and subsequent AML reclamation are important factors in not only the mitigation of the past effects of historic mining, but also in the future development of uranium resources, as reclaimed areas may define baseline conditions for future mining operations. Recovery of water levels are a critical aspect of successful uranium ISR mining and establishing a suitable up gradient baseline condition is a regulatory requirement prior to the commencement of mining operations. Establishing a historic water quality characterization and evaluation through a comprehensive, long-term monitoring plan will provide valuable information to remediate future health and safety hazards as well as mitigate environmental degradation from subsequent uranium mining.

Earlier AML water quality studies have been conducted by Lidstone & Anderson, Inc. as well as LA. Following the comprehensive reclamation of the EGH project area (1989-1993 under AML Projects 16D and 16E), AML contracted with LA to investigate post-reclamation conditions of the Wind River Aquifer in East Gas Hills, pre-reclamation water quality sampling and analysis was conducted in 1989 and post-reclamation water quality sampling and analysis was completed in 1993, 1996 and 1998. Lidstone & Anderson, Inc. (1989 and 1994) presented geochemical trends from the 1989 and 1993 water quality data. To investigate AML impact to groundwater in the Day Loma area, AML contracted with LA to complete a summary study of groundwater conditions in the Day Loma area (Lidstone and Associates, 2008). Similarly and under separate contract, AML requested and LA continued a sampling program in the West Gas Hills to document the impacts of AML reclamation at the Sunset and D-Pit areas, as well as the Sagebrush Tablestakes reclamation. This report was completed in March 2011. At AML's request the scope of the Sagebrush Tablestakes reclamation report was expanded to look at other historic monitoring wells present throughout the Gas Hills. This work effort led to an interim partially comprehensive groundwater study over the 2010-2012 period.

In 2012, LA developed a surface water and groundwater monitoring plan that would provide the first comprehensive ground and surface water investigation of the Gas Hills and Shirley Basin. This study addressed biannual sampling of existing monitor wells, surface water sample sites and the construction of new wells, where additional data were needed. Repairs were completed on some monitor wells and new staff gages were installed to monitor the water levels at various final impoundments. This effort took place across the five disturbed

mining areas following the completion of AML reclamation. The purpose of this expanded monitoring program was to provide a comprehensive study that could be used to assess the impacts of AML reclamation

This report will summarize the results of the monitoring program and propose recommendations for future water quality monitoring. It will describe the water quality monitoring network, the methodologies of data collection, and provide data compilation tables of sample analytical results. The report includes documentation of the construction and geologic logging of nine additional groundwater wells added to the monitoring network in 2012. Overall, the monitoring plan and this report aim to provide AML guidance so that future monitoring efforts will provide consistent and meaningful data that will benefit future planning, including future development of the mineral resource.

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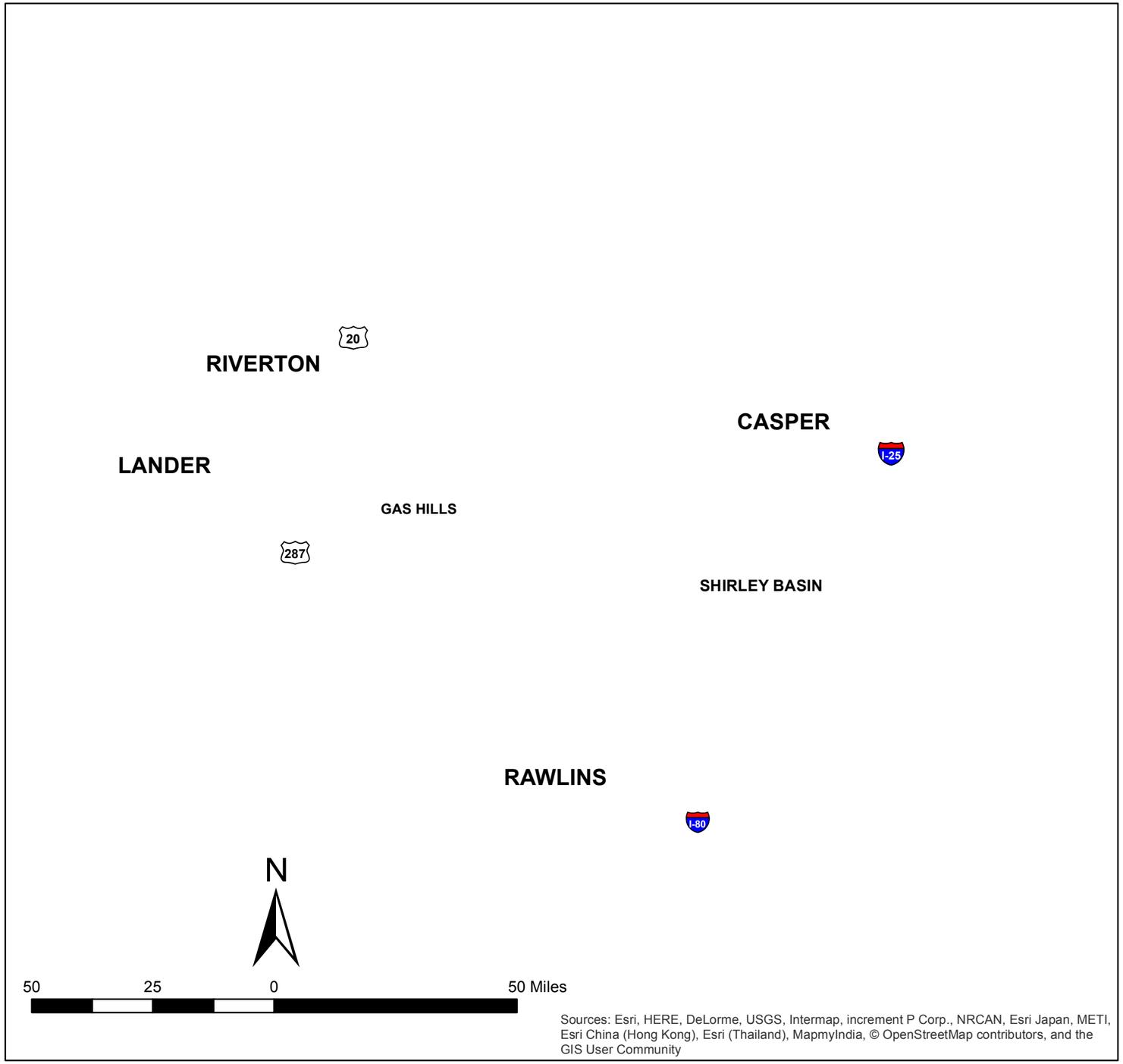
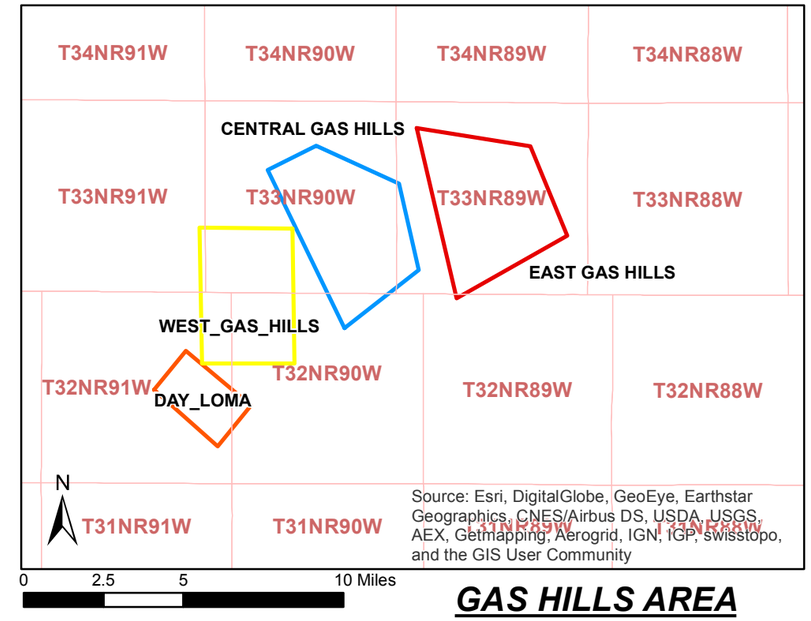
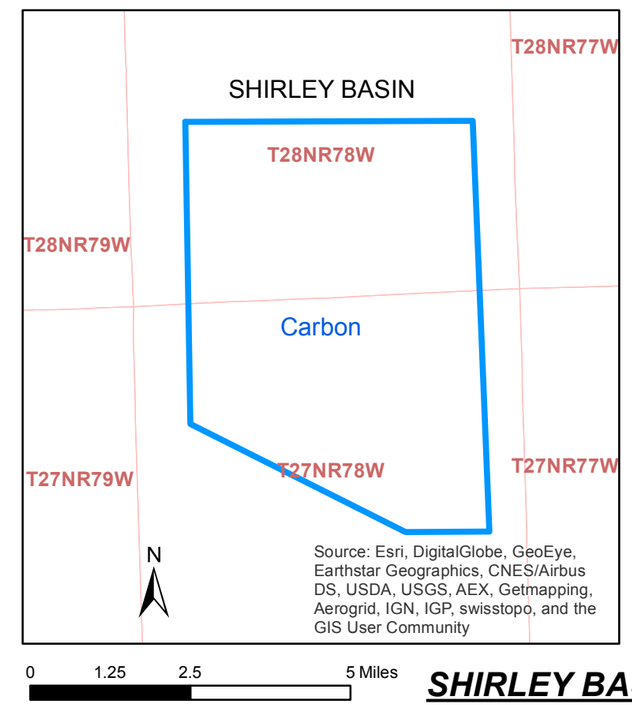




GAS HILLS AREA



SHIRLEY BASIN

WYOMING

PROJECT NUMBER	WYAML102
DATE:	4/5/2016
DESIGN:	JHF
CHECKED:	GHS
APPROVED:	CDL

FIGURE 1-1
Project Study Areas

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_Gas Hills Area LOCATES.mxd

2.0 Study Area Background

2.1 Mining and Reclamation History

Uranium mining in the Gas Hills began shortly after uranium was discovered by Neil McNeice in 1953. Within the next few years thousands of claims were staked and a series of small open-pit mines were developed on shallow oxidized ore deposits above the water table. By the mid to late 1950's a uranium mill was constructed in Riverton that began milling Gas Hills ore. During the late 1950's significant deposits were discovered below the groundwater table, and large-scale surface and underground mining commenced. Over the next few years three uranium mills were constructed in the Gas Hills. As many as 50 mining companies engaged in exploration and operations from 1954 through the 1970's, but the principal Gas Hills mining reserves were eventually controlled by the four companies possessing milling facilities: Federal American Partners (FAP) later American Nuclear Corporation (ANC), Union Carbide (later Umetco), Utah Construction and Mining (Lucky Mc, later Pathfinder), and Western Nuclear. Production continued through the 1960's and accelerated in the 1970's with ore prices as high as $50 per pound in 1978 (Whissen, 1988). Active mining ceased by the mid-1980's and company reclamation and tailings closures continued in earnest from the mid-1980's through the early 2000's. As the price of uranium began to escalate in 2005 interest in the development of uranium resources rekindled. By mid-2007 the spot price of uranium reached $136 per pound and has since declined below $30 per pound. During this period of higher uranium prices several ISR permit applications were filed for development of Gas Hills and Shirley Basin uranium resources. Interest in conventional mining also increased; not only in the Gas Hills but other parts of Wyoming as well.

Reclamation planning by AML began in the Gas Hills in 1988 with the completion of the Regional Planning Document (Forsgren & Perkins, Inc. 1988). The 1988 Planning Document was the first comprehensive investigation of the Gas Hills Uranium District and the initial determination of AML eligibility conducted by AML. The Planning Document developed conceptual reclamation plans and cost estimates for each eligible Gas Hills disturbance. Reclamation design and construction of nine projects in the Gas Hills commenced shortly after the Planning Document was completed. **Figure 2-1** shows the disturbed areas in 1987 in the Day Loma, WGH and CGH along with the identified AML project sites. **Figure 2-2** shows the same information for the EGH.

Time, funding and amendments to the governing statutes of the AML program adjusted the focus of AML over the next 30 years. The economic market for conventional mined (open pit) uranium never achieved its anticipated recovery in the 1980's resulting in active mining interests sorting out and fulfilling their reclamation obligations in the 1980's. New companies, including Cameco, Strathmore and Energy Fuels and new mining techniques (ISR) became active in the Gas Hills. In 1992, Lidstone & Anderson, Inc. completed a second Gas Hills Planning Document that inventoried, established AML eligibility and prepared conceptual designs for 22 remaining mine disturbances in the Gas Hills. AML reclamation in the Gas Hills continues to date.

Teton Exploration Drilling Company discovered uranium west of the Little Medicine Bow River in the Shirley Basin in 1955 (A.V.I. , 1986). The Utah Mining Company began development for commercial production in the spring of 1959. Later mining operations by

Petrotomics, Getty Oil, Tidewater Uranium and Kerr McGee dominated the Shirley Basin landscape. Pathfinder Mines Corporation (PMC) and now UR Energy (NFU Uranium) remain in the Shirley Basin area. Production from the Shirley Basin proceeded at a pace similar to that of the Gas Hills District with reclamation by PMC continuing through the 1990's. The former Pathfinder Mill still receives §11(e)2 toll material at the Shirley Basin Facility. By 1985 AML commenced reclamation planning for mining disturbances that were eligible for AML reclamation. The Shirley Basin Report of Investigation was completed by AVI Engineering in 1986. AML reclamation work commenced in 1987 and continued through 1997. PMC commenced their reclamation work at the same time and with the exception of the mill license, their work was completed by the year 2000.

More detailed descriptions of the mining and reclamation in the Gas Hills and Shirley Basin are presented in the following sections.

2.1.1 Day Loma

The Day Loma Area extends from the Beaver Divide on the south to the Jeffrey City-Waltman Road on the northwest. The former Utah Pit is immediately north of the Jeffrey City-Waltman Road and was effectively within the Day Loma area. The area is drained by Coyote Creek along its eastern side and Muskrat Creek along its western side. Mining in the Day Loma area was initiated by Western Nuclear in the late 1950's at the Day Loma Mine (Everett, 1963). Utah International mined the Utah Pit in the early 1960's. When Lidstone & Anderson, Inc. completed the updated Planning Document in 1992 disturbances at the Day Loma area were "characterized by a series of abandoned open pit uranium mines, abandoned or inadequately reclaimed spoil piles interspersed with existing and bonded reclamation, unstable drainages, abandoned underground workings, impounded surface water features and flooded pits." At that time the largest disturbance in the area was the Day Loma Mine Pit occupying approximately 100 acres. The Day Loma Pit was first opened in 1962. Underground mining in the area was conducted by Western Nuclear from 1972 through 1973, and by U.S Energy from 1975 through 1977. By 1978 Western Nuclear sold the majority of their Day Loma interests to Centurion Nuclear who continued mining operations until 1982. Other mining companies that operated in the area include Silver King Properties, a contractor for the Tennessee Valley Authority (TVA), PMC, Umetco, and Centurion-Energy Fuels.

Documented disturbances included the Clyde B-1/B-2, Clyde 4-Bret 11 and Loco Pits, and extensive associated spoils piles. Site hazards included unstable highwalls of extreme vertical height, highly acidic or toxic waters in the Clyde B1/B2 Pit, open vertical mine shafts, active or impending subsidence, extreme radioactivity associated with 245 acres of spoil material and other waste sites, inadequately reclaimed uranium heap leaches, ongoing contamination of Coyote Creek from surface runoff and erosion of adjacent spoil piles, and environmental degradation of surface water and groundwater.

From 1997 through 2002, Lidstone & Anderson, Inc. completed five phases of reclamation design and construction in the Day Loma Area. The Day Loma Pit was partially dewatered into the Clyde Pit. The southwestern and northeastern highwalls were reduced and the pit was partially backfilled forming a ground and surface water-fed impoundment. The Clyde B1/B2 Pit was dewatered to Coyote Creek and partially backfilled. The Clyde 4/Bret 11 and Loco pits were partially backfilled with spoil material and highwalls were reduced. The Loco North spoils were regraded and partially reclaimed. AML ceased reclamation in 2002 and commenced a second master plan and a second phase of reclamation in 2008. BRS

Engineering (BRS) has continued reclamation activities at Day Loma/Clyde area since that time.

2.1.2 West Gas Hills

The Sagebrush/Tablestakes (SATA) and Sunset Mines were located in the WGH. At SATA, mining by Western Nuclear began in the 1950's and continued through 1979 as a TVA project. Besides the above companies, several other mining companies conducted open pit and underground mining in the WGH during this timeframe including Umetco, PMC, FAP, ANC, and Silver King. (Lidstone & Anderson, 1992). At Sunset, mining began during the 1950s and continued both underground and as open pit operations through 1977 (BRS, Inc., 2002). The 1988 Planning Document identified several sites in the WGH eligible for AML reclamation including the George, Hunter, North Rex, Phil/Andria, K Pits, Bullrush Spoils, old Umetco pits, and the Pathfinder Solution Mines. The partially reclaimed ANC Mill site is located on the north side of the WGH area. The 1992 Planning Document also identified the Classic Pit, Blarco, and the 2RS Pit as eligible for AML reclamation. These latter three pits were reclaimed by PMC. The locations of the AML projects in the WGH are shown on **Figure 2-1**.

AML commenced reclamation in the West Gas Hills in 1989. Reclamation of the George area was completed in several phases between 1994 and 2012. Andria/Hunter was reclaimed between 1989 and 1993. The North Rex and Bullrush Spoils were reclaimed initially in the early 1990's and later in 2012 (Bullrush). When LA and BRS began investigating additional properties in the WGH in 2001, both the Sunset and SATA Pits were groundwater-fed impoundments. Mining company reclamation resulted in partial backfill of the intervening K and D Pits, and adjacent extensions of the Sunset and SATA. This Company reclamation effort involved placement of undifferentiated mine spoils into the groundwater table during the period (D9 and K2 Pits) prior to 1994. The entire area was reclaimed by AML between November 2002 and October 2009 resulting in backfilling and eliminating the groundwater impoundments at the Sunset and SATA Pits. Final reclamation left surface water impoundments at the former locations of the two pits.

2.1.3 Central Gas Hills

Neil McNeice staked his earliest claims in the CGH, and these claims became the core of the Lucky Mc mining properties a division of the Utah Construction and Mining Corporation. Mining of the Lucky Mc claims began in 1955 (LTA, 2015). The Lucky Mc mill was completed in 1958. The 1988 Planning Document identified three open pits and associated highwalls, large expanses of partially to totally unreclaimed spoils, dilapidated structures, two abandoned underground operations, drainages and a surface impoundment contaminated by runoff from spoil piles, and high concentrations of low-level radioactive waste on or near the surface in the CGH. Based upon these factors, the John Gunnel site was given the highest hazard ranking, and reclamation began shortly after the Planning Document was completed. The 1992 Planning Document identified nine additional sites in the CGH eligible for AML reclamation: Atlas Peach Underground; the George Ver Area, 7-1 Slot, Fraser Draw, H and I Spoils, Area 5 Pits and Spoils, Stan Claims Area, and Area 6 (**Figure 2-1**).

PMC continued mining and milling at the Lucky Mc site until 1988. Remediation of the mill tailings site began with groundwater pumping in 1980 and continued until reclamation of the site was completed in 2004. The Pathfinder Mill site is now under the authority of the U.S. Department of Energy for long term monitoring. PMC reclaimed the Lucky Mc Area 4 Pit

and Spoils as a groundwater-fed impoundment. The 5F1 and 4R pits have been left as groundwater impoundments after PMC reclamation. UR Energy and Cameco currently have applications for permits to mine in the CGH using ISR methods. AML has completed reclamation of the John Gunnel site (1992), Atlas Peach (1990), H and I spoils (2004), Fraser Draw (7-1 Slot) (1999), and George Ver. Other areas in the CGH are considered low priority by AML and have not been reclaimed.

2.1.4 East Gas Hills

Underground mining commenced in the EGH in the 1960's and continued until 1984. Reclamation of historic mining disturbances in the EGH was completed by active mining companies and the AML program through 2014 (Power Resources, 2010). The 1988 Planning Document prioritized five sites in the EGH: Veca (originally disturbed by the Vanadium Exploration Company of America (VECA) and later FAP, Tee Pit (TVA), B2/B3, and A-8(all disturbed by Umetco), and Two States (mined by FAP, later TVA). The 1992 Planning Document identified additional sites in the EGH eligible for AML reclamation: Area 9, Buss/Russ (mined prior to 1973 through 1980), PC Pit, C-12/C-18 Pits (mined by Umetco late 1970's), B-5 Pit (mined by Umetco with no reclamation obligation), Rim 2 Pit, (surface and underground mining commenced in the 1960's by PMC, later mining by Umetco), and Thunderbird/Rox (initially disturbed in the 1960's by Western Nuclear).

Reclamation in the EGH was accomplished concurrently by AML, TVA, Power Resources, Inc. on behalf of TVA, and Umetco. The Veca Pit and spoils were reclaimed by AML in 1989 as a surface water impoundment. The Buss Pit and Spoils were reclaimed as a groundwater-fed impoundment by Power Resources, Inc. (now Cameco). The Bengal Pit and spoils were reclaimed by TVA between 1988 and 1991. Area 6 and the Two States Pit and spoils were reclaimed by AML. The Tee Pit and the A-8 Pit were reclaimed by AML in 1989.The C-13 Pit was reclaimed before 1988 by Umetco. Surface reclamation at the Thunderbird and Rox shafts was completed by AML in 1989. Area 6 and the PC Pit was reclaimed by AML in 1991. The Two States Pit was left as a groundwater-fed impoundment. Construction of the UPZ Shaft was completed by TVA around 1979. Minimal amount of ore was mined from the shaft when the market collapsed. The site was reclaimed by TVA in the 1990's.

2.1.5 Shirley Basin

In March 1960, the first uranium ore produced from the Shirley Basin region came from an underground mine constructed by the Utah Mining Company (Rosenberg, 1986). Petrotomics Company began an open pit operation shortly afterwards producing the first ore from the mine in December 1960. Ore from the Utah mine was shipped to the Lucky Mc Mill in the Gas Hills, and Petrotomics shipped their ore out of the area until they completed a mill in Shirley Basin in 1962. In 1964 Utah Mining abandoned their underground operations and commenced in situ leaching using sulfuric acid injected through drill holes. Petrotomics began a second open pit operation at the Dave Properties in October 1966 and continued mining until 1973. The Kerr-McGee Nuclear Corporation began mining in the Shirley Basin in 1970 when they opened North Walker Mine, which later expanded to the Walker-Sullivan Mines that last operated during 1974. Utah Mining Company opened their mill in 1971, which later became the Pathfinder Mill. In 1977 Utility Fuel began overburden removal from the Jenkins Mine. Mining and reclamation of that area was completed by mid-1981. By 1985 only PMC (formerly Utah) and Petrotomics continued mining in the area. By 1992 all open pit mining had ceased. Rocky Mountain Energy Company (1981) estimated that 8.2 million tons of uranium ore were produced in Carbon County between 1970 and 1979.

Since most of the disturbance caused by uranium mining in the Shirley Basin (southern district) occurred prior to the inception of federal and state environmental regulations, little or no reclamation work was completed prior to the passage of the Federal Surface Mining Control and Reclamation Act in 1977. Mining was governed by economics. Millions of cubic yards of overburden were removed and left as spoil piles. Deep pits containing sizeable quantities of water with highwalls of questionable stability existed. Little or no topsoil was salvaged for later use in establishing vegetative cover. Low grade ore was disposed of in waste dumps with little or no protection from radioactive contamination of adjacent land and water. To facilitate mining operations, the Little Medicine Bow River was diverted and straightened approximately 0.5 mile east of its original course. Over the course of this channel straightening, the Little Medicine Bow River lost over 2.5 miles of channel length and became an unstable and hydraulically dangerous river course.

The AML investigation and design for reclamation in the Shirley Basin began on Project AML 13 in 1986 by A.V.I. p.c. and their subconsultants Lidstone & Anderson, BRS and HydroEngineering. **Figure 2-3** shows the extent of pre-reclamation disturbance in the area. The reclamation included elimination of radioactive waste piles, partial filling of the northern portion of the Walker/Jenkins Pit, filling the Dave Pit, partial filling of the Phase 10 Pit, elimination of the Little Medicine Bow River diversion channel and rerouting the River in a southwesterly direction over the backfilled Dave Pit and around the west side of the Sullivan Pit and back to the natural river course. Reclamation construction began in 1987 and was completed by 1997.

2.2 Geologic and Hydrogeologic Conditions

2.2.1 Geologic Setting

The Gas Hills Uranium District occupies approximately 40 square miles along the south-central flank of the Wind River Basin in Central Wyoming. The Wind River Basin is marked by a northwest-trending topographic depression surrounded by mountains on all but the eastern side. The southern margin of the Basin, in the Gas Hills, is defined by a 500 to 1,000 foot high erosional escarpment, known as the Beaver Rim. This feature forms a topographic boundary between the Wind River Basin to the north and the Granite Mountains to the south (TriHydro, 1988). The most important stratigraphic unit in the District is the Tertiary Wind River Formation, which is typically divided into two major subdivisions: the Upper and Lower Wind River Members. The economically recoverable uranium deposits are located in the Upper Wind River Formation.

The initial uranium deposits developed in the Wind River Formation (epigenetic deposits) as the result of a Tertiary Age northward ground water flow pattern. Secondary faulting and tilting associated with later post-Laramide, post-Wind River deposition resulted in an eventual southward structural dip for the Tertiary rocks. This resumption of tectonic activity was associated with the Granite Mountain Fault, and re-initiated roll front migration. The uranium and regional groundwater flow migrated in accordance with the secondary permeability associated with the local structural conditions. Late Tertiary faulting of Miocene and Pliocene ages controlled the localization of the epigenetic uranium deposits (Lidstone and Associates, 2008).

2.2.2 Day Loma

Hydrogeologic conditions are well documented in the Day Loma area from reports of investigation prepared for AML. Important members of the Upper Wind River Formation in the Day Loma area are the Puddle Springs Arkose Member, Muskrat Creek Conglomerate Bed, and the Dry Coyote Conglomerate Bed. The Dry Coyote Conglomerate Bed is an excellent marker bed because it is laterally continuous and maintains a relative uniform thickness of 20 to 30 feet across the Day Loma area (Lidstone & Anderson, 1991). Deposits of granite cobbles and pebbles with yellow uranium minerals coatings are located in the stratigraphic interval from 50 feet above to 150 feet below the Dry Coyote Conglomerate Bed (Soister, 1967a, 1967b).

Contemporaneous and post-depositional faulting added complexity to the local geologic conditions of the Day Loma area. The most significant structure is a system of east-west trending normal faults on the northern edge of the Day Loma area, referred to as the Coyote Springs Fault Zone (Soister, 1967). In poor exposures along Coyote Creek near Coyote Springs, the Dry Coyote Conglomerate Bed lies within a few feet of the Cretaceous Mowry Shale. The stratigraphic relationships indicate a total displacement of over 200 feet throughout this fault zone. It is this fault zone which was responsible for bringing the Day Loma area uranium deposits to an economically recoverable stratigraphic position (Lidstone and Associates, 2008).

Groundwater in the Day Loma area is produced from several formations where they are sufficiently saturated to yield water to wells and springs. The Upper Wind River and Quaternary alluvial aquifers are the principal groundwater yielding units that have been impacted by mining activities. Aquifer testing prior to AML reclamation design calculated transmissivity values for the Wind River Aquifer ranging from 45.1 to 2,530 gal/day/ft^2. Transmissivity of two backfill wells were calculated at 191 and 258 gal/day/ft^2 (Lidstone and Associates, Inc., 2008).

Although individual sandstone beds generally dip slightly south, groundwater moves from areas of higher elevation and perpendicular to local topographic contours, discharging at springs or streams located either at the northern margin of the Wind River outcrop area (Puddle and Willow Springs), or adjacent to the local faults (Coyote Springs). Coyote Springs used to flow prior to the disruption of the hydrogeologic system by mining.

Quaternary alluvial aquifers play a very minor role in the local hydrogeologic setting. In most places within the area, the Quaternary sand, gravel, silt, and clay that are derived from the Wind River Formation are generally unsaturated. Aside from direct recharge through the infiltration of rainfall, these aquifers appear to be dependent upon underlying formations for additional supply (Lidstone and Associates, 2008).

Prior to AML reclamation, water quality in the Day Loma Mine Pit was generally suitable for livestock purposes with elevated concentrations of sulfate and radionuclides. Water quality at the Clyde Pit was unsuitable for livestock use with pH values of 3.82 and 3.70 and elevated levels of metals and radionuclides. Water samples from wells completed down gradient from some of the mining disturbances detected elevated concentrations of radium 226.

2.2.3 West Gas Hills

The Wind River Formation is the uranium host and principal aquifer in the vicinity of the West Gas Hills. AML reclamation took place at the Bullrush, George, Sagebrush and Tablestakes Pit, D Pits, K-Pits and the Sunset Pit. Regional groundwater flow through the Wind River Aquifer in the WGH is generally towards the northwest and encounters its initial mining disturbance at the PMC 2RS Pit. Localized faulting and historical mining disturbances, combined with regionally discontinuous low permeability shale horizons, deflect groundwater contours and influence groundwater gradients in the vicinity of the former pits. A change in regional aquifer transmissivity likely associated with faulting is suggested by the change in groundwater gradient in the vicinity of the reclaimed SATA pit. In the vicinity of the 2RS Pit located south of the Sunset reclamation, PMC reported a representative transmissivity for the Wind River Aquifer of 2,200 gal/day/ft^2 with a storage coefficient of 2.2E-3 (PMC, 1988).

The bottom of the former SATA and Sunset Pits penetrated the Wind River Aquifer, resulting in groundwater impoundments. Prior to AML involvement, the pits were partially backfilled by the mining companies with undifferentiated spoil material below the water table. The D9 and K2 pits had been backfilled above the water table. While the pH of the SATA Pit in 2001 was neutral (7.7), the pH of the Sunset Pit was acidic (3.8) due to oxidation of acid forming materials (Lidstone and Associates, Inc., 2002; BRS, 2002). Although both former pits were considered in hydrologic equilibrium with respect to evaporation at that time, LA (2002) noted a cone of depression remained around the SATA Pit, while BRS (2002) observed that no cone of depression was present around the Sunset Pit.

With the exception of the 2RS Pit reclaimed by PMC south of the Sunset Pits, all of the groundwater impoundments in the WGH have been completely backfilled either by the mining companies or AML. Surface water impoundments were constructed above the reclaimed SATA and Sunset Pits to retain seasonal rainfall.

The former ANC mill and tailings site is located on the northern end of the WGH down gradient from the AML reclamation at SATA and Sunset. The Johnny Potatoes South Well was constructed in 1976 to provide water supply to the historic man camp near the ANC mill. The George Pit, Bullrush spoils located just northwest of the Johnny Potatoes Well were reclaimed by AML. The ANC Bullrush Heap was identified by AML in the 1988 Planning Study and was excavated by WDEQ Land Quality Division (LQD) as part of a bond forfeiture in 1996. These heap leach materials were placed on the ANC Tailings Pond No. 1. Subsequent AML reclamation of Bullrush regraded the lands underlying the Bullrush Heap Leach. Beginning in 2006, the Johnny Potatoes Well has been pumped intermittently to provide construction water for ongoing reclamation on AML projects. It has also been used to provide drilling water to private companies, including Strathmore.

With the exception of radionuclides, water quality in the WGH met Chapter 8 livestock standards during and shortly after AML reclamation. Concentrations of total dissolved solids (TDS) in backfill wells around the SATA Pit ranged from 1,800 to 3,000 mg/L. Sulfate concentrations ranged from 1,010 to 1,900 mg/L. Prior to reclamation water in the SATA Pit had a TDS of 3,820 and sulfate concentration of 2,590 mg/L. Prior to AML reclamation water quality in the Sunset Pit was poor, with a TDS concentration of 6,010 mg/L and pH of 3.8. Shortly after AML reclamation water quality improved with respect to these two constituents, but radionuclides were elevated.

2.2.4 Central Gas Hills

Groundwater conditions in the CGH are not well documented, as AML reclamation in the area is limited, and the mining companies did not collect much groundwater data prior to commencement of surface mining operations. PMC documented leaky confined conditions in the Wind River Aquifer in the CGH. They estimated representative values of transmissivity and storage coefficient of 2,340 gal/day/ft^2 and 1.2E-4 (Forsgren-Perkins, 1988). Cameco has permitted ISR activities in their proposed Mine Unit 3 located south of the PMC 4R Pit. Their proposed mining unit incorporates uranium trends in several Wind River sands that occur spatially between Cameron Spring and the AML- reclaimed Atlas Mine Underground Shaft. Water levels in monitoring wells completed in the Wind River Aquifer in Mine Unit 3 indicated a cone of depression in the potentiometric surface in 1997 remaining from PMC open pit mining in the CGH. Cameco proposes to utilize ISR to mine multiple mineralized, saturated sand zones in Mine Unit 3. The units consist of medium to very coarse grained arkosic sands ranging in thickness from pinch out to 50 feet. The sands are generally separated by confining claystones and siltstones which can range up to 30 feet in thickness (Cameco Resources, 2009). The groundwater gradient transitions from northeast to southwest in the EGH to southwest to northeast in the CGH and WGH.

2.2.5 East Gas Hills

AML began collecting site specific geologic and groundwater data in the EGH in 1989 for the pre-design investigations for the Veca and A-8 projects. The stratigraphy in the EGH is complicated by the facies relationships within the Upper Wind River Formation and the complex faulting. As in the rest of the Gas Hills District, the principal ore bearing zones occurred in the Upper Wind River Formation. The East Canyon Conglomerate is recognized as a marker horizon in the EGH. Prior to reclamation a thrust fault was identified in the southern flank of the Tee Pit that carried the Paleozoic section against the Tertiary Wind River Formation. Another major structural feature is the Thunderbird Graben characterized by two parallel-striking normal faults. An ore body associated with this feature was mined at the Thunderbird and Rox Mines. This structural feature impacted ore locations associated with the PC Pit, the Veca and the Tee Pits. Facies changes resulted in increased pyrite formation in an easterly direction in the EGH and influenced acidic conditions in the reclaimed pits and recovering groundwater (Lidstone & Anderson, 1989).

Prior to AML reclamation, groundwater flow in the EGH was generally from a northeast to a southwesterly direction under a gradient of 0.03 ft/ft. Groundwater contours formed cones of depression around several mine disturbances including the B2-B3, A-8, Veca, and Buss Pits, and the Thunderbird/Rox area. Aquifer testing reported relatively low transmissivities in wells completed in the vicinity of the A-8, B2-B3, and Tee Pits, ranging from 0.3 to 3 gal/day/ft^2.

Prior to reclamation in the EGH, groundwater was generally consistent in character across the area, predominantly calcium-sulfate with minor amounts of magnesium, sodium and bicarbonate. pH values in groundwater and the Tee Pit were neutral ranging from 6.66 to 7.76. Other pits including the B-2, the B-3, A-8, and Veca Pits contained very low pH water, 2.77, 2.61, 4.84, and 4.5 respectively. TDS concentrations ranged from 520 to 3,390 mg/L. Concentrations of radium 226 ranged from 0.9 to 198 pCi/L exceeding the Chapter 8 livestock standard in some areas.

Cameco's permitted ISR operations in Mine Units 2, 4 and 5 are all located in the EGH west and north of the Buss Pit.

2.2.6 Shirley Basin

The uranium ore that was mined in the Shirley Basin was removed from two major sand units in the Upper and Lower Wind River Formation. Hydro Engineering (1986) identified two saturated sands that act as two aquifers separated by a clay layer of varying thickness. Cretaceous deposits are encountered beneath the lower ore sand and mark the base of the Lower Wind River Aquifer in the Shirley Basin. As in the Gas Hills, the Wind River Formation is comprised of clay/claystone, silt/siltstone, sand/sandstone and conglomerate of fluviatile origin. The claystones and siltstone are generally greenish or grayish-green in color and often contain carbonaceous material or are interbedded with lignite. The sandstone beds are poorly cemented, arkosic, medium-grained to very coarse-grained and typically gray in color. Prior to AML reclamation, two of the mine pits, the 3A and the Phase 10 penetrated only the Upper Wind River Aquifer. The Dave, Sullivan and Jenkins Pits penetrated both aquifers. A third aquifer, the Quaternary alluvial aquifer along the Little Medicine Bow River had been removed by mining in the area. Furthermore, the channel of the Little Medicine Bow River had been diverted around the eastern side of the disturbed areas (**Figure 2-3**).

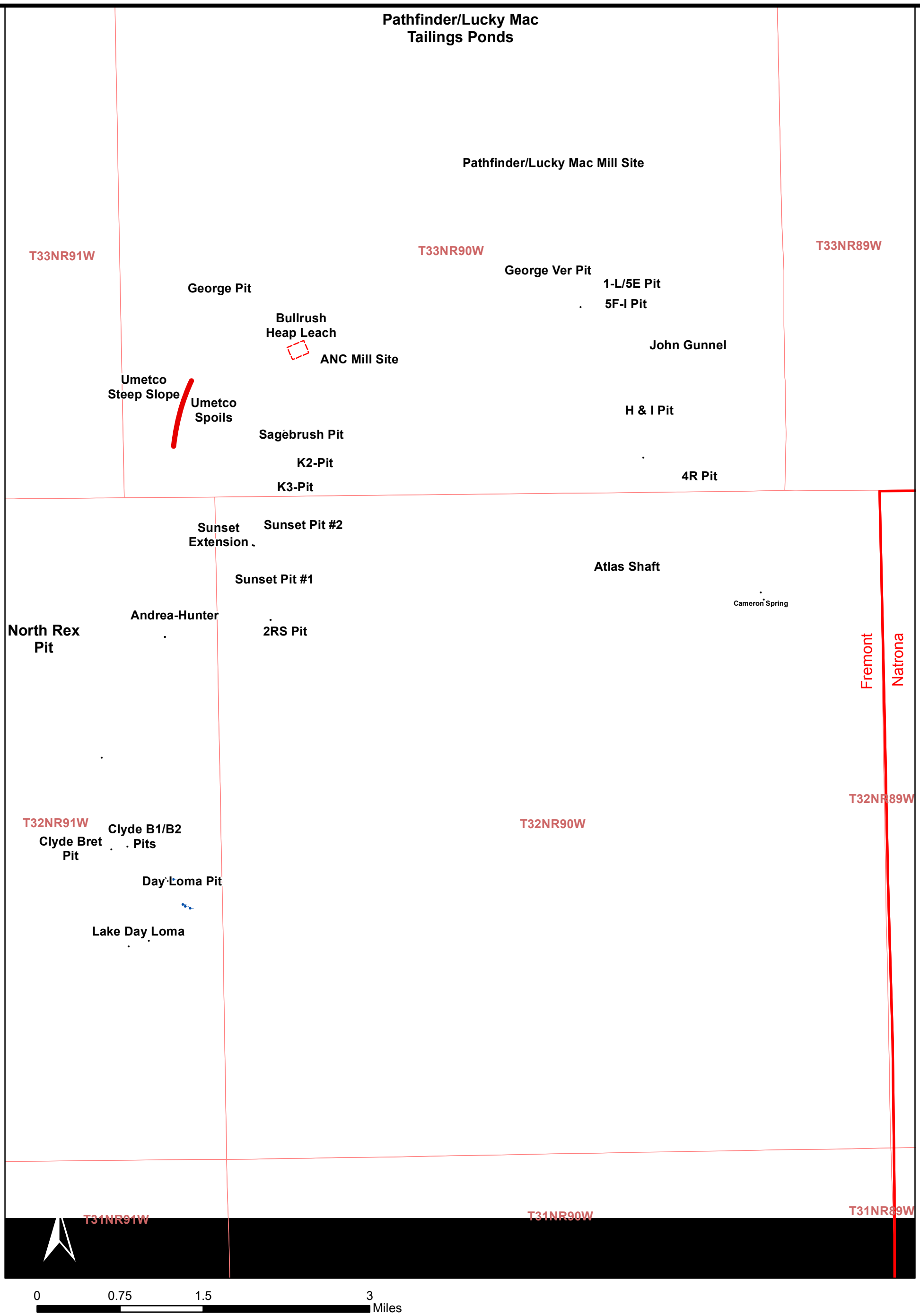
Aquifer testing was conducted on all of the aquifers near the AML Project 13 reclamation project. Transmissivity of the Wind River Aquifers varied across the site, ranging from 810 to 1,800 gal/day/ft^2 for the Upper Wind River Aquifer. The transmissivity of the Lower Wind River Aquifer ranged from 99 to 16,000 gal/day/ft^2, with the higher values associated with a paleochannel in the Lower Wind River deposits. Storage coefficients of 1.5E-4 and 4E-4 are considered representative of the Upper and Lower Wind River Aquifers respectively (Hydro Engineers, 1986). The transmissivity of the alluvium ranges from 23 to 1,200 gal/day/ft^2.

Water levels collected from wells completed prior to reclamation indicated a cone of depression in both aquifers around the mine pits with a recharge mound associated with the Phase 10 area. Prior to AML reclamation water level elevations in the alluvial aquifer indicated alluvial groundwater flow toward the river in the vicinity of a heap leach area, discharging to the Little Medicine Bow River.

Water quality in areas unaffected by mining was considered suitable for domestic or livestock use. pH values were slightly higher than neutral and TDS was generally below 500 mg/L. Elevated sulfate concentrations and isolated areas with high ammonia and some trace metals were encountered.

DRAFT

Figures



PROJECT NUMBER	WYAML102 3.2
DATE:	4/12/2016
DESIGN:	JHF
CHECKED:	KJL
APPROVED:	CDL

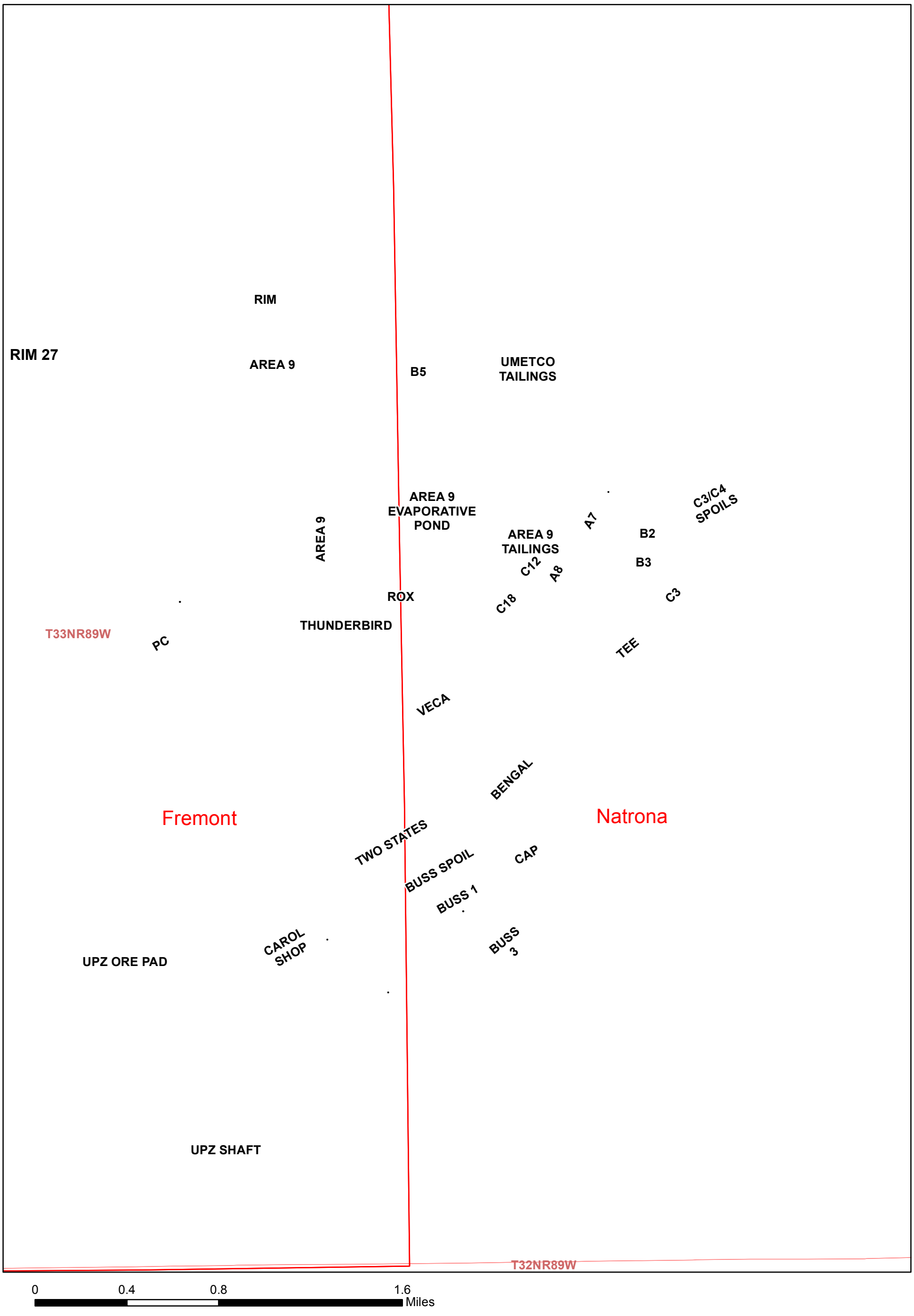
Figure 2-1
1987 Day Loma,
West & Central Gas Hills
Pre-AML Reclamation Disturbances

LEGEND

COUNTY BOUNDARY

TOWNSHIP/RANGE

Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_GAS HILLS AREA PRE-REC-DISTURBANCE-F2-1.mxd



PROJECT NUMBER	WYAML102 3.2
DATE:	4/12/2016
DESIGN:	JHF
CHECKED:	KJL
APPROVED:	CDL

Figure 2-2
1987 East Gas Hills
Pre-AML Reclamation Disturbances

LEGEND

COUNTY BOUNDARY

TOWNSHIP/RANGE

Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_EAST GAS HILLS AREA PRE-REC-DISTURBANCE-F2-2.mxd

[redacted]

PROJECT NUMBER	WYAML102
DATE:	4/12/2016
DESIGN:	JHF
CHECKED:	KJL
APPROVED:	CDL

Figure 2-3
1985 Shirley Basin
Pre-AML Reclamation
Disturbances

Legend

Township-Range

Section

Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Shirley Basin\WYAML102_3.2_Shirley Basin_PRE-AML.mxd

3.0 Methodology of Data Collection

The following section describes the monitoring site network in each reclamation area and the data collection efforts undertaken to describe the comparative water quality characteristics over time. The site locations, Sampling and Analysis Plan, equipment, extent of data set, quality control, and data analysis are detailed.

3.1 Data Collection Sites

Surface water sample sites include surface water impoundments, springs, creeks, and rivers. Groundwater sample sites include both historic AML monitoring wells, newly installed monitoring wells and groundwater-fed mining pits. Summary tables and locations of the monitoring sites have been provided for the study areas as follows: Day Loma-**Table 3-1 and Figure 3-1**, West Gas Hills-**Table 3-2 and Figure 3-2**, Central Gas Hills-**Table 3-3 and Figure 3-3**, East Gas Hills-**Table 3-4 and Figure 3-4**, and Shirley Basin-**Table 3-5 and Figure 3-5**. Summary information for the wells includes well designation, total drilled depth, screened interval, years of sampling, geologic formation, comments, 2015 status, and recommendations for future monitoring. Surface water summary information includes name, sampling dates, comments, water supply source (i.e. groundwater, surface fed), and recommendations for future monitoring.

Groundwater monitoring wells are an expensive investment for any project, yet monitoring wells fill a critical and necessary role in providing data with which to characterize hydrogeologic characteristics of potentially impacted aquifers. Over time, AML has made significant investments in groundwater monitoring wells in the Gas Hills and Shirley Basin. As a part of this project, LA completed maintenance, reconditioning, and security improvements throughout the groundwater data collection sites. In 2014 and 2015, LA completed work on 26 of the monitoring wells in the network in order to meet current monitor well standards, protect from surface contamination, secure them and ensure their long-term viability. This repair work varied from installation of a locking cap to full surface modifications and completions. LA installed locks, attached labels, repaired covers, placed concrete sanitary seals to approximately 36 inch depth, placed concrete surface pads, installed steel protective casing, and installed aluminum locking caps. **Appendix A** includes a table and photo log providing a summary of monitoring well improvements work completed on a well-by-well basis.

3.1.1 New Monitoring Wells

Nine new monitoring wells were constructed between November 2012 and January 2013 as part of this project. These wells are located throughout the study areas and are denoted in **Tables 3-1 through 3-5**. The newly constructed wells in the areas include: DL-11 in Day Loma; Sage 2 and Sun 1 in West Gas Hills; H&I in Central Gas Hills; LA-9 and LA-10 in East Gas Hills, and; Jenkins 5, Sullivan 1, and Sullivan 2 in the Shirley Basin. The locations of these wells are shown on **Figures 3-1 through 3-5**.

In the Day Loma area shown on **Figure 3-1**, DL-11 was constructed to a depth of 223 feet with the screened interval in the Wind River Aquifer from 188 to 218 feet below ground surface. This location was selected because it lies down gradient of the ongoing Clyde Pit reclamation. In 2011, AML continued backfill at the Clyde 4 Bret 11 Pit and then transported

the Western Nuclear Heap Leach to the backfilled floor of the pit. Design considerations suggested that the floor of the heap leach would be placed above the post reclamation recovery level of the groundwater. Because of the potential contamination source, the complete backfilling of the Day Loma Pit, and anticipated water table rise, this well will allow monitoring of the water level and quality as groundwater levels recover in this area.

In the West Gas Hills shown on **Figure 3-2**, two new monitoring wells were installed in the Wind River Aquifer to increase the effectiveness of the current monitoring plan. Sun 1 was completed to a depth of 236.5 feet and is located up gradient and south of the Sunset Pit. This well was constructed at this location to provide background water quality data. Sage 2 was constructed to a depth of 308 feet, and lies between the backfilled Sunset and SATA Pits. Due to indications that impacted groundwater from the Sunset Pit was moving down gradient towards the north, Sage 2 was installed to identify impacts from the permitted reclamation (FAP and PMC) as well as identify impacts to the Wind River Aquifer associated with AML reclamation.

In the Central Gas Hills shown on **Figure 3-3**, the H&I monitoring well was drilled and completed to a depth of 198 feet in backfill material. Because of the large area of PMC disturbance and reclamation in this area, it is difficult to discretize AML reclamation. To establish characteristic data of a backfill aquifer, the H&I well was competed in backfill material at the H&I reclamation site, which includes the backfilled PMC 4-X Pit. This well allows for sampling to establish post reclamation groundwater quality. LA also completed aquifer testing on this well to evaluate transmissivity of the backfill aquifer.

In the East Gas Hills area shown on **Figure 3-4**, two new monitoring wells were completed in the Wind River Aquifer, LA-9 and LA-10, to replace LA-5 and LA-6. LA-9 and LA-10 were drilled and completed to depths of 163 and 193 feet, respectively. LA had recommended the replacement of LA-5 and LA-6 after assessment in 2011 indicated LA-5 had been compromised and LA-6 could not be found. LA-9 will monitor water quality down gradient from the A-8 Pit reclamation and was offset from the plugged and abandoned LA-5 well. LA-10 provides data to characterize groundwater quality down gradient from all of the AML reclaimed mine pits in the East Gas Hills. LA-10 is located north of the Veca Pit and down gradient of the AML reclaimed mine pits.

In the Shirley Basin area shown on **Figure 3-5**, three new monitoring wells were constructed in the Wind River Aquifer near the Walker/Jenkins and Sullivan Pits. Jenkins 5 was completed to a depth of 205 feet north of the Walker/Jenkins Pit to establish the quality of the water entering the site. At the landowner's request and with agreement from AML, Jenkins 5 was completed with 5 inch diameter casing and screen, and permitted with the Wyoming State Engineer's Office to allow for stock use of this monitoring well. Sullivan 2 was constructed to a depth of 113 feet, is located down gradient of the Walker/Jenkins Pit and up gradient of the Sullivan Pit to quantify water quality changes between these two pits. Sullivan 1 was completed to a depth of 108 feet to evaluate water quality conditions south and down gradient of the Sullivan Pit.

New Monitoring Well Construction

Between November 2012 and January 2013, LA collaborated with Douglas Exploration (Douglas) of Douglas, Wyoming, to drill, complete, and develop the nine new monitoring wells. This drilling effort also included a review of LA-5, which reportedly had been compromised, to determine whether this well could be rehabilitated or required

replacement. An obstruction was first observed in this well in 2011 at a depth of 40 feet. During the assessment on January 16, 2013, LA obtained a depth to water measurement of 83.53 feet below top of casing, but found an obstruction at 85 feet. LA and Douglas attempted to redevelop the well using airlifting techniques. The airlifting process produced black water smelling of hydrogen sulfide, along with seeds, plant material, several dead mice, and ultimately gravel pack material. Because the well integrity had obviously been compromised, LA directed Douglas to plug and abandon this well, and drill LA-9 as its replacement.

Douglas drilled and completed the nine new monitoring wells using a Gardner Denver drill rig. With the exception of the H&I and Sullivan 1 wells, the monitoring wells drilled into the Wind River Formation were completed in two passes. Douglas first drilled a pilot hole using direct air rotary methods to a depth determined by LA's onsite professional geologist based on the hydrogeologic characteristics of the encountered geologic units. Strata Data of Casper, Wyoming, geophysically logged the pilot hole using the following logging suite: natural gamma, spontaneous potential, short and long normal resistivity, and point resistivity. To complete the well, Douglas reamed the borehole to an appropriate diameter using direct mud rotary system. The H&I and Sullivan 1 wells were also completed in two passes, but only a direct mud rotary system was used for the drilling and installation of these wells due to the unconsolidated character of the backfill or loose fill material encountered.

Using the well design parameters LA provided, Douglas then typically completed the wells with 4-inch diameter screen and casing. Only the Jenkins 5 well was completed with 5-inch diameter casing and screen. The monitoring wells were cased with 4-inch diameter, flush threaded, Johnson Schedule 40 PVC well casing from the top of the screen to above the surface. The wells were completed using 30 feet of 4-inch diameter; 0.20-inch factory slotted Johnson PVC well screen typically installed across permeable sandstone beds of the Wind River Formation. The annular space between the borehole wall and the screen/casing was filled with 10X20 Colorado Silica Sand from the bottom of the borehole to a height of approximately 10 feet above the top of the screened interval. Bentonite chips were then placed into the annular space from the top of the filter pack to within approximately 18-20 feet of land surface. The remaining annular space was sealed with neat cement to land surface. PVC well caps were placed to cover the top end of the casing, and a lockable steel cover was placed around the PVC wellhead for further wellhead protection. A concrete pad was placed from 1 foot below, to above the ground surface around the well to complete the annular seal and secure each wellhead. Jenkins 5 was completed similarly with 5 inch diameter SDR 17 certalock PVC casing and 0.032 inch slotted SDR 17 PVC screen. LA prepared completion diagrams for each of the nine new monitoring wells. Those documents are included in **Appendix B**.

After installation, each monitoring well was developed using a combination of airlifting and surging techniques. Initially, Douglas lowered an open ended pipe into each well to remove the drilling fluids, and then progressively lowered the development tubing to different depths on the way to the bottom of each well. During this process, LA monitored field water quality parameters and sand, sediment, and turbidity levels. Douglas surged each well using the airlift system to further clean and develop it. This development process was continued for one to two hours per well until the fine sediment in the water had diminished to acceptable levels based on LA's review of the field data. Total development times for each well are noted on the well completion diagrams in **Appendix B**.

3.1.2 Day Loma

In the Day Loma area, thirteen wells and four surface water sites were visited semi-annually for sampling and in-situ measurements and observations. **Table 3-1** provides a list of the monitoring wells and surface water sites as well as summary information. **Figure 3-1** shows the locations of the monitoring sites. A more thorough inventory of monitoring wells in the Day Loma area and their history can be found in the report *Ground Water Geology Evaluation of the Day Loma Area* (Lidstone and Associates, 2008).

Groundwater monitoring wells in the Day Loma area are predominantly screened for monitoring the Upper Wind River Aquifer. Well P-4 is screened in the Cloverly Formation, located below the Wind River Formation, and DL-2 and DL-10 are constructed in backfill material. Wells are located throughout the Day Loma area both up gradient and down gradient from reclaimed areas. Monitoring wells DL-8, DL-9, and DL-10 were constructed in 2007. Monitoring well DL-11 was constructed in 2012.

Well DL-4, northeast of the Day Loma Pit has been historically dry and has not been sampled. Well DL-8 was completed on native ground southeast of the Day Loma Pit to obtain water level and water quality information up gradient from the Pit. Well DL-9, located within the alluvial channel of Coyote Creek down gradient of Day Loma, was constructed to evaluate water levels within the Quaternary alluvial aquifer near Coyote Springs. Prior to mining, this spring was a perennial water supply and provided both domestic and livestock water. Since mining commenced, Coyote Springs has gone dry- an impact of dewatering and drawdown associated with the groundwater-fed open mine pits. Given that an objective of any AML project is to provide sustainable livestock and wildlife water within the reclaimed area, this well (DL-9) serves to monitor the potential recovery of Coyote Creek Springs. Well DL-10 is located in the active reclamation area around the Clyde Pit. It was not sampled in 2014 or 2015 because of access and construction issues. As reclamation backfill continues, it is expected that casing extensions will be added to DL-10 to ensure its future viability. With that said, maintenance of the sanitary seal will be more difficult unless AML's engineer makes a concerted effort to do so. Well DL-11 was constructed to monitor water level and quality down gradient of the current Clyde Pit reclamation project. Based on design considerations in the Clyde Pit reclamation and the potential contamination source and area, this well will allow monitoring of the water level and quality as the groundwater levels recover in this area.

In addition to the groundwater-fed Day Loma Pit, surface water sites include Lake Day Loma, the surface water impoundment-Clyde Pit, and Coyote Creek Springs. The Day Loma Pit is a groundwater-fed water body within the historic open pit mine. Highwalls remain on the southeast and northeast sides of the pit. Lake Day Loma is an up gradient surface water-fed waterbody representing baseline, undisturbed water quality conditions. It is located within the Coyote Creek alluvial channel where that watercourse has been cut-off by the historic open-pit mining. The Clyde Pit is a surface-fed impoundment within the currently active mine reclamation area. In 2011 AML started reclamation project work to backfill the Clyde 4 Bret 11 Pit. This work has continued during the current monitoring period. The area of the Clyde Pit has undergone annual summer season earthwork, regrading, and reclamation. During this period, the Clyde Pit sampling site has contained surface runoff (stormwater) from the active earthwork areas has been relocated and reshaped as reclamation and earthwork operations have progressed. This impoundment has also provided dust control water for the reclamation earthwork. Coyote Creek Springs is a historic spring located down gradient of the mine area in the Coyote Creek watercourse.

Following Day Loma mine dewatering and earthwork activities, Coyote Creek Springs no longer flows. This site is checked for hydrologic activity with each sampling event.

3.1.3 West Gas Hills

In the West Gas Hills area, nine groundwater monitoring wells and four surface water sites were monitored. **Table 3-2** provides a list of the monitoring wells and surface water sites as well as summary information. **Figure 3-2** shows the locations of the monitoring sites.

Monitoring wells P-2 and P-4 were constructed in 2006 to replace the former wells of the same name which were compromised during reclamation. P-2 and P-4 are constructed in the Wind River Formation. Replacement P-2 was sited approximately 1,600 feet east of the former P-2 and replacement P-4 was sited approximately 500 feet northeast of the former P-4. Monitoring wells Sun 1 and Sage 2, constructed in 2012, were completed in the Wind River Aquifer and serve to monitor water quality up gradient from the backfilled Sunset Pit and SATA Pit, respectively. The Sun 1 well also is located up gradient or side gradient to historic mining disturbance and reclamation areas and is interpreted to represent background water quality conditions.

Surface water sites in the West Gas Hills include three surface-fed impoundments and one groundwater-fed pit. At the backfilled and reclaimed Sunset and SATA pits, surface water impoundments have been created which store runoff and supply water to livestock and wildlife. These two impoundments were not visited in 2013 but contained significant water and were sampled in 2014 and 2015. Andrea Hunter is another surface water runoff impoundment located up gradient and west of the Sunset Pit. It has been monitored and sampled since 2011 and usually contains water. The 2RS Pit is a groundwater-fed pit located up gradient from the Sunset Pit.

3.1.4 Central Gas Hills

In the Central Gas Hills area, one groundwater monitoring well and two surface water sites were monitored. **Table 3-3** provides a list of the monitoring wells and surface water sites as well as summary information. **Figure 3-3** shows the locations of the monitoring sites.

Monitoring well H&I, constructed in 2012, was completed in backfill material. Because of the large area of PMC disturbance and reclamation, this well serves to establish characteristic data of the backfill aquifer in a location central to the AML reclamation projects in the area: John Gunnel, Atlas Peach, and the H&I Spoils. Although useful to help establish a groundwater gradient, the H&I well is not expected to successfully isolate AML reclamation groundwater recovery from PMC reclamation effects.

Surface water sites include the groundwater-fed 4-R and 5F-1 pits. Both pits are equipped with staff gauges for monitoring of water level changes over time.

3.1.5 East Gas Hills

In the EGH area, ten groundwater monitoring wells and four surface water sites were monitored. **Table 3-4** provides a list of the monitoring wells and surface water sites as well as summary information. **Figure 3-4** shows the locations of the monitoring sites.

Monitoring wells LA-9 and LA-10, constructed in 2012, were completed in the Wind River Aquifer. LA-9 serves as a replacement of well LA-5, which was compromised by downhole debris and was plugged and abandoned in 2012. LA-5 and its replacement, LA-9, monitor

down gradient water quality from the A-8 Pit reclamation. LA-10 is located further down gradient from LA-5, serving to provide data to characterize groundwater quality down gradient from all of the AML reclaimed mine pits in the EGH.

Surface water sites in the EGH include two surface-fed impoundments and two groundwater-fed pits. The Cap and Veca Pits were reclaimed as surface water-fed impoundments. The Cap Pit holds water intermittently and the Veca Pit, constructed with a low permeability liner, reliably retains water and is a water source for livestock and wildlife. The Buss Pit and PC Pit are groundwater-fed historic mining pits with exposed highwalls. Staff gauges are installed at the Buss Pit, PC Pit, and Veca Pit to monitor and record water level elevations during each sampling event.

3.1.6 Shirley Basin

In the Shirley Basin area, eight groundwater monitoring wells and nine surface water sites were monitored. **Table 3-5** provides a list of the monitoring wells and surface water sites as well as summary information. **Figure 3-5** shows the locations of the monitoring sites.

Three new monitoring wells were constructed in 2012 including Jenkins 5, Sullivan 1, and Sullivan 2. The monitoring well network prior to 2012 consisted of 5 wells, all constructed in backfill and located close to the groundwater-fed, open pits. They had limited value for quantifying regional geochemical trends and impacts on the Wind River Aquifer. The three new monitoring wells were constructed to allow a cross gradient, from north to south, analysis of water quality in the Shirley Basin. Jenkins 5 is an up gradient well to establish the quality of the water entering the site.

Surface water sites in the Shirley Basin include seven locations along the Little Medicine Bow River and two groundwater-fed pits. As part of reclamation completed in the early 1990s, approximately 3 miles of the Little Medicine Bow River were relocated and reconstructed over historic, backfilled mining pits. Sites along the river are sampled to monitor water quantity, water quality, and geomorphic response in the river to reclamation. In addition to water quality sampling, flow integrated Total Suspended Solid (TSS) samples, turbidity, stage, and discharge measurements are regularly completed. Site SW-1 represents baseline water quality as it enters the reclamation impacted areas. SW-2 is located near the mid-point in the 3 mile reconstructed river reach. Site SW-4 is a groundwater seep flowing into the Little Medicine Bow River. SW-4 along with an upstream (SW-3) and downstream (SW-5) river location are sampled to ascertain river water quality impacts from the mining influenced groundwater seep. SW-6 is downstream of the reconstructed river reach and allows for evaluation of water quality changes through the reclaimed area. The remote downstream site, SW-7, is used for monitoring TSS, turbidity, and discharge for evaluation, comparison, and correlations of parameters such as sedimentation. Water samples from SW-7 are not analyzed for the full suite of post-reclamation water quality parameters. The Walker/Jenkins and Sullivan Pits are groundwater-fed reclaimed mining pits. Walker/Jenkins is open to the public for fishing while the Sullivan Pit does not have public access. A staff gauge is installed at both pits to monitor and record water level elevations during each sampling event. Both pits serve as a water source for livestock and wildlife.

3.2 Data Collection Summary

3.2.1 Water Level Measurements

Routine data collection at monitoring wells and select pits and surface water sites included measurement and recording of water levels. Prior to initiating any pumping or sampling at monitoring wells, technicians measured the static water level utilizing a water level indicator, recording the depth to water from the measuring point, a marked point on top of the well casing. At groundwater-fed pits and some surface water locations, a surveyor's level was utilized to back sight a benchmark of known elevation for comparison to the surveyed water surface level. Water level elevations are calculated from these records and the known surveyed elevations of the benchmarks and monitoring well measuring points: the top of casing.

In January 2012, LA completed Real Time Kinematic (RTK) surveying in the Day Loma and East Gas Hills Areas to record accurate location and measuring point elevations on the monitoring wells. Surveying included checks against existing control points and utilized geodetic systems and projections for NAD83, Wyoming West Central 4903, and Geoid03. For consistency with previous elevation records, measuring point elevations were converted to the NAD27 and NGVD29 geodetic systems. Measuring point (Top of Casing) elevations for the wells are noted in the data summary tables.

Additional RTK surveying was completed in 2013 in all project areas. The surveying recorded locations and elevations of the newly constructed wells and new control pins were placed and monumented at many surface water locations. Monument caps were set at the following surface monitoring locations: Day Loma Pit, Lake Day Loma, Clyde Pit, 2RS Pit, Andrea Hunter, 4-R Pit, 5F-1 Pit, PC Pit, Veca Pit, Walker/Jenkins Pit, and Sullivan Pit.

3.2.2 Water Quality Sampling

Data collection included field measurements of pH, temperature, specific conductivity, and water levels and groundwater and surface water sample collection. Samples were collected and analyzed according to the March 2005, WDEQ, LQD *Guideline No. 8 Hydrology Coal and Non Coal - Appendix 1: Premining Water Quality Sampling*. **Table 3-6** provides a summary of the analytical parameters of the water samples collected during this recent monitoring period (2011 to 2015). Energy Laboratories located in Casper was utilized for all sample analysis during this time.

Guideline No. 8 was revised by LQD in May of 2015. The revisions included changes to analysis requirements for uranium mines. These changes include the following:

- Added analytical constituents Nitrate as N, Alkalinity as CaCO3, Thorium, and Beryllium;
- Changed dissolved uranium to total uranium, and;
- Removed analytical constituents gross beta and vanadium.

Following discussions of these changes with AML, and on the basis of maintaining consistency with the long term sampling program, LA has continued sampling under the 2005 guideline.

Monitoring wells were sampled by a subcontractor, Pronghorn Pump LLC (Pronghorn) of Evansville, Wyoming, using variable controlled submersible pumps. Generally, Pronghorn

used truck-mounted pumps for larger, high-volume producing wells, and smaller generator driven submersible pumps for slower recharging wells. Five wells in the West Gas Hills are equipped with dedicated sample pumps. Monitoring wells were pumped at adjusted constant flow rates to collect water directly from the aquifer throughout the screened interval. Wells were pumped for a minimum of three casing volumes and until consistency in at least three consecutive readings of indicator parameters. The indicator parameters are temperature, pH, and specific conductivity. In slow recovery wells, dedicated pumps were set and the wells were pumped dry daily. Samples were collected after the third day. Slow recovery wells include P-4, P-5, and P-6 in Day Loma and LA-1, LA-3, LA-7, and MW-3A in the East Gas Hills.

Surface water samples were gathered as grab samples in clean sampling containers for filtering before the transfer to sample bottles or collected directly into sample bottles provided by Energy Laboratories. Field observations and water quality parameters were measured on site and recorded on field sampling data sheets. Groundwater-fed mining pits were sampled using the same grab sample techniques as the surface sampling.

All groundwater monitoring well samples were filtered onsite using an in-line 0.45 micron capsule filter. Surface water sample volumes were filtered onsite using a peristaltic pump with virgin polyethylene sample tubing and 0.45 micron capsule filter. Samples were transferred from the grab sample containers to the laboratory bottles via the peristaltic pump. On occasion and for efficiency purposes, when laboratory delivery was ensured within 48 hours, surface water grab samples were not filtered in the field, but were delivered to the laboratory unfiltered within holding times. Sample bottle sets for analysis of total metals, dissolved metals, radiometrics, and nitrogen were treated in the field with a nitric or sulfuric acid preservative, as stipulated by the laboratory, to prohibit precipitation of the elements in transit.

The monitoring plan developed in 2012 for this Project included a detailed Sampling and Analysis Plan (SAP). The SAP has been included as **Appendix C** for reference.

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Tables

Table 3-1: Day Loma Monitoring Sites

Groundwater Monitoring Wells						
Well Name	**Total Depth (ft)**	**Screened Interval (ft-bgs)**	**Samples [Year(#)]**	**Formation**	**Comments / 2015 Status**	**Recommendations**
DL-2	120	90-120	1990, 1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Down gradient of Day Loma Pit; up gradient of Clyde Pit.	Biannual Sampling
DL-4	233	203-233	None	Upper Wind River	Like gradient of Day Loma Pit.	Annual Sampling, Biannual SWL
DL-5	165	125-155	1991, 1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Upper Wind River	Up gradient of Loco North; down gradient of Clyde Bret Spoils.	Biannual Sampling
DL-6	240	210-240	1991, 1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Upper Wind River	Like gradient of Day Loma Pit.	Annual Sampling, Biannual SWL
DL-8	308	268-278; 288-298	2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Upper Wind River	Up gradient of Day Loma Pit.	Annual Sampling, Biannual SWL
DL-9	48	28-48	2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Coyote Creek Alluvium/ Upper Wind River	Down gradient of Day Loma Area, near Coyote Creek Spring.	Biannual Sampling
DL-10	118	88-108	2007, 2011, 2012, 2013(2),	Backfill Material	Clyde Pit Backfill, access issues in 2014 and 2015, within active backfill project area.	Biannual Sampling
DL-11 (New 2012)	223	188-218	2013(2), 2014(2), 2015(2)	Wind River	Down gradient of Day Loma Pit and Clyde Pit; Up gradient of Coyote Spring.	Biannual Sampling
P-1	167	149-159	1990, 1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Upper Wind River	Up gradient of Clyde Pit.	Annual Sampling, Biannual SWL
P-3	182	164-181	1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Up gradient of Coyote Spring; down gradient of Day Loma Pit.	Biannual Sampling
P-4	260	235-260	1990, 1996, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Cloverly	Down gradient of Day Loma area; near Coyote Creek Spring.	Biannual Sampling
P-5	201	151-201	1990, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Base of Wind River	Up gradient of Coyote Spring; down gradient of Day Loma Pit.	Biannual Sampling, Investigate well integrity
P-6	161	119-159	1990, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)	Upper Wind River	Up gradient of reclamation.	Annual Sampling, Biannual SWL

Surface Water Sites				
Pits	**Samples [Year(#)]**	**Comments**	**2015 Status**	**Recommendations**
Day Loma Pit	1990, 1998, 2007, 2011, 2012, 2013(2), 2014(2), 2015(2)		Groundwater-fed.	Biannual Sampling; Staff Gauge
Clyde Pit	1990[1], 2007, 2011, 2012, 2013, 2014(2), 2015(2)	Reclaimed between 1997 and 2002, Surface detention area filled/moved during 2011 to 2015 with ongoing reclamation activities.	Formerly a groundwater-fed pit, surface water-fed since approximately 2000, used for dust control water for active mine reclamation.	Biannual Sampling
Lake Day Loma	2011, 2012, 2013, 2014(2), 2015(2)	Up gradient of Clyde and Day Loma Pits, watershed area consists of native up gradient and some reclaimed areas.	Surface water-fed, wildlife water source.	Biannual Sampling, Staff Gauge
Coyote Creek Springs	None	Checking for hydrologic activity during each field expedition.	Dry.	Biannual Observations (sample if possible)

[1] 1990 data reflects ground water-fed reservoir

Table 3-2: West Gas Hills Monitoring Sites

Groundwater Monitoring Wells						
Well Name	**Total Depth (ft)**	**Screened Interval (ft-bgs)**	**Samples [Year(#)]**	**Formation**	**Comments / 2015 Status**	**Recommendations**
Sun 1 (New 2012)	236.5	196.5-226.5	2013(2), 2014(2), 2015(2)	Wind River	Up gradient from Sunset Pit.	Annual Sampling, Biannual SWL
Sun 2	180	148-168	2001, 2002, 2003, 2004, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material, equipped with a dedicated pump.	Biannual Sampling
Sun 3	99	79-99	2001, 2002, 2003, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
K2 Pit	105	75-95	2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	In reclaimed K2 Pit; equipped with a dedicated pump.	Biannual Sampling
P-2	203.5	168-198	2001, 2002, 2003, 2004, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Reduced casing in 2004 and 2005 with reclamation; replaced in 2006 at location 1600 feet east; equipped with a dedicated pump.	Biannual Sampling
P-4	230	195-225	2001, 2002, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Replaced in 2006 at location 500 feet northeast, equipped with a dedicated pump.	Biannual Sampling
Sage 1	114	89-109	2001, 2002, 2003, 2004, 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	In reclaimed Sagebrush Pit; extended in 2005, 2007, 2009; equipped with a dedicated pump.	Biannual Sampling
Sage 2 (New 2012)	308	268-298	2013(2), 2014(2), 2015(2)	Wind River	Up gradient from Sagebrush Pit.	Annual Sampling, Biannual SWL
Johnny Potatoes South	360	Assume 170 - 365	2003, 2004, 2006, 2007, 2009, 2010, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Downgradient of reclamation; equipped with a dedicated pump and utility power supply-used for dust control water; pump pulled/cleaned/reinstalled in 2009.	Biannaul Sampling, Investigate Well Integrity

Surface Water Sites				
Pits	**Samples [Year(#)]**	**Comments**	**2015 Status**	**Recommendations**
Sunset Pit	2001[1], 2014(2), 2014	Pit reclaimed/backfilled between 2001 and 2004.	Surface water-fed, livestock water source – dry some years.	Biannual Sampling
Sagebrush/ Tablestakes Pit	2001[1], 2014(2), 2015(2)	Pit reclaimed/backfilled between 2001 and 200.	Surface water-fed, livestock water source – dry some years.	Biannual Sampling
2RS Pit	2011, 2012, 2013(2), 2014(2), 2015(2)	Up gradient of Sunset Pit.	Groundwater-fed, livestock water source.	Biannual Sampling, Staff Gauge
Andrea Hunter	2012, 2014(2), 2015(2)		Surface water-fed, livestock water source – dry some years.	Biannual Sampling

[1] 2001 data reflects ground water-fed reservoir

Table 3-3: Central Gas Hills Monitoring Sites

Groundwater Monitoring Wells						
Well Name	**Total Depth (ft)**	**Screened Interval (ft-bgs)**	**Samples [Year(#)]**	**Formation**	**Comments / 2015 Status**	**Recommendations**
H&I (New 2012)	198	158-188	2013(2), 2014(2), 2015(2)	Backfill Material	Completed in backfilled H&I Pit.	Biannual Sampling
Surface Water Sites						
Pits	**Samples [Year(#)]**		**Comments**		**2015 Status**	**Recommendations**
4-R (Area 4)	2011, 2012, 2013(2), 2014(2), 2015(2)		Due to high water the water level survey cap was relocated in 2015.		Groundwater-fed, livestock water source.	Biannual Sampling; Staff Gauge
5F-1 (Area 5)	2011, 2012, 2013(2), 2014(2), 2015(2)		Due to high water the water level survey cap was relocated in 2015.		Groundwater-fed, livestock water source.	Biannual Sampling; Staff Gauge

Table 3-4: East Gas Hills Monitoring Sites

Groundwater Monitoring Wells						
Well Name	**Total Depth (ft)**	**Screened Interval (ft-bgs)**	**Samples [Year(#)]**	**Formation**	**Comments / 2015 Status**	**Recommendations**
LA-1	60	20.5-40.5	1989, 1993, 1996, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Provides background water quality data; up gradient of reclamation	Annual Sampling, Biannual SWL
LA-2	165	125-145	1989, 1993, 1996, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Provides background water quality data; up gradient of B-2/B-3 AML Pit reclamation area	Annual Sampling, Biannual SWL
LA-3	195	158-178	1989, 1993, 1996, 2011, 2012, 2013(2), 2014(2), 2015(2)	Partial Backfill	Characterizes backfill water quality in a pit reclaimed by UMETCO prior to AML reclamation	Biannual Sampling
LA-7	105.2	65.2-85.2	1989, 1993, 1996, 2011, 2012, 2013(2), 2014(2), 2015(2)	Wind River	Up gradient from the Tee and B-2/B-3 Reclamation Projects.	Annual Sampling, Biannual SWL
LA-8	161.8	131.8-151.8	1994, 1996, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill water quality in the reclaimed A-8 Pit.	Biannual Sampling
LA-9 (New 2012)	163	128-158	2013(2), 2014(2), 2015(2)	Wind River	Downgradient from reclaimed A-8 Pit, constructed as replacement of LA-5 well.	Biannual Sampling
LA-10 (New 2012)	193	158-188	2013(2), 2014(2), 2015(2)	Wind River	Down gradient from reclaimed pits.	Biannual Sampling
MW-3A*	155	135-155	1989, 1993, 1996, 2011, 2012, 2013(2), 2015(2)	Upper Wind River	Down gradient from the A-8 reclamation project.	Biannual Sampling
GW-10A*	312	245-295	1997, 1998(3), 1999, 2006, 2011, 2012, 2013(2), 2014, 2015(2)	Wind River	Down gradient of the Veca Pit.	Annual Sampling, Biannual SWL
PRI-1*	289	233-278	1993, 1996(2), 1997(4), 1998, 1999, 2006, 2011, 2012(2), 2013(2), 2014, 2015(2)	Wind River	Down gradient of the Veca Pit.	Annual Sampling, Biannual SWL

Surface Water Sites				
Pits	**Samples [Year(#)]**	**Comments**	**2015 Status**	**Recommendations**
Cap Pit	2014(2), 2015	Reclaimed and backfilled between 1989 and 1993.	Surface water-fed, livestock water source – dry some years.	Biannual Sampling
Veca Pit	1996(2), 1997(3), 1998(2), 1999, 2006, 2011, 2012, 2013(2), 2014(2), 2015(2)	Reclaimed and lined between 1989 and 1993.	Surface water fed, livestock water source.	Biannual Sampling, Staff Gauge
PC Pit	1996(2), 1997(4), 1998(2), 1999, 2011, 2012, 2013(2), 2014(2), 2015(2)		Groundwater-fed, livestock water source.	Biannual Sampling, Staff Gauge
Buss Pit	1996, 1997(4), 1998(2), 1999, 2006, 2011(2), 2012(2), 2013(2), 2014(2), 2015(2)		Groundwater-fed.	Biannual Sampling, Staff Gauge

* Power Resources Inc. (PRI) Wells

Table 3-5: Shirley Basin Monitoring Sites

Groundwater Monitoring Wells						
Well Name	**Total Depth (ft)**	**Screened Interval (ft- bgs)**	**Samples [Year(#)]**	**Formation**	**Comments / 2015 Status**	**Recommendations**
1-SE	82.8	60-80	1989, 1990, 1992, 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
2-NE	63.1	40.2-60.2	1989, 1990, 1992(2), 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
3-NW	62.3	40-60	1989, 1990, 1992(2), 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
4-SW	92.7	70.4-90.4	1989, 1990, 1992(2), 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
MW-650	100	80-100	1986(3), 1989, 1990, 1992, 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Backfill Material	Characterizes backfill material.	Biannual Sampling
Jenkins 5 (New 2012)	205	132-192	2013(2), 2014(2), 2015	Wind River	Up gradient from the Walker/Jenkins Pit, establishes quality of water entering the site.	Annual Sampling, Biannual SWL
Sullivan 1 (New 2012)	108	68-98	2013(2), 2014(2), 2015(2)	Wind River	Down gradient from Sullivan Pit.	Annual Sampling, Biannual SWL
Sullivan 2 (New 2012)	113	78-108	2013(2), 2014(2), 2015(2)	Wind River	Down gradient from Walker/Jenkins Pit and up gradient from Sullivan Pit.	Annual Sampling, Biannual SWL

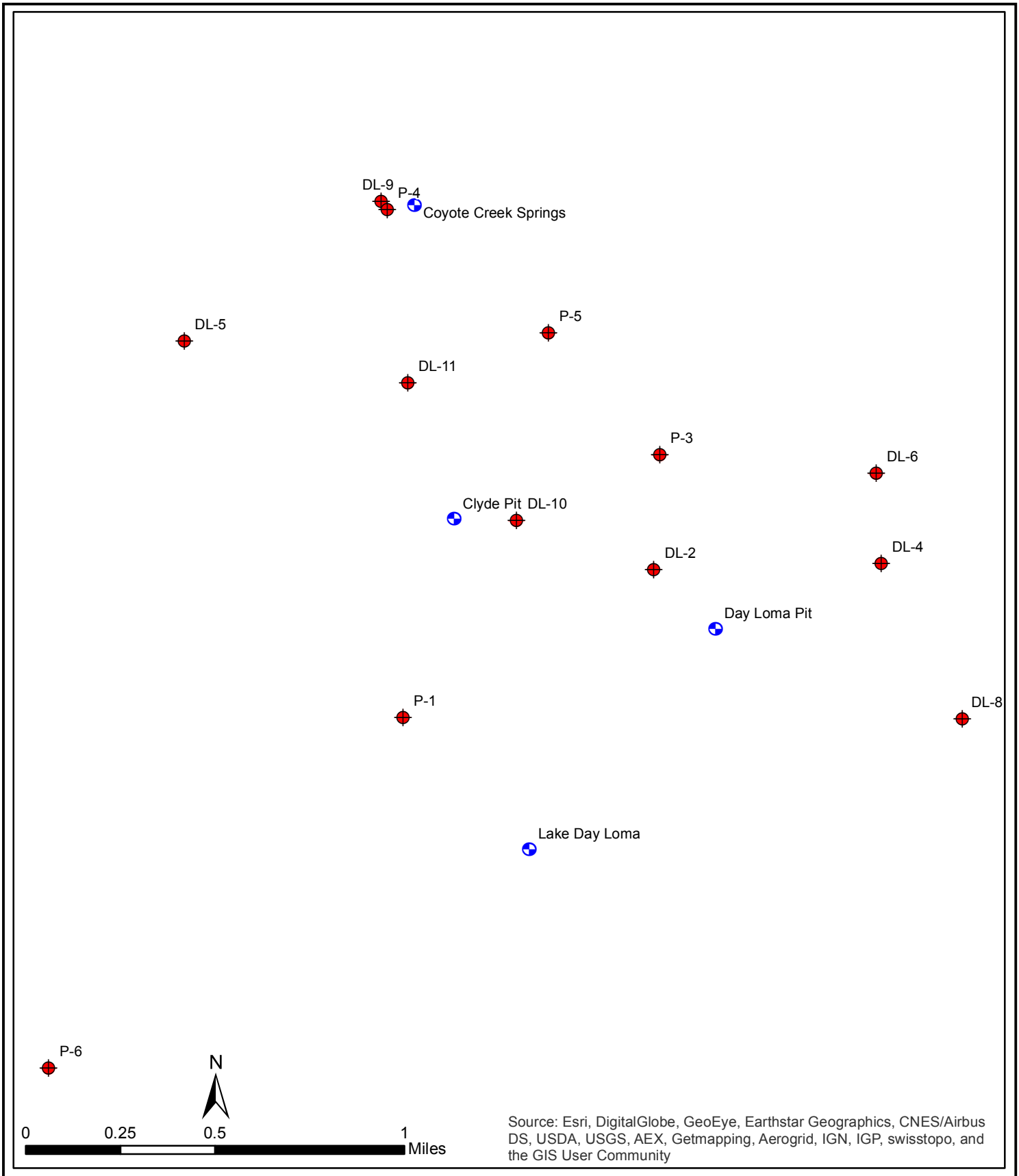
Surface Water Sites				
Name	**Samples [Year(#)]**	**Comments**	**2015 Status**	**Recommendations**
Walker/Jenkins Pit	1982, 1983(2), 1984(5), 1985(5), 1990, 1992, 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Partially backfilled and reclaimed in early 1990s.	Groundwater-fed, livestock and wildlife water source.	Biannual Sampling; Staff Gauge
Sullivan Pit	1981(2), 1982, 1983(2), 1984(4), 1985(5), 1986, 1989(4), 1992, 1998, 2011, 2012, 2013(2), 2014(2), 2015(2)	Partially backfilled.	Groundwater-fed, livestock and wildlife water source.	Biannual Sampling; Staff Gauge
SW-1	2011, 2012, 2013(2), 2014(2), 2015(2)	Upstream of Walker/Jenkins Pit.	Little Medicine Bow River.	Biannual Sampling with stage and discharge
SW-2	2011, 2013(2), 2014(2), 2015(2)	Upstream of lignite.	Little Medicine Bow River.	None
SW-3	2011, 2013(2), 2014(2), 2015	~100 feet upstream of main seep.	Little Medicine Bow River.	None
SW-4 (Seep)	2011, 2012, 2013(2), 2014(2), 2015	Dry in spring 2015.	Groundwater hillside seep into river.	None
SW-5	2011, 2013(2), 2014(2), 2015	~100+ feet downstream of main seep.	Little Medicine Bow River.	None
SW-6	2011, 2012, 2013(2), 2014(2), 2015(2)	Downstream of reclamation.	Little Medicine Bow River.	Biannual Sampling with stage and discharge
SW-7		Located approximately 6 miles downstream of reclamation area; monitoring for discharge, TSS, and Turbidity - no WQ samples.	Little Medicine Bow River.	None

Table 3-6: Guideline No. 8 Water Quality Analytical Parameters

WDEQ-LQD, 2005 Guideline No. 8					
Major Ions		**Physical Properties**	**Metals**		**Radionuclides**
Ammonia, Nitrogen as N	Dissolved Calcium	Total Dissolved Solids @ 180° F	Boron	Dissolved Selenium	Radium 226 (pCi/L)
Nitrate + Nitrite as N	Dissolved Chloride	pH (standard units, in situ)	Dissolved Arsenic	Dissolved Zinc	Radium 228 (pCi/L)
Bicarbonate	Dissolved Magnesium	Temperature °C (in situ)	Dissolved Cadmium	Dissolved Aluminum	Gross Alpha (pCi/L)
Carbonate	Dissolved Potassium	Specific Conductivity (uS/cm, in situ)	Dissolved Chromium	Dissolved Barium	Gross Beta (pCi/L)
Fluoride	Dissolved Sodium		Total Iron	Dissolved Copper	Uranium
Sulfate			Dissolved Iron	Dissolved Lead	Vanadium
			Total Manganese	Dissolved Mercury	
			Dissolved Molybdenum	Dissolved Nickel	

Notes:
Mg/L unless noted otherwise.
Radionuclides constituents under Guideline No. 8 are specific to uranium mines.
Some additional constituents not listed are analyzed with the standard laboratory metals and ions analysis.

Figures



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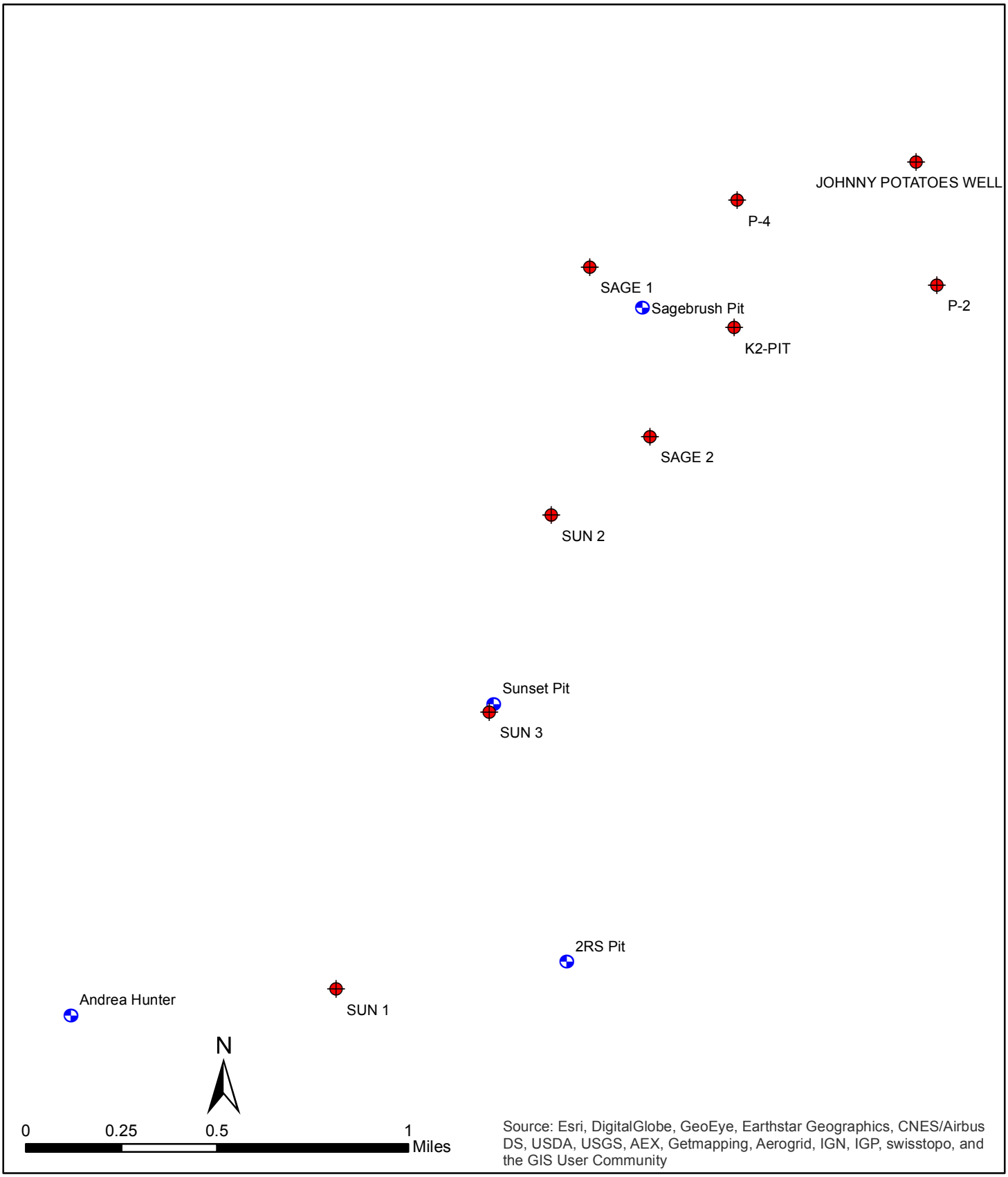
PROJECT NUMBER	WYAML102
DATE:	4/4/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 3-1
Day Loma Project Area
Groundwater and Surface Water Sampling Locations

Legend

- Groundwater Sampling Location
- Surface Water Sampling Location

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_DAY-LOMA_GW-SW-SAMPLING MAP.mxd



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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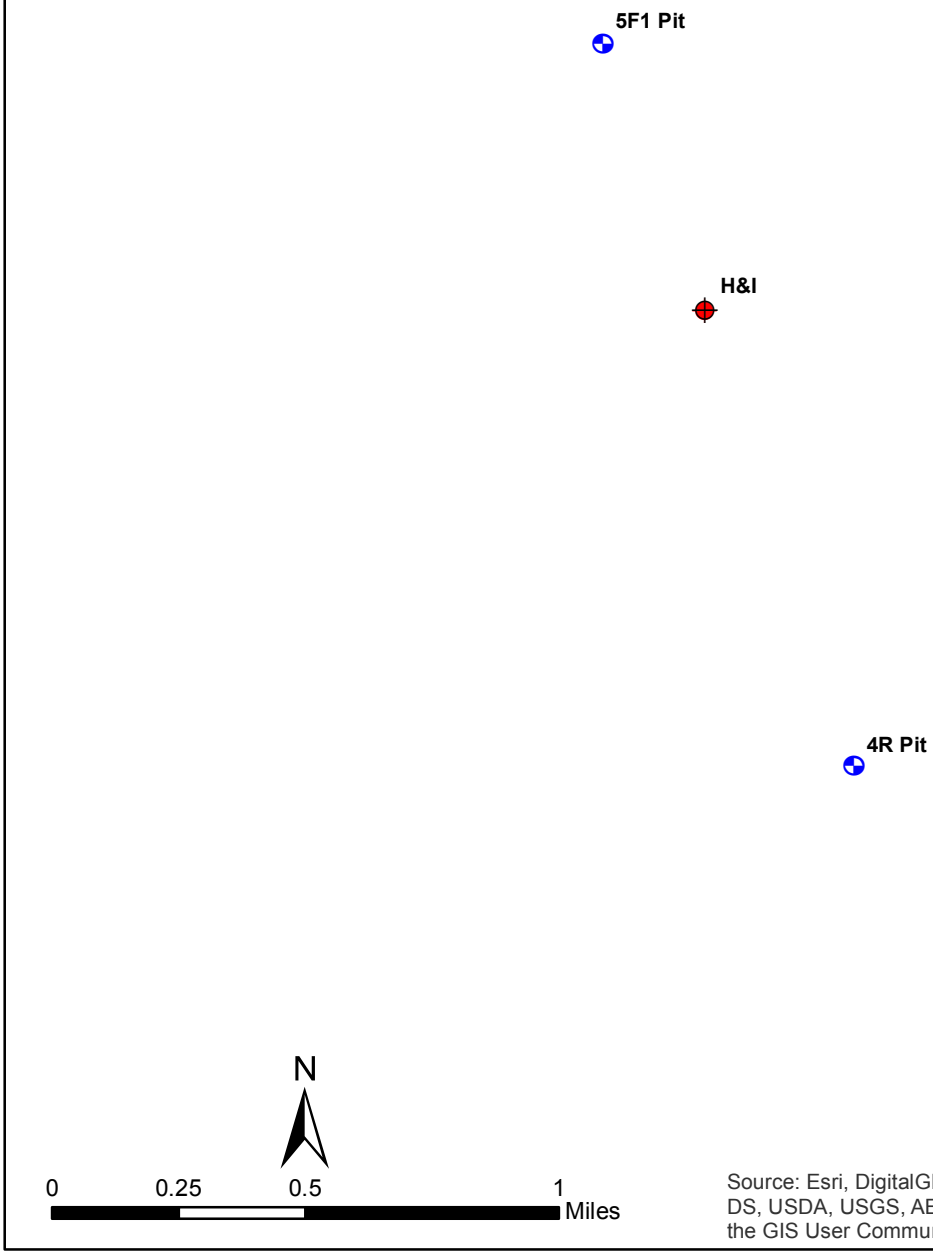
PROJECT NUMBER	WYAML102
DATE:	3/3/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 3-2
West Gas Hills Project Area Groundwater and Surface Water Sampling Locations

Legend

- Groundwater Sampling Location
- Surface Water Sampling Location

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_WEST GAS HILLS_GW-SW-SAMPLING MAP.mxd



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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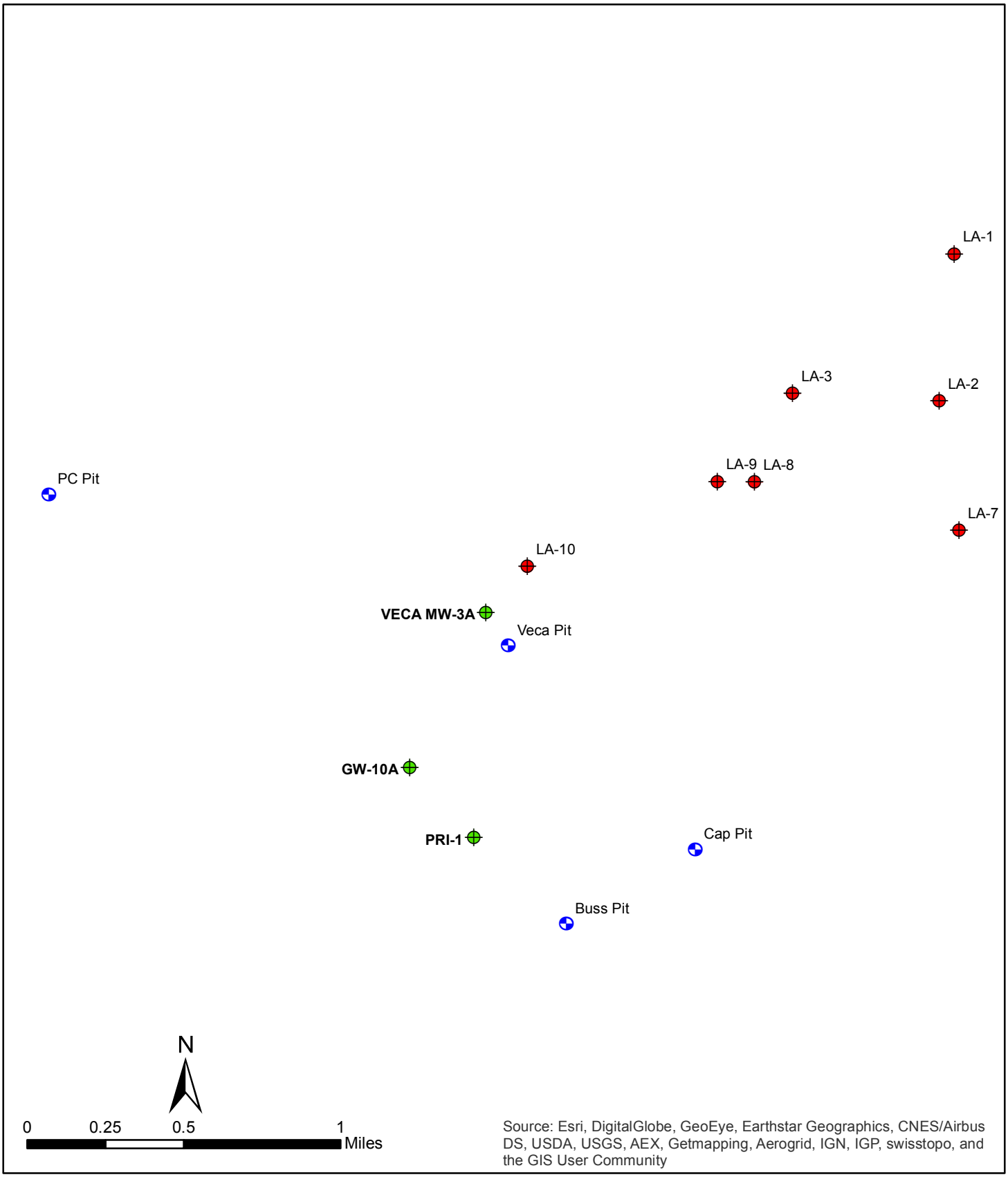
PROJECT NUMBER	WYAML102
DATE:	02/29/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 3-3
Central Gas Hills Project Area Groundwater and Surface Water Sampling Locations

Legend

- Groundwater Sampling Location
- Surface Water Sampling Location

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_CENTRAL GAS HILLS_GW-SW-SAMPLING MAP.mxd



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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PROJECT NUMBER	WYAML102
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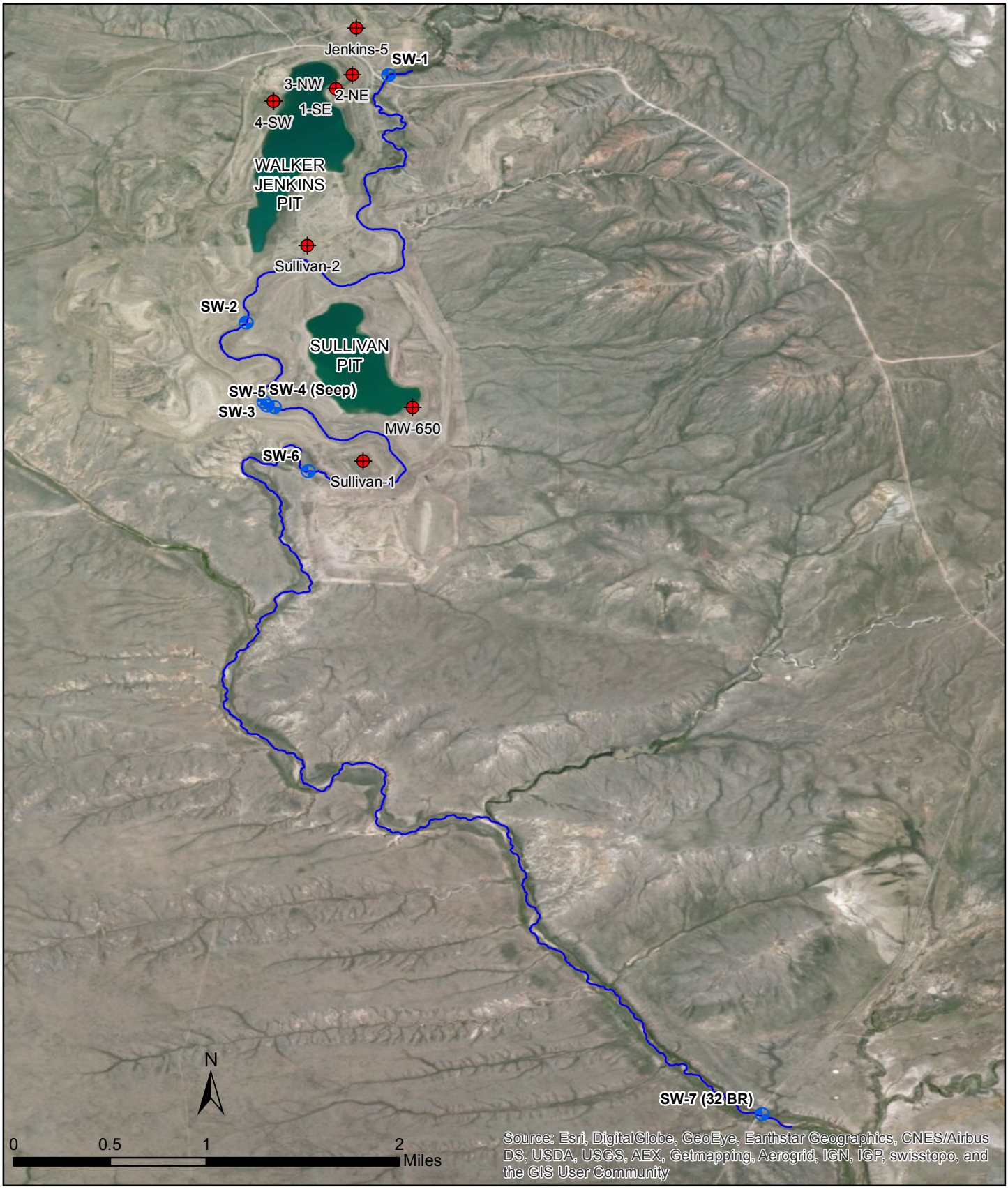
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 3-4
East Gas Hills Project Area
Groundwater and Surface Water Sampling Locations

Legend

- Groundwater Sampling Location
- Surface Water Sampling Location
- PRI Groundwater Sampling Location

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_EAST GAS HILLS_GW-SW-SAMPLING MAP.mxd



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DATE:	4/14/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 3-5
Shirley Basin Project Area
Groundwater and Surface Water Sampling Locations

Legend

- Groundwater Sampling Location
- Surface Water Sampling Location
- Little Medicine Bow River

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_SHIRLEY BASIN_GW-SW-SAMPLING MAP.mxd

4.0 Data Analysis and Results

4.1 Introduction

The following section will summarize the main observations and analytical results from the historical and the current data. The discussion will include a look at seasonality trends in the water quality results from the spring and fall sampling expeditions in 2013, 2014, and 2015 particularly as it applies to surface water and unconfined aquifers. A comparative analysis of longer term trends from sample results dating back into the 1980's through the current period will be discussed. Analysis of both groundwater and surface water quality, water levels, and trends in each study area will be made. Groundwater levels, potentiometric surfaces in the Wind River Aquifer, analysis of changes in water levels over time, and groundwater flow conditions will be discussed.

Data tables are provided for both groundwater and surface water in each area, summarizing the compiled water quality results from each monitoring site. The tables are not intended to be a complete compilation of all available water quality data from each monitoring station, but rather a thorough compilation of readily available data records. The tables provide field measurements, including water level elevation (when applicable), pH, conductivity, and temperature. The tables indicate sample statistical outliers (values outside two standard deviations) for each parameter with cell shading and incidences where concentration values exceed the livestock drinking standard with bold font. Dissolved concentrations of trace metals and radionuclides in the sampled water are compared to WDEQ, Water Quality Division Chapter 8 groundwater standards for livestock (Class III).

The Class III parameter concentration limit for each analyte is listed for reference in column 3 of the data summary tables. Figures have been developed for each area to visually display trends and significant changes in concentration over time. Typically for each area, these plots present concentration of TDS, sulfate, radium 226, and uranium in all groundwater or surface water monitoring sites over time. Where notable trends or changes are discussed, accompanying figures are included which may show other parameters at individual monitoring stations. Values at or below the detection limit have not been plotted on the figures.

Standard concentration limits are most frequently exceeded in sample results for radiometric analytes. An expanded radiometrics analysis was added to the sampling suite in 2012, including gross alpha, gross beta, and radium 228. The standards limit of gross alpha is 15 pCi/L; no standard exists for gross beta. The Chapter 8 standard related to radium (5 pCi/L Class III standard) is a concentration for combined radium 226 and radium 228, although the historic dataset often only analyzed for radium 226. For purposes of evaluating radium concentrations against a standard, within this report LA has used the 5 pCi/L standard as applicable to all radium 226, radium 228, or combined radium 226/228 values reported.

On the figures, the variability in radium 226 and uranium is noteworthy. Outside of a trending increase or decrease, this variability is the result of several factors. First, the biannual sampling looks highly variable in comparison to the historical data collected years apart in which the longer time gaps tend to smooth out the time/concentration curve. Secondly, radium 226 is always reported as a number with a precision plus or minus

number, representing the possible range the actual value may be within. In some cases this precision number can be as much as 20% of the reported concentration. For example, a recent sample report had a radium 226 concentration of 72 pCi/L with a precision factor of 14, meaning the actual value is in the range of 58 to 86 pCi/L. Thirdly, there are geochemistry processes to consider. Radium tends to be more soluble at lower pH (<6) while uranium is more mobile under higher oxygen conditions. Radium generally travels with uranium, but will rapidly adsorb onto formation clays. The geochemistry of the Gas Hills is very complex. Backfilling the pits (containing oxygenated groundwater) with mine spoils introduced additional dissolved solids, major anions and cations, metals and radionuclides, which slowly move down gradient through the aquifer. If the water encounters a natural uranium orebody that was not mined and the water is still in an oxygenated state, it can mobilize additional uranium which will then be carried with the water potentially passing through an existing monitoring well like a chemical front creating a temporary increase in the uranium and the radium concentrations. This "natural" variability has been observed with respect to sulfate, TDS, uranium and radium at an East Gas Hills in situ mine site, which is surrounded by reclaimed open pit mines. Depending on what oxidation/reduction conditions exist in the groundwater at the time of sampling, parameter concentrations can vary significantly from one sampling event to the next.

Other water quality constituents showed more consistent trends when compared with historical sampling and trends. Groundwater elevations in the study areas generally show rising trends, suggesting continued recovery of aquifer levels to new post-reclamation static water level elevations and water quality.

4.2 Day Loma

Water quality data compiled from sampling in the Day Loma area spans the timeframe from 1990 through 2015. **Tables 4.2-1 and 4.2-2** provide a summary data compilation of the available water level measurements and groundwater and surface water quality from the monitoring network in Day Loma through fall 2015.

During the recent monitoring period, seasonal groundwater samples were gathered from all monitoring sites except DL-4 and DL-10. DL-4 has traditionally been dry and was not sampled. DL-10 was not sampled in 2014 or 2015 due to its inaccessibility within the Clyde Pit. Surface water sites sampled included the groundwater-fed Day Loma Pit, surface water-fed Lake Day Loma, and the Clyde Pit, which has transitioned from a groundwater-fed mine pit, to a stormwater-fed surface impoundment to a combination of ground and surface water. Water was not observed in Coyote Creek Springs.

4.2.1 Water Level Changes and Groundwater Flow Conditions

Review of the water level data presented in **Tables 4.2-1 and 4.2-2**, along with the historical water level data indicates that water surface elevations in the mine impacted and backfilled areas continue to rise. Groundwater in the Upper Wind River Aquifer generally flows from the southeast to northwest. Monitoring wells within the mined area and down gradient show rising water elevations, while up gradient wells indicate relatively stable water levels. Between October 2011 and September 2015, water levels in wells within or cross gradient to the mine disturbance area, including DL-2, DL-5, DL-6, P-3 and P-6, have risen from 2.6 to 3.5 feet. Up gradient wells DL-8 and P-1 showed a rise of 1 foot and drop of 0.6 feet, respectively. Furthest up gradient well P-6 showed a drop of 4.4 feet in water surface elevation. Well DL-4 was historically dry before 2007, when it was observed with 4.1

feet of water column. DL-4 was visited in 2013 and found with approximately 7.4 feet of water column (elevation of 6468.71 feet). These are the only records of DL-4 water levels.

A potentiometric surface map showing 1991 and 2015 surfaces for the Upper Wind River Aquifer in the Day Loma area is presented as **Figure 4.2-1**. Comparison of the potentiometric contours in the Day Loma and Clyde Pit areas indicates that the cone of depression in the potentiometric surface around the pits has been shrinking since 1991 as water levels have risen. Although water levels continue to recover down gradient of the backfilled Clyde Pit, the open Day Loma Pit at the up gradient end of the mine area continues to influence the groundwater flow regime throughout the down gradient mine area.

At the down gradient end of the monitoring network, water levels in DL-9 have risen 6 feet between 2011 and 2015. Soister's (1967b) geologic map indicates that the adjacent Coyote Creek Springs historically discharged at an elevation of 6,456 feet, or roughly 12 feet above the 2015 water level in monitoring well DL-9. Under conditions that the Clyde and Day Loma Pits were fully backfilled, the post-reclamation water level in the Clyde Pit was estimated to be 6,510 (Lidstone, 2008) and renewal of the springs could be expected. However, because of the impact of the open Day Loma Pit on the existing groundwater flow regime, reestablishment of the historic springs is unlikely.

Data records from the groundwater-fed Day Loma Pit show that the pit water elevation continues to rise following the last significant dewatering operations that took place in the mining era. It should be noted that partial dewatering took place during mine reclamation efforts by AML (Lidstone and Associates, 2000). The water surface elevation has increased from 6,395 feet in 1985 to almost 6,466 feet in fall 2015, a nearly 77 foot rise (**Figure 4.2-2**). However, despite the rises in water levels, the Day Loma Pit continues to act as a regional hydrogeologic sink. Lidstone & Anderson (1992) predicted a relatively static water level 6,461 feet in the pit would be reached when groundwater inflow and precipitation are balanced by evaporation. The current water level is slightly higher than that predicted, though the rate of rise in water level has slowed, suggesting a stable water level under current conditions is imminent.

4.2.2 Groundwater

Groundwater quality in the Day Loma Area shows some general trends of improvement with decreasing and more consistent concentrations of major ions. With rare exceptions and excluding radiometrics, groundwater quality meets Chapter 8 livestock standards. As displayed in the shaded cells in the groundwater summary data **Table 4.2-1,** during the period from 1990 to 2007 concentrations of several analytes showed frequent statistical outliers (outside 2 standard deviations). Since 2007 the data have shown less outliers and suggest that the groundwater is becoming more consistent in quality and may be approaching an equilibrium condition. Groundwater quality is graphically presented on **Figures 4.2-3** through **4.2-6**, displaying TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations in all the monitoring wells over time.

TDS concentrations are highest from well DL-10, located in the active reclamation area of the Clyde Pit. As might be expected, TDS concentrations increase in wells moving from up gradient in undisturbed areas to locations down gradient of reclaimed areas. Concentrations of TDS in individual wells show level to slightly declining concentrations. Curiously, well P-4, screened in the Cloverly Formation, has TDS levels closely tracking the adjacent DL-9 well,

screened 210 feet higher in the Coyote Creek alluvium and Upper Wind River Formation. Although the water levels in the two wells show a downward vertical gradient from upper to lower aquifer, the similarities in water quality in the two wells may also indicate a possible compromised P-4 well seal or casing.

Sulfate across the group of monitoring wells also show stable to slightly declining concentrations. Again, wells P-4 and DL-9 show curiously similar sulfate concentrations.

Radiometrics including gross alpha and combined radium 226/228 regularly exceed the livestock standard in the Day Loma Area, although they are generally consistent with historical sampling at each well. Dissolved radium 226 concentrations are near the 5 pCi/L standard in all wells except DL-5. Radium 226 concentrations in DL-5 (shown on an inset plot on **Figure 4.2-5** are an order of magnitude higher than the other wells, which suggests well completion within an ore zone. Radium 226 concentrations in the remaining wells indicate rising trends between 1990 and 2007, with generally decreasing concentrations since 2007, although current concentrations are still higher than baseline levels seen in 1990 samples. Higher concentrations are in wells near the central part of the Day Loma area, with lower levels in up gradient and down gradient wells. The recent, more frequently gathered samples reflect variability that does not appear to have a seasonality. Well DL-10, located within the Clyde Pit reclamation area, reflects the most improved radium concentration, decreasing by half from 2007 to 2013.

Uranium concentrations in wells near the Clyde Pit, including P-3, P-5, DL-9, and DL-10 also show some non-seasonal changes in recent sampling. The remainder of the wells show slightly decreasing uranium concentrations approaching historic levels measured in 1996.

4.2.3 Reclamation Mine Pits and Surface Water

Surface water quality in the Day Loma Area shows general trends of improvement and, excluding the Clyde Pit, meets all livestock standards except for radiometrics. In the Clyde Pit, water quality since 2007 has been highly variable due to the ongoing reclamation activities involving the pit; it is a surface water impoundment fed with runoff from an active construction watershed. Surface water quality is graphically presented on **Figures 4.2-7** through **4.2-10**, displaying TDS, sulfate, dissolved radium 226, and dissolved uranium over time.

Water quality at the groundwater-fed Day Loma Pit has been generally consistent since 2007. TDS and sulfate levels indicate relative stability over the past 10 years. As expected due to evaporative concentration effects, TDS and sulfate levels are elevated two to four times above the up gradient groundwater concentrations. Radium 226 concentrations show some fluctuations up and down but have not exceeded the 1999 peak level. Dissolved uranium concentrations have been trending lower since 1998, moving from 0.741 mg/L to 0.4 mg/L in 2015. Recent water quality meets Chapter 8 livestock standard for all analytes except total combined radium 226/228 and gross alpha. Total combined dissolved radium 226 and 228 was recorded just over the 5 pCi/L standard in fall 2014 and 2015. Gross alpha shows a decreasing trend from 405 to 264 pCi/L during the 2012 to 2015 period, remaining elevated far above the 15 pCi/L livestock standard. Past studies have suggested concern that the Day Loma Pit's water quality would degrade over time. At this time, the current data show slightly increasing concentrations of major ions, yet no long term degradation in other trace metals.

Ongoing, active reclamation earthwork in and around the Clyde Pit since 2011 has resulted in a constantly reconfigured surface water impoundment in the area of the historic pit. The impoundment was also used for dust control construction water. Samples gathered since 2007 were collected from the general area of the impoundment as its location and configuration changed over time and reflect water quality of surface runoff. Radium 226/228 and gross alpha exceeded Chapter 8 livestock standards in water collected from the Clyde Pit.

Lake Day Loma, which is surface water-fed, has been routinely sampled since 2011, with one sample data set from 1990, around the time of reclamation. It is a shallow waterbody with no natural outfall and occasionally evaporates dry, as occurred in fall 2013. A majority of its watershed is native terrain, making water quality measurements a good reference for the range of naturally occurring conditions in the area. Prior to any reclamation, the 1990 sample exhibited variable water quality-perhaps a reflection of several years of limited freshwater inflow and the influence of barren mine spoils Constituent concentrations in water samples since completion of reclamation and revegetation have been more consistent. Alkaline pH levels in Lake Day Loma average 8.7 s.u., regularly exceeding the Class III standard of 8.5. In 2011, an anomalous sample had high concentrations detected for several analytes, in particular aluminum and iron, along with a maximum recorded pH of 9.4 s.u. The aluminum concentration was 40.3 mg/L against a 5.0 mg/L standard and iron results were 22.5 mg/L against an average of 0.19 mg/L from all other samples. These anomalous results are likely related to evaporation and concentration leading to high alkalinity, rather than mining influences. With the exception of aluminum in 2011, an alkaline pH, and gross alpha concentrations, Lake Day Loma generally has good water quality with no other analytes exceeding Chapter 8 livestock standards. Gross alpha exceeded the standard in 2012 and 2013 but the average since 2011 (12.4 pCi/L) is within the 15 pCi/L standard.

4.3 West Gas Hills

Water quality data compiled from sampling in the West Gas Hills were collected from 2001 through 2015. **Tables 4.3-1 and 4.3-2** provide a summary data compilation of the available groundwater and surface water quality data, and water level measurements from the monitoring network in the West Gas Hills through fall 2015.

During the most recent sampling period (2013- 2015), seasonal groundwater samples were gathered from all monitoring sites. Seasonal surface water samples were gathered when water was present. No samples were collected in 2013 from the Sunset Pit, SATA Pit, and Andrea Hunter pond, and the Sunset Pit was dry again in fall 2015. Water level measurements were taken on all wells with each visit and surface water levels were surveyed in relation to an elevation monument at the 2RS Pit and Andrea Hunter pond.

4.3.1 Water Level Changes and Groundwater Flow Conditions

Groundwater elevations across the monitoring network did not significantly change from 2013 to 2015. Changes ranged from a drop of 0.22 feet in the P-4 well to a rise of 3.07 feet in the K2 Pit well, suggesting that water levels in the area have generally recovered though additional rise and water level stabilization is still ongoing in some areas near the SATA Pit. The largest observed change in water level was a rise of 20.08 feet between 2001 to fall 2015 in the P-2 well, including a 1.3 foot rise during the last 2 years. Wells P-2, P-4, and Sage 1 are located in close proximity to each other, on the north end of the area and

eastern side of the SATA pit and have experienced similar increases in static water levels over the 15 year period of monitoring.

Review of the water level data presented in **Tables 4.3-1 and 4.3-2** indicates that water surface elevations in the SATA area continue to recover as a result of the AML reclamation. The Wind River Aquifer has not achieved complete flow through the SATA area since there is still a cone of depression associated with the reclamation backfill. Groundwater in the Wind River Aquifer in the West Gas Hills area generally flows from south to north. A map comparing fall 2001 and fall 2015 potentiometric surfaces for the Wind River Aquifer in the West Gas Hills area is presented as **Figure 4.3-1**. Up gradient monitoring wells in the Sunset Pit area and south including Sun 1, Sun 2, and Sun 3, have relatively stable water levels (within 1.2 feet) over the monitoring period since 2001. In the SATA pit area, pre-reclamation water levels measured in 1987, 1990, 1993, 1997, and 2001 ranged from 6,401.5 to 6,410 with rising and falling variability over that time. These observations over that period were an indication that the water level in the pit was near equilibrium with respect to evaporation (LA, 2002). Water levels in the K2 Pit, P-2, P-4, and Sage 1 wells have risen continuously since 2004-when backfilling of the open SATA impoundment began. The total rise in these nearby wells ranged from 16 to 20 feet. Most of this rise occurred between 2004 and 2011, following AML backfill above the groundwater table in 2004. The rate of water level recovery has diminished at these wells since 2012. Water levels at P-4 appear stable since 2013; similar water levels in the K-2 Pit well and Well P-2 have exhibited an overall increase of 3.1 and 1.3 feet, respectively. A water level of 6,432 feet in 2015 in the Sage 1 well, most representative of the locale of the historic SATA Pit, was essentially equal to the predicted recovery water level elevation of 6,430 feet (LA, 2002). Water levels in Sage 1 were as high as 6,434 in fall 2014 and fell back to 6,432 in fall 2015, suggesting it is nearing a steady state water surface elevation. In the former K2 Pit, best represented by the K2 Pit well, predicted water level recovery of 6,440 feet above mean sea level (amsl) is essentially equal to the 2015 water level recorded at 6,437 feet. The K2 Pit well continues to indicate rising water levels over time, indicating recovery levels may soon meet the predicted static water level. A variability in water levels around the SATA pit suggests that there remains a slight cone of depression and other influences on water levels from historic mining activities and that additional recovery and stability in water levels should be expected and monitored.

In the former Sunset Pit, best represented by the Sun 3 well, the water level observed in 2015 was 6,490 feet. BRS (2006) predicted a conservative recovery water level of 6,500 feet and observed that there was no indication of a cone of depression around the Sunset Pit. Water levels in the Sun 2 and Sun 3 wells have been essentially stable since 2001, when the groundwater-fed pit water level was recorded at an elevation of 6,490 feet. Reclamation efforts included placement of select backfill directly into the 15 foot deep groundwater-fed pit, therefore the apparent lack of recovery of water levels is attributed to the fact that there was no cone of depression around the pit prior to reclamation. Equilibrium had already been reached in the groundwater-fed pit and surrounding areas prior to backfilling.

4.3.2 Groundwater Quality

With the exception of radiometrics, and pH and occasionally select trace metals, groundwater quality throughout the monitored sites meets Chapter 8 livestock standards. All wells had exceedances of gross alpha and combined radium 226/228 in water quality samples collected during the most recent sampling period. In situ pH measurements from many of the wells indicated acidic water, below the 6.5 to 8.5 s.u. livestock standard. This

includes all the wells except Sage 2 and Sun 1, both of which are screened in the native Wind River Aquifer. Sun 2 was consistently acidic with average pH of 6.4 s.u. Average pH of the other long-term monitor wells was slightly higher: 6.7 s.u. in the backfill K2-Pit well; 6.8 in the backfill Sun 3 and Sage 1 wells; 6.8 in the Wind River Formation P-2 well; and, 7.1 in the Wind River Formation P-4 well. The livestock standard for mercury concentration is 0.00005 mg/L, while the minimum detection limit in samples taken during the recent monitoring were .001 or .0001 mg/L, depending on the year of analysis. Any detection of mercury at or near its detection limit is then an exceedance of the standard, which occurred in Sun 3 in fall 2013 and 2014 and in Sun 2 in fall 2013.

As displayed in the shaded cells in the groundwater summary data **Table 4.3-1,** analyte concentrations during the data period from 2001 to 2007, when active reclamation was occurring, showed frequent statistical outliers (outside 2 standard deviations). Since 2007 the data have many fewer occurrences of outliers indicating that the groundwater is becoming more homogenous and consistent in quality. The Sunset Pit reclamation completed backfill above the water table in 2003 and SATA Pit was backfilled above the water table in 2004.

Figures 4.3-2 through **4.3-5** display TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations in all the monitoring wells over time. Wells completed in backfill include Sun 2, Sun 3, K2 Pit, and Sage 1, which occupy the higher analyte concentration line plots in all four figures. During reclamation, oxidized backfill materials become saturated with oxidized water introduced by rising groundwater levels at the air interface. Trace metals and salts entrained in the backfill will dissolve, resulting in deteriorating water quality under the initial pore volume condition.

Concentrations of TDS over time in the monitoring wells is displayed on **Figure 4.3-2**. TDS concentrations in wells screened in native Wind River Aquifer materials have shown slight improvement. In particular, TDS in the P-4 well was rising from 2002 to 2006, but has since trended lower, decreasing from 1,030 mg/L in 2007 to 722 mg/L in fall 2015. On the other end of the spectrum, TDS concentrations in the Sage 1 (backfill material) well declined considerably during reclamation from 2002 to 2005 but have steadily increased since 2005 from 2,910 to 3,540 mg/L, with a concurrent rise in water level of 6.6 feet. Sulfate levels in the monitoring network mirror the TDS trends over time (**Figure 4.3-3**).

Uranium and radium 226 concentrations reflect similar trends to TDS and sulfate in terms of higher concentrations in backfill wells compared to Wind River wells (**Figures 4.3-4** and **4.3-5**). Some variability in concentrations is also apparent in the backfill wells, though no seasonality trend is observed. This behavior was discussed in detail at the introduction of Section 4. Dissolved uranium concentrations ranged from 0.0004 in Sun 1 to 20.0 in Sun 3 in fall 2015. In comparing uranium concentrations in Sun 3 with water levels, some correlation exists between rising water levels and rising uranium concentrations, suggesting re-saturation of backfill material is contributing to uranium concentration increases.

Dissolved radium 226/228 concentrations in all of the nine wells regularly exceed the WDEQ, Water Quality Division (WQD) Chapter 8 livestock standard (5.0 pCi/L). Sage 1 and Sun 2 had particularly high combined radium of around 100 pCi/L in 2014, while Sun 1, Sage 2, and P-4, all Wind River wells, have lower concentrations (below 10 pCi/L). The remaining wells are in the 20 to 60 pCi/L range. Gross alpha showed behavior similar to radium; all wells typically exceed the gross alpha standard (15 pCi/L) with backfill wells much higher than Wind River wells. Sage 1, Sun 2, Sun 3, and K2 Pit have much higher

concentrations, with gross alpha ranging from 699 to 12,200 pCi/L. Of these four wells, gross alpha concentrations in Sage 1, Sun 2, and K2 Pit are trending lower over the last 2 years, while Sun 3 has no apparent trend and had the highest gross alpha values, typically exceeding 10,000 pCi/L with the highest recorded value of 12,200 pCi/L in fall 2014. Gross alpha in the Wind River wells ranged from 11 to 103 pCi/L. Sun 1 and P-4 had the lowest concentrations, consistently near the 15 pCi/L standard.

Groundwater quality in the West Gas Hills generally shows that wells completed in backfill material exhibit poorer water quality while wells in native Wind River Aquifer materials and especially those up gradient or cross gradient from the mine disturbances show better water quality. The Johnny Potatoes South well reflects a down gradient multiple sand Wind River completion. Whereas water quality in backfill wells is not expected to improve until several pore volumes of groundwater have passed through the backfill, the native wells (those completed in the Wind River Aquifer) are likely to see improved water quality over time. Excluding the Johnny Potatoes well, the wells monitoring native Wind River materials including Sun 1, P-2, P-4, and Sage 2 have lower analyte concentrations than backfill wells. Slightly declining concentrations of TDS and sulfate in native formation wells P-2 and P-4 (located down to cross gradient from SATA) since 2006 suggests that water quality is gradually improving, likely through processes of dilution, dispersion, and advection.

In support of the AML reclamation design, SATA Pit water was utilized for batch test feed water with various combinations of spoil material to determine selective handling of suitable backfill material that was placed within the anticipated groundwater recovery levels and unsuitable material that was placed above the groundwater levels. Water quality trends in backfill wells showing constant or only slightly decreasing water quality as the groundwater level recovers indicates that spoils segregation during backfill has been largely successful in mitigating severe water quality deterioration with rising water levels.

4.3.3 Johnny Potatoes South Monitoring Well

The Johnny Potatoes well is a Wind River Aquifer well, which was first completed in 1963. Recently it has exhibited an abrupt deterioration in water quality between spring and fall sampling in 2013 (**Figure 4.3-6**). The concentrations of several analytes have exhibited a rising trend between 2006 and 2013. TDS concentrations for example, rose steadily from 1,200 to 1,660 mg/L. However, between the spring and fall samples in 2013, concentrations spiked for many analytes and remained high thereafter. This spike in concentrations was seen in TDS (1,660 to 3,460 mg/L), primarily attributable to: sulfate doubling from 785 to 1,570 mg/L; sodium more than doubled from 119 to 275 mg/L; calcium more than doubled from 309 to 637 mg/L; bicarbonate more than doubled from 423 to 903 mg/L; and, chloride - a nearly fourfold increase from 63 to 232 mg/L. Dissolved metals including arsenic, iron, manganese, and uranium also spiked. The most dramatic spike was in dissolved and total iron concentrations, increasing sixfold from 1.54 to 8.94 mg/L in dissolved and from 1.58 to 9.73 mg/L in total. Radionuclides exhibited less drastic changes with radium 226 concentrations increasing from 11 to 18 pCi/L. The abrupt rise in parameters measured at the Johnny Potatoes well indicates a contaminant front has reached this well. A discussion on the possible source of this contaminant front follows.

The Johnny Potatoes well was originally constructed as a water supply well and continues to be used for construction dust control water. According to completion records, the Johnny Potatoes well was constructed to 360 feet with water recorded at 170 feet below ground surface. Though records do not indicate, it is highly likely that the well completion included

at least 190 feet of screening across the entire depth of potential water source stratigraphy. In contrast, P-2 and P-4 have 30 foot screens with the bottoms of wells screened more than 200 feet above the bottom of the Johnny Potatoes well.

The nature of the Wind River Formation with interspersed layers of water-bearing sand, sandstone, siltstone, claystone, and conglomerate results in different groundwater gradients and hydraulic conductivities within the varying sand horizons. The broad intersection of the Johnny Potatoes well screening with the deeper aquifer layers may have allowed a contaminant front in the Johnny Potatoes well to be detected sooner than in other down gradient Wind River wells. In comparing well screen elevations with some limited historic references and assumptions of final depths of open mine pits, it was determined that the Johnny Potatoes well screen is deeper than AML backfill materials in the SATA and K2 Pits. This suggests that AML selective backfill and reclamation is not the source of the contaminant front detected in the Johnny Potatoes well. However, prior to AML backfill and before 1994, the K1, K2, and D9 Pits were backfilled to levels above the water table. Limited records suggest the final mining depths of these pits were at elevations that intersect stratigraphy that the Johnny Potatoes well screen also intersects. Reclamation techniques and requirements at the time did not require selective material handling for backfill below the water table. Therefore, it is possible that the Johnny Potatoes well has detected a contaminant plume sourced from backfill materials placed into pits and below the water table deeper and pre-dating AML reclamation. Hydraulic conductivity of around 0.1 ft/day is a realistic rate for sandstone and matches well with around a 30 year timeframe to migrate the approximately 2,000 foot distance from the historic K1 Pit to the Johnny Potatoes well. Well screens in P-2 and P-4 are approximately 50 and 30 feet, respectively, above the top of the Johnny Potatoes well screen. The 2015 potentiometric surface indicates a deflection towards the Johnny Potatoes well that may be a result of increased pumping.

The above explanation addresses natural processes-given that the Johnny Potatoes well is a prolific multiple completion Wind River Aquifer well in a down gradient position to the WGH disturbances. With all that said it is a significant concern that the deterioration in water quality occurred so quickly and abruptly in 2013. It is possible that a well integrity (or perhaps a vandalism) issue may have developed resulting in deterioration of the Johnny Potatoes well water quality. To address this issue, LA recommends that a new well inspection and well video be completed. In addition a new well should be constructed to a similar depth and located between the Johnny Potatoes well and P-4.

4.3.4 Reclamation Mine Pits and Surface Water

Surface water quality in the West Gas Hills is represented by three sites with surface runoff-fed impoundments and the groundwater-fed 2RS Pit. Tabulations of surface water quality sample results are provided in **Table 4.3-2**. Water quality over time is displayed on **Figures 4.3-7** through **4.3-10**, showing TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations. With the exception of radionuclides and pH, water quality from all surface water sampling sites meets Class III livestock standards. Radionuclides exceed standards consistently in all sites and pH in the 2RS pit and Andrea Hunter impoundment regularly exceeded the upper pH limit of 8.5 s.u. Livestock were observed regularly throughout the West Gas Hills, drinking from all but the Sunset impoundment. Protective fencing around the Sunset area was removed in 2015, allowing livestock into the area.

In the Sunset and SATA pit data sets, one sample each was gathered in 2001 (pre-reclamation) from the groundwater-fed pit, while more recent samples represent surface

water impoundment water quality. A comparison of pre-reclamation pit water to surface runoff shows dramatic improvements in water quality. Water quality in surface-fed impoundments is highly influenced by precipitation and evaporation, resulting in increasing concentrations when evaporation dominates, and decreasing concentrations when precipitation dilutes concentrations. Radium 226 in the surface water-fed impoundments is generally around the 5 pCi/L level, with increasing and decreasing levels following precipitation conditions. The Andrea Hunter impoundment, occasionally dry or near empty, exhibited the highest range in radium 226 concentration, from 0.44 to 25 pCi/L. Gross alpha in the three water bodies was consistently over the 15 pCi/L standard, ranging from 36 to 239 pCi/L. In the Andrea Hunter impoundment, pH ranged from 7.3 to 9.7.

In the 2RS groundwater-fed pit, water quality was generally consistent with historical sampling. Gross alpha, radium, and pH were consistently outside Class III livestock standards. Gross alpha ranged from 225 to 385 pCi/L with an apparent decreasing trend. Radium concentrations ranged from 6.8 to 3.1 pCi/L with no apparent trend. Combined radium 226/228 exceeded the 5 pCi/L standard in 6 of 8 samples, with an average of around 6 pCi/L.

4.4 Central Gas Hills

Water quality data were collected in the Central Gas Hills from 2011 through 2015. Annual samples were collected in 2011 and 2012. From 2013 to 2015, biannual (seasonal) water samples were collected from all three monitoring sites: the H&I backfill well and the 4R and 5F-1 pits. **Tables 4.4-1 and 4.4-2** provide a compilation summary of the groundwater and surface water quality data, and water level measurements from the monitoring network through fall 2015.

4.4.1 Water Level Changes and Groundwater Flow Conditions

In 2015, the survey monumented water level reference pins at both the 5F-1 (north) Pit and the 4R (south) Pit were submerged due to rising water levels and had to be relocated. New pins were installed and their elevations surveyed in relation to the area around the submerged monument pins. Review of the water level data presented in **Tables 4.4-1 and 4.4-2**, quantifies this rising water surface elevation in the pits and the monitoring well. From 2013 to 2015, the 5F-1 and 4R Pit water levels rose 2.8 and 5.9 feet, respectively. Water level in the H&I well rose 2.7 feet. The rate (1.35 to 2.95 ft/yr) of groundwater elevation rise indicates that recovery of groundwater levels is still very dynamic and a new post-mining equilibrium condition may be several years away. Water level data collected by Cameco in their proposed Mine Unit 3 indicate that groundwater in the Upper Wind River Aquifer in the CGH generally flows from the south to north. The northward groundwater gradient between the 4R and 5F-1 Pits is approximately 0.0083 (55 feet over 6600 feet). The extent of groundwater level data is insufficient to ascertain a meaningful potentiometric surface at this time. **Figure 4.4-1** shows plots of water elevation over time in the three monitoring sites.

4.4.2 Groundwater Quality

The H&I well, drilled in backfill, was completed in 2012. A total of six samples have been collected from that well to date. Water quality was generally consistent across the sample period from spring 2013 to fall 2015. **Figure 4.4-2** provides a snapshot of the fairly consistent water quality in well H&I over the sampling period. **Figures 4.4-3** through **4.4-6**

display water quality over time for the surface and groundwater sites, showing TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations. Groundwater quality in the H&I well does not meet Class III livestock drinking standards for pH, gross alpha, and combined radium 226/228. pH in the well has been consistently measured between 6.0 and 6.2 s.u., below the Class III livestock standard range of 6.5 to 8.5. Gross alpha concentrations range from 1,060 to 1,930 pCi/L against a standard of 15. Combined radium 226/228 ranges from 16.2 to 22.0 pCi/L against a standard of 5. No clear trends were observed in pH, gross alpha, nor radium, although the radium data suggest some seasonality with slightly lower concentrations in the spring samples and higher concentrations in the fall samples. The H&I well water quality exhibited higher dissolved metal concentrations (iron, manganese, nickel, uranium, and zinc) than the local groundwater-fed pits. TDS and sulfate concentrations in the H&I well are similar in magnitude to the down gradient 5F-1 Pit: around 3,200 to 3,400 mg/L average TDS and 1,900 to 2,000 mg/L average sulfate. Concentrations in the 4R Pit were considerably lower around 1,900 mg/L average TDS and 1,300 mg/L average sulfate (**Figures 4.4-2 and 4.4-3**).

4.4.3 Reclamation Mine Pits and Surface Water

The quality of water accessible at the surface in the CGH is limited to the two pits, which are principally fed by groundwater. The outflow component is evaporation. Water quality was generally consistent across the sample period from fall 2011 to fall 2015. Water quality data indicate that all parameters are within Class III livestock standards except gross alpha. Livestock and wildlife were observed regularly in and around both pits. Gross alpha in all pit samples range from 172 to 919 pCi/L against a standard of 15 pCi/L, with 4R on the lower end of that range and 5F-1 on the higher end. In both pits, dissolved gross alpha values are trending downward between 2012 and 2015: from 919 to 655 pCi/L in 5F-1 and from 290 to 172 pCi/L in 4R. Comparing plots of water quality for both pits and the H&I well groundwater (**Figures 4.4-2 through 4.4-5**) shows that TDS and sulfate concentrations are much lower in the 4R Pit than the 5F-1 or H&I well. This is a reflection of the much greater extent of mining disturbances up gradient of H&I and 5F-1 versus the 4R Pit. TDS levels in the 5F-1 Pit indicate a trend of increasing concentration, likely due to a combination of inflow of groundwater from backfilled pits and evaporative effects. TDS levels in the 4R Pit indicate a trend of falling values, likely due to the significant inflow of relatively low TDS groundwater which resulted in the nearly 6 foot rise in water surface elevation. One would expect TDS to eventually trend upward in the 4R Pit as groundwater levels stabilize and evaporative concentration effects dominate over lower TDS groundwater inflow. Radium and uranium concentrations in both pits was fairly consistent and generally stable over the data period. Uranium concentrations follow a similar pattern with TDS, trending slightly higher in 5F-1 and slightly lower in 4R.

4.5 East Gas Hills

Water quality data compiled from sampling in the East Gas Hills was collected from 1989 through 2015. **Tables 4.5-1 and 4.5-2** provide a summary data compilation of the available groundwater and surface water quality data and water level measurements from the monitoring network in the East Gas Hills through fall 2015.

During the most recent sampling period, biannual groundwater samples were gathered from all monitoring sites, with a few exceptions: MW-3A was not sampled in spring or fall 2014 and GW10A and PRI-1 were not sampled in spring 2014. Seasonal surface water samples

over the 3 year biannual sampling period were gathered from all sites except the often dry, Cap Pit surface water impoundment. The Cap Pit was dry and no samples were gathered in 2013 and fall 2015. With each sampling visit, water level measurements were taken at each well and surface water levels were surveyed in relation to an elevation monument at the Veca Pit, PC Pit, and Buss Pit.

4.5.1 Water Level Changes and Groundwater Flow Conditions

Review of the water level data presented in **Tables 4.5-1 and 4.5-2** indicates that water surface elevations in the reclaimed areas of the historic A-8 pit, best represented by the LA-8 monitoring well, have recovered the most over the long term. Water levels in down gradient wells GW-10A and PRI-1 have dropped over the long term. Similar trends were observed during the recent 3 year biannual sampling period. A map comparing 1993 and fall 2015 potentiometric surfaces for the Wind River Aquifer in the East Gas Hills area is presented as **Figure 4.5-1**. Groundwater in the Wind River Formation in the East Gas Hills generally flows from the east to southwest. Deflections in the 1993 potentiometric surface around the A-8 Pit and UMETCO reclamation have largely dissipated following reclamation of several groundwater impoundments. Groundwater elevations in the area of the A-8 Pit, rising to around 6,917 feet in the LA-8 well, have risen and remained far above the predicted recovery groundwater levels (6,860 feet) with the filling of adjacent UMETCO and AML pits. Water levels far above predicted static levels carry the risk that backfill materials intended for placement outside of the water table may in fact be saturated and induce unintended down gradient water quality deterioration.

Groundwater elevations across the monitoring network exhibited variable levels of change during the recent monitoring period. Changes ranged from a drop of 2.4 feet in the LA-3 well to a rise of 1.8 feet in LA-10. Four of ten wells exhibited rising water levels, including LA-8 (+0.44 feet), LA-9 (+1.33 feet), LA-10 (+1.8 feet), and MW-3A (+0.7 feet), all located in an up to down gradient line. All other wells exhibited dropping water levels of less than 0.7 feet, except that LA-3 dropped 2.4 feet. The gradient path from LA-3 to LA-10 and the observed falling level in LA-3 to rising in LA-8, LA-9, and LA-10 suggest a groundwater "mound" has moved off of LA-3, creating a drop in water level, and into LA-8, 9, and 10. The chronology of the water level changes also support this concept. LA-3 experienced the largest decline from fall 2013 to spring 2014. LA-8 experienced its largest gain between fall 2013 and spring 2014. The next down gradient well LA-9 experienced its largest gain from spring 2014 to fall 2014. LA-10 shows a more consistent incremental rising water level over the recent monitoring period.

Long term water level trends indicate little change in up gradient wells LA-1 and LA-7, and in the down gradient GW-10A. LA-1 and LA-7 exhibited a decline in water levels from 1989 to 2015 of around 1.7 feet. Water level in GW-10A declined by 2.3 feet between 1997 and 2015. These relatively small declines over a long monitoring period can be attributed to natural variation.

LA-2, LA-3, and LA-8 exhibited large rises in water surface elevations over the long term monitoring period. LA-2 rose over 50 feet from 1989 to 2015. LA-2, although located up gradient, was significantly affected by the cone of depression from mine dewatering operations and has shown significant recovery following reclamation. LA-3 and LA-8 are located in or near the A-8 reclaimed pit and have shown water levels rise 36 and 42 feet. Down gradient wells MW-3A and PRI-1 exhibited long term drops in water level of 15 and 20 feet, respectively. MW-3A is a slow recharging well, taking three days to sample. PRI-1 is

nearest the Buss Pit, with water levels likely affected by the potentiometric sink that exists around the Buss Pit.

4.5.2 Groundwater Quality

Groundwater quality in the East Gas Hills Area shows some general long term trends suggesting ongoing deteriorating water quality. With exceptions of pH and radiometrics, groundwater quality throughout the monitoring sites meets Chapter 8 livestock standards. Field measured pH below the 6.5 s.u. standard was recorded once over 10 to 11 samples in each of wells LA-1, LA-2, LA-3, and LA-7 with the lowest value at 6.32 in Well LA-7. LA-1, 2, and 7 are up gradient water quality monitoring wells, indicating that variability in pH is not uncommon. Slightly acidic measured pH values outside the standard have occurred consistently in wells LA-8 and LA-9. Radiometrics including gross alpha, radium 226, and combined radium 226/228 regularly exceeded livestock standards in all wells except LA-7 and only occasionally in LA-1, both up gradient wells.

Groundwater quality is graphically presented on **Figures 4.5-2** through **4.5-5**, displaying TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations in all the monitoring wells over time. Broadly, groundwater quality in the East Gas Hills across the monitoring network exhibits a general upward trend in analyte concentrations, suggesting deteriorating water quality. The water quality variability throughout the monitoring network, without clear trends or obvious contaminant fronts moving from up to down gradient, is a reflection of the extent of disturbance and the different approaches to reclamation utilized for the multiple company and AML projects in the area. The varying degrees to which reclamation projects approached material handling, segregation, and selective backfill above and below projected groundwater recovery levels creates inconsistencies, volatility, and discontinuities in water quality. The widely interspersed reclamation projects throughout the area make identifying constituent source areas or contaminant plume characterizations very difficult.

LA-1, LA-2, and LA-7, all completed in the native Wind River Aquifer, provide baseline data up gradient (east) of reclamation areas. Water samples collected from these wells reflect lower TDS and dissolved radionuclide concentrations than the wells in areas affected by mining and down gradient of reclamation. LA-1 had some exceedances in radionuclide concentrations, with levels of gross alpha and combined radium 226/228 generally near or just over Class III limits. LA-2 consistently exceeds radionuclide standards and LA-7 had no exceedances. LA-2 has dissolved radionuclide (gross alpha, radium 226, and radium 228) concentrations three times greater than at LA-1 and four times greater than at LA-7. LA-2 radionuclide concentrations can be assumed to represent worst case scenario baseline levels. LA-2 radium 226 concentrations are consistently above the 5.0 pCi/L standard. Eleven samples from 1989 to 2015 have concentrations between 6.0 and 25.0 pCi/L. The variability in up gradient, baseline water quality across these three monitoring wells provides guidance in the natural variability in radionuclide concentrations throughout the East Gas Hills area.

LA-3, constructed in backfill material, represents water quality at the A-7 Pit reclaimed by UMETCO prior to AML reclamation. Generally, LA-3 water quality does not appear to exhibit increasing or decreasing concentration trends. A noteworthy outlier sample in June 2014 showed significant spikes in several dissolved analytes including bicarbonate, calcium, magnesium, nitrogen, potassium, sulfate, TDS, iron, manganese, uranium, gross alpha, gross beta, and radium 226. Gross alpha in particular jumped from 14.2 in fall 2013 to 2130

in spring 2014. The sample also recorded the lowest pH reading for this well, 6.4 s.u. against an average of 6.8 s.u. Most parameters returned to more typical concentrations in the following sample with parameters including iron, gross alpha, manganese, and radium 226 concentrations receding to more typical concentrations over the following year. Concentrations of most constituents remain elevated over historic levels in LA-3 in 2015.

LA-8 (backfill wells) and LA-9, located down gradient from LA-8 and completed in the Wind River Formation are screened at similar elevations- around 6,800 feet. The wells have comparable major ion concentrations, conductivity, and TDS, at some of the highest levels seen in all of the East Gas Hills wells. Both wells exhibit pH averages in the acidic range (average field pH of 6.3 and 6.5 s.u.). In dissolved metals, LA-8 has high uranium concentrations and LA-9 has high iron concentrations. LA-8 uranium concentrations have shown a decreasing long-term trend from 5.9 mg/L in 1996 to 2.7 mg/L in 2015, but they remain an order of magnitude more than in any other East Gas Hills well. Uranium concentrations are expected to continue to decrease with time as reducing conditions are restored in the A-8 Pit area (second or third pore volume passes through the disturbed area) and uranium is converted to its less mobile state. Gross alpha is also an order of magnitude higher in LA-8 (average 1900 pCi/L) than LA-9 (average 135 pCi/l). In a reverse, LA-9 radium 226 concentrations (average 48 pCi/L) are four times the levels seen in LA-8 (average 14 pCi/L). LA-9 iron concentrations average 32 mg/L compared to the secondary Class I standard of 0.3 mg/L (no standard exists for livestock). Iron dissolved by acidic conditions within the A-8 pit and, under continued low pH conditions, remains mobile, moving down gradient. LA-8 has an average iron concentration of 7.5 mg/L. In dissolved radionuclides, LA-8 results for gross alpha average 2515 pCi/l, against a standard (which excludes uranium) of 15 pCi/l.

Column leach studies and geochemical modeling in1994 predicted 35 to 150 years for the initial pore volume to move through the reclaimed A-8 Pit. The LA-8 well fully penetrates the backfill placed in the A-8 Pit. Reclamation methods for the A-8 Pit involved placing spoils materials directly in the free water surface. The acidic conditions within the pit at the time of reclamation are still exhibited in LA-8 and LA-9 water quality observations. Coarse, sandier spoil used for backfill below the water table is typically, in the East Gas Hills, higher in uranium and radium content (Lidstone & Anderson, 1994). The 1994 report observed initial improvements in groundwater quality in LA-3 from 1989 to 1994. However, continuing rise in groundwater elevations and saturation of backfill material has resulted in no water quality improvement since 1994, but rather, water quality in LA-3 and LA-8 is better than 1989 but somewhat worse than 1994. Clearly water quality conditions have not improved to within background levels in wells LA-3 and LA-8.

LA-10, constructed in 2012, is located further down gradient from LA-8, LA-9, and the reclaimed pits. It is screened at a deeper elevation, centered around 6,730 feet amsl. LA-10 exhibits lower concentrations of major ions and trace metals compared to LA-9 and LA-8. It has the highest concentration of radium. Combined radium 226/228 averaged 87 pCi/L during the recent biannual sampling period. The next highest values in the East Gas Hills are in LA-9 and LA-2 with averages during most recent sampling of 61 and 27 pCi/L, respectively. These values along with gamma readings from the geophysical log obtained during well construction (**Appendix B**) suggest that LA-10 is constructed in a mineralized zone with high radium levels.

Overall groundwater quality exhibited some indications of deterioration over time, with TDS concentrations rising in LA-3, LA-9, and MW-3A. Water levels in the A-8 Pit area are 57 feet higher than predicted, saturating backfill materials that likely includes unsuitable mine spoil materials. Along with lower pH values, groundwater is dissolving minerals and metals, creating deteriorated water quality pulses to down gradient wells. Slowly recharging wells may induce variability in analytical results. These include LA-1, LA-3, LA-7, and MW-3A, which were evacuated three times over three days to gather a representative sample. GW-10A and PRI-1 with 50 foot well screens may reflect more of a mixed water quality across the broad range of sand zones in the formation, rather than allowing for data collection reflecting a down gradient moving contamination front from one zone.

4.5.3 Reclamation Mine Pits and Surface Water

East Gas Hills surface water sites include the groundwater-fed PC Pit and Buss Pit, and the surface water-fed Veca Pit and Cap Pit. Water quality over time is displayed on **Figures 4.5-6** through **4.5-9**, showing TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations. With the exception of radionuclides, pH, and dissolved aluminum, water quality from all surface water sampling sites meets Class III livestock standards. Gross alpha consistently exceeds the 15 pCi/L standard in all but the Cap Pit. Other radionuclides are within standards. In the surface-fed Veca Pit, pH is occasionally exceeded on the alkaline side while in the acidic Buss Pit, in situ pH averaged 3.8 during the recent biannual sampling period and exhibits long term deterioration (drop) in pH. Dissolved aluminum in the Buss Pit also consistently exceeded the standard, averaging 15.7 mg/L since 2006 against a standard of 5.0. Evidence of livestock were observed around the PC, Veca, and Cap Pits.

TDS and sulfate in the groundwater-fed PC Pit and Buss Pit compare well with each other with a long term trend of increasing concentrations. Buss Pit TDS is consistently above 4,000 mg/L since 2013 and sulfate near the 3,000 mg/L Class III standard. Recent PC Pit concentrations have been slightly lower than the Buss Pit, approximately 3,700 mg/L TDS and 2,200 mg/L sulfate. This is a result of groundwater inflow and evaporative concentration effects. The surface water-fed Veca Pit, because of being lined during reclamation in order to retain water, also shows a long term trend of rising TDS and sulfate concentrations; although concentrations are much lower near 1,100 mg/L TDS and 500 mg/L sulfate. Values in the often dry Cap Pit (around 200 mg/L TDS and 100 mg/L sulfate) are much lower and show no trends, though data points are limited to only three samples in 2014 and 2015. Dissolved chloride concentrations in the Veca Pit, though far below the 2,000 mg/L Class III standard, exhibit a long term rising trend with values rising from 4 to 14 mg/L from 2006 to 2015.

In the Buss Pit, pH remained consistently neutral until the spring of 1998, when pH began to drop. This correlates to the rise and recovery of the water table and the inundation of oxidized pyrite-bearing strata. The current pH is 4.2 s.u. with elevated levels of certain metals including aluminum and iron. With the low pH, a trend of deteriorating water quality is seen in not only TDS and sulfate, but also through increasing concentrations of other dissolved metals including manganese, nickel, uranium, and zinc.

The Buss Pit exhibits a long term trend of increasing uranium concentrations, while the PC Pit exhibits a decreasing trend. Buss Pit concentrations averaged 0.08 mg/L during 1996 to 1999, then experienced an increase to 0.26 mg/L in 2006 and has averaged 0.23 since. The PC Pit average uranium concentration was 0.46 mg/L though 1999 and 0.35 mg/L in the

2011 to 2015 period. Concentrations in the Veca Pit were consistent over time with a 0.15 mg/L average since 1996 and the Cap Pit had concentrations near the detection limit.

Radium 226 concentrations were typically near or below the 5.0 pCi/L standard across all the surface sampling sites. Since analysis of gross alpha started in the 2011 sample set, concentrations are trending lower in the PC Pit and not trending in the Veca Pit or Buss Pit.

4.6 Shirley Basin

Historic water quality data compiled from sampling in the Shirley Basin Area spans from 1981 through 2015 for groundwater and 2011 to 2015 for Little Medicine Bow River samples. **Tables 4.6-1, 4.6-2, and 4.6-3** provide a summary data compilation of the available groundwater, surface water, and river water quality, respectively, and water level measurements from the monitoring network in the Shirley Basin Area through fall 2015. Five wells, four surrounding the Walker/Jenkins Pit and one on the southeast corner of the Sullivan Pit, were established during reclamation (**Figure 3.5**). Three additional wells were constructed in 2012 in native Wind River Formation geologic zones located up gradient, down gradient, and between the two groundwater-fed pits. Hydro-Engineering (1993, 1999) provides an assessment of static water levels and water quality data from the Shirley Basin from 1986 to 1998. Hydro-Engineering water samples gathered in 1998 provide a single data point in the gap in monitoring that occurred from 1992 through 2010.

During the most recent sampling period, biannual samples were gathered from groundwater monitoring wells and surface water sites with some exceptions. In spring 2015, the SW-4 site (a hillslope seep adjacent to the Little Medicine Bow River) was not sampled due to no flow and, therefore, the seep related sites SW-3 (upstream) and SW-5 (downstream) were also not sampled. The river site SW-7, 6 miles downstream from the reclamation areas, was established for discharge and sediment measurements and has not been sampled for Guideline 8 water quality analysis.

4.6.1 Water Level Changes and Groundwater Flow Conditions

Review of the water level data presented in **Tables 4.6-1 and 4.6-2** indicate that groundwater elevations in the Wind River Formation and flooded mine pits were relatively stable to slightly rising during the recent sampling period. Measurements during the recent sampling period generally reflected slightly higher elevations during spring measurements, suggesting some seasonality in water elevations. Water surface elevations in the Walker/Jenkins and Sullivan Pits experienced spring levels up to a foot higher than fall levels. Some data suggests long term rising water levels may be continuing, though at rates too slow to conclusively determine in the 3 year data set.

Wells constructed in 2012 include the up gradient Jenkins 5 (located north of the Walker/Jenkins Pit), the Sullivan 2 well (located between the two pits), and Sullivan 1 (located south or down gradient of the Sullivan Pit). Water level elevations in Sullivan 2 are higher than both pits, suggesting a groundwater divide or ridge between the pits and supporting the observations of a potentiometric sink on all sides of the Pits. The perennial flowing Little Medicine Bow River streambed elevations lose grade while meandering around the pits and are approximately 25 to 40 feet above the water level of the Walker/Jenkins Pit and approximately 10 to 35 feet above the Sullivan Pit. A potentiometric surface map comparing 1989 and fall 2015 surfaces for the Wind River Aquifer in the Shirley Basin area is presented as **Figure 4.6-1**.

Data compiled from historical records indicates that groundwater levels in the Walker/Jenkins Pit rose rapidly during the period of 1986 to 1988 due to backfill materials placed directly in the pit. This is evident by the water level elevations in the map of the 1989 potentiometric surface, with a higher level in the Pit versus the wells to the east. The wells to the east, 1-SE and 2-NE, are located in low permeability backfill, approximately 0.2 ft/day (Hydro-Engineering, 1993). The backfill into the Pit created a surcharge water elevation that had not reached an equilibrium with the wells to the east. Moderated rising water levels in both Pits continued through the 1990s. During the mid-1990s water levels in wells 1-SE and 2-NE, located east of Walker/Jenkins Pit, and well MW-650, located south of the Sullivan Pit, experienced annual average rise rates of 1.5 to 2 ft/yr. During the same timeframe, water level in wells 3-NW and 4-SW, located west of the Walker/Jenkins Pit, had mean annual rise of less than 0.1 ft/yr. During the 2000s, average water level rise rates slowed to 0.3 to 0.4 ft/yr east of Walker/Jenkins and to less than 0.1 ft/yr near Sullivan Pit. Rise rates increased on the west side of Walker/Jenkins Pit to around 0.25 ft/yr, suggesting the broader water table surrounding the Walker/Jenkins Pit was approaching normalization.

Water elevation in the Sullivan Pit in 1986 was around 6,900 feet and rose 6 feet by 1992. Elevations during the most recent sampling period appear to have stabilized around 6,915.5 with some seasonal rise and fall variation. The groundwater monitoring well MW-650 located adjacent to the Sullivan Pit has experienced similar water level changes, consistently tracking a water elevation approximately 2 feet higher than the Pit. As the Little Medicine Bow River meanders around the west side of the Sullivan Pit, its streambed elevation is higher than the Sullivan Pit water surface elevation. The Little Medicine Bow River streambed elevation north of the Sullivan Pit is approximately 6,950 and drops to around 6,925 on the south side, suggesting that the stream is losing water to the Pit.

Water elevation in the Walker Jenkins Pit in 1986 was around 6,863. It rose rapidly by around 45 feet to about 6,908 feet through 1988 and 1989, due to backfill material placement directly into the pit (Hydro-Engineering, 1993). Most recent water surface elevations appear relatively stable around 6,922.5 feet, with seasonal variability. Groundwater elevations in the nearby wells are approximately 6 feet above the pit on the west side and 8 feet above the pit on the east side. The Little Medicine Bow River streambed elevations drop from about 6,960 on the northeast side of the pit to around 6,945 on the south side of the pit- again reflecting loss of water from the stream to the mine pit.

Water level measurements in wells and pits, coupled with streambed elevations and the buildup in the Pits of TDS via evaporative concentration effects, indicate that the water levels in the groundwater-fed pits have largely stabilized and, due to evaporative losses, have created potentiometric sinks resulting in groundwater flow toward each pit from all surrounding directions. As groundwater enters the two pits, it will flow through backfill materials and as such will affect the long term water quality of these permanent impoundments.

4.6.2 Groundwater Quality

Groundwater quality in the Shirley Basin area is generally consistent with historical sampling and trends since reclamation activities stopped around 1993. Groundwater quality generally meets Chapter 8 livestock standards with the exception of radionuclides and pH. Groundwater quality is graphically presented on **Figures 4.6-2** through **4.6-5**, displaying TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations in all of the monitoring wells over time. Water quality in the groundwater-fed Walker/Jenkins Pit and

Sullivan Pit are included in the figures for comparative and analytical purposes. However, discussion of pit water quality is found in Section 4.6.3.

Radionuclides consistently exceed livestock water quality standards in backfill wells including 1-SE, 2-NE, 3-NW, 4-SW, and MW-650. In Wind River Formation wells, radionuclides are within standards in Jenkins 5 and Sullivan 1, while the Sullivan 2 well consistently exceeds standards in gross alpha and radium, and in uranium is two orders of magnitude greater (though still at trace levels of around 0.1 mg/L). These values in Sullivan 2 along with gamma readings from the geophysical log obtained during well construction (**Appendix B**) suggest that Sullivan 2 is constructed in a mineralized zone with high radium levels.

Acidic pH below the 6.5 s.u. standard are common in the backfill wells east of the Walker/Jenkins Pit (wells 1-SE and 2-NE), though the pit pH is around 8.0 s.u. Wells to the west of Walker/Jenkins Pit have pH around 7.3 to 7.5. No other wells exhibited pH levels outside the livestock standard (6.5 to 8.5 s.u).

Wind River Formation wells have the highest water quality of the groundwater monitoring network, exhibiting the lowest TDS and sulfate values. The up gradient Jenkins 5 well provides baseline water quality levels for comparison to down gradient water quality in the reclamation areas. In backfill wells 3-NW and 4-SW, west of the Walker/Jenkins Pit, TDS and sulfate concentrations are near Wind River Formation levels seen in Jenkins 5. Wells on the east side of Walker/Jenkins (1-SE and 2-NE) exhibit the highest TDS and sulfate levels of wells in the Basin. Groundwater quality around the Walker/Jenkins Pit indicates much higher quality on the west side than the east side and all but radium 226 support this observation.

Backfill material around the Walker/Jenkins and Sullivan Pits connects the interspersed sands of the Wind River Aquifers to the pits. Permeability in the backfill wells varies. West of the Walker/Jenkins Pit, permeability of the backfill from testing of wells 3-NW and 4-SW is approximately 2 ft/day. Permeability east of Walker/Jenkins in well 2-NE and south of the Sullivan Pit in well 650 is much lower at approximately 0.2 ft/day (Hydro-Engineering, 1993). The ability to transmit water through the backfill material is much greater on the west side and allows up gradient Wind River Formation water to more quickly move through the material, in the down gradient direction toward the Pit, while slowly moving water on the east side accumulates higher concentrations of constituents due to slower flow through flushing of pore spaces.

Radium 226 concentrations exceed the 5 pCi/L standard in wells on the west of the Walker/Jenkins Pit, the Wind River Formation well Sullivan 2, and in the MW-650 well south of the Sullivan Pit. The 3-NW and 4-SW wells west of the Walker/Jenkins Pit may be the best reference for monitoring radium and water quality recovery in backfill. Up gradient Wind River Formation water moves through a limited backfill zone, through high permeability backfill through the wells and into the Pit. The rising trend indicates that radium in backfill has not been adsorbed or flushed out and that until a decreasing radium trend is seen in these wells, groundwater quality recovery processes continue. No apparent trend was observed in the other high radium wells. The Sullivan 2 well radium levels are likely due to its construction in a mineralized zone. Higher radium 226 concentrations in the low permeability well MW-650 (ranging from 50 to 180 pCi/L) were predicted in column leach tests of the nearby backfill materials due to more mineralization in the area (Hydro-Engineering, 1993). Wells east of Walker/Jenkins, 1-SE and 2-NE, exhibit a decreasing trend

in radium during the most recent sampling period. This is likely due to clays in the low permeability backfill to which radium will rapidly adsorb. Also, up gradient, low radium Little Medicine Bow River water may also be contributing to low and decreasing radium levels.

Long-term uranium concentrations across the groundwater monitoring network suggest that concentrations are slightly declining from higher levels detected in 1992 through 1998. Current values are lower than historical peak concentrations, but values recorded in the most recent sampling period do not exhibit clear trends. Maximum background uranium concentrations in Wind River Formation wells are up to about 0.1 pCi/L in Sullivan 2. Backfill wells west of Walker/Jenkins Pit (3-NW and 4-SW) have uranium concentrations around background levels. East of the Pit in wells 1-SE and 2-NE, uranium levels have declined from peak concentrations recorded in 1992 (around 1.3 pCi/L) to around 0.8 to 1.0 pCi/L. The highest uranium concentrations in the backfill wells is in MW-650, with values around 7 to 10 pCi/L in samples gathered since 2011.

4.6.3 Reclamation Mine Pits and Surface Water

Surface water quality in the Shirley Basin is represented by five routinely monitored stations along the Little Medicine Bow River, one hillslope groundwater seep flowing into the River (designated SW-4), and the groundwater-fed Walker/Jenkins and Sullivan Pits. Water quality samples gathered in the Little Medicine Bow River and groundwater-fed pits during the period of record indicate good water quality. With the exception of gross alpha and pH, river and pit samples meet Class III livestock standards. The acidic groundwater seep (SW-4) has poor water quality and consistently exceeds livestock standards for sulfate, total dissolved solids, pH, aluminum, cadmium, gross alpha, and radium. However, because of the low discharge, the seep characteristics have little influence on the overall surface water quality.

River samples indicate slightly alkaline conditions with field measured pH generally in the range of 7.5 to 8.5 s.u. and some recorded values above the 8.5 s.u. standard. Gross alpha detection in river samples had regular exceedances of the 15 pCi/L standard, generally ranging from 10 to 20 pCi/L. Trace metals were detected near or below detection limits and major ions were detected at low concentrations. River water quality changes or trends were not observed over the most recent sampling timeframe nor from an upstream to downstream direction, including TDS, sulfate, pH, and gross alpha. Plots of data from river monitoring sites with low concentration constituents over time and no observed trends were deemed uninformative and are not included in this report.

In order to evaluate impacts on river water quality from the hillslope seep (SW-4), water quality samples were gathered from the seep, as well as from the river just upstream (SW-3) and downstream (SW-5) of the seep. Flow from the seep is not significant enough for measure or observation, rather the seep consists of a saturated area from the hillslope down to the river. Cattle hoof prints filled with seep water and a lack of vegetation characterize the area. In spring of 2015 the seep lacked sufficient standing water and a sample was not collected. Seep water quality is considered poor. Average values of select analytes exceeding livestock standards (in parentheses), based on six samples from 2011 to 2015, include: 7,250 mg/L sulfate (3,000); 9,700 mg/L TDS (5,000); 3.5 s.u. pH (6.5-8.5); 375 mg/L aluminum (5.0); 0.09 mg/L cadmium (0.05); 71 pCi/L gross alpha (15.0); and, 10.4 pCi/L radium 226 (5.0). Analyte concentrations over time had some variability and may suggest general increasing concentrations, but no clear trends have been observed.

Influence on river water quality from upstream to downstream of the seep was not observed in the compiled data.

Average gross alpha in the Walker/Jenkins Pit over seven samples since 2012 was 207 pCi/L and in the Sullivan Pit was 116 pCi/L, exceeding the livestock standard of 15 pCi/L. All other analytes met Class III livestock standards during the most recent sampling period.

Water quality from the Walker/Jenkins and Sullivan Pits, as well as groundwater monitoring wells, is graphically presented on **Figures 4.6-2** through **4.6-5**, displaying TDS, sulfate, dissolved radium 226, and dissolved uranium concentrations over time. Long term data analysis from the Pits suggests a decrease in water quality due to evaporative concentration effects on TDS and sulfate. TDS concentrations have been gradually increasing over time in both Pits. TDS in Walker/Jenkins has increased 1,124 mg/L since 1982, from 1,136 to 2,260 mg/L, a rate of 34 mg/L/yr. Similarly, TDS in the Sullivan Pit has increased 1,200 mg/L since 1981, from 1,196 to 2,400 mg/L, a rate of 35 mg/L/yr. This trend appears to continue through the most recent sampling, despite some variability seen in the more frequent sampling. Sulfate concentrations for the Pits show an overall pattern very similar to TDS because sulfate makes up a large percentage of the TDS. Sulfate concentrations have increased by approximately 22 to 24 mg/L/yr in both Pits. Current data and observations indicate that both Pits create a potentiometric sink, suggesting that the only turnover of water in the pits is from groundwater inflow to evaporative losses, resulting in continuation of current TDS and sulfate trends.

Radium and uranium concentrations in the Pits have decreased slightly in the long term, but have shown more consistent values during the more recent sampling than the high variability during reclamation. Chloride concentrations in the Walker/Jenkins Pit indicate a rising trend, though concentrations near 40 mg/L are well below the 2,000 mg/L Class III standard.

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Tables

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	P-1											P-3									
			1990	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/17/1990	9/11/1996	7/27/2007	10/4/2011	10/17/2012	5/28/2013	9/24/2013	6/20/2014	9/23/2014	6/8/2015	9/21/2015	9/12/1996	7/19/2007	10/5/2011	10/17/2012	5/28/2013	9/25/2013	6/18/2014	9/23/2014	6/8/2015	9/22/2015
MAJOR IONS (mg/L)																							
Hardness as CaCO3			523	670	794	750	753	729	703	723	733	693	713	684	857	719	705	657	649	616	611	597	619
Alkalinity, Total as CaCO3			NM	242	251	232	251	NM	NM	NM	NM	NM	NM	180	180	178	182	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		317	295	307	282	306	301	313	307	322	323	296	220	210	217	222	221	227	229	227	245	221
Calcium	1		157	216	252	241	242	231	232	227	234	223	226	217	317	263	254	235	235	217	218	211	218
Chloride	1	2,000	20.1	34.3	77.0	71.0	65.0	64.0	61.0	58.0	62.0	55.0	56.0	6.7	3.0	4.0	4.0	4.0	5.0	5.0	5.0	4.0	5.0
Fluoride	0.1	-	0.31	0.39	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.33	0.40	0.30	0.30	0.30	0.30	0.20	0.30	0.30	0.30
Magnesium	1		31.9	31.6	40.0	36.0	36.0	37.0	30.0	38.0	36.0	33.0	36.0	34.5	15.8	15.0	17.0	17.0	15.0	18.0	16.0	17.0	18.0
Nitrogen, Ammonia as N	0.05	-	0.20	0.09	0.08	0.08	0.11	0.08	0.07	ND	0.08	0.05	0.06	0.09	0.59	0.13	0.13	0.11	0.12	ND	0.08	0.07	0.09
Nitrite as N		10.0	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		22.0	19.7	21.8	22.0	22.0	22.0	21.0	23.0	22.0	21.0	21.0	15.3	14.0	13.0	14.0	13.0	12.0	13.0	13.0	13.0	12.0
Silica	0.2		NM	26.3	22.6	27.0	25.0	25.1	25.7	27.0	25.4	23.9	25.7	25.6	15.4	12.4	12.7	11.9	12.0	12.1	11.7	10.8	11.7
Sodium	1		158	144	129	138	136	143	117	153	145	135	135	35	22	20	23	24	21	23	22	22	24
Sulfate	2	3,000	620	665	737	779	715	740	711	728	745	707	716	659	717	622	526	496	541	473	466	447	483
PHYSICAL PROPERITES																							
Lab Conductivity @ 25°C (umho/cm)	5		1590	1630	1970	1880	1880	1830	1860	1900	1860	1880	1840	1400	1560	1310	1250	1170	1240	1170	1140	1140	1180
Lab pH (std units)	0.01	6.5-8.5	7.90	7.63	7.41	7.68	7.37	7.32	7.26	7.27	7.25	7.25	7.41	7.21	7.23	7.60	7.18	7.25	7.18	7.18	7.21	7.13	7.34
Total Dissolved Solids @ 180°C	20	5000	1216	1190	1410	1440	1520	1450	1420	1420	1460	1420	1430	1090	1230	1050	974	952	982	878	895	875	923
Field pH (std units)		6.5-8.5	NA	NA	6.98	7.77	7.05	7.07	6.92	6.77	6.80	7.02	6.93	NA	7.01	7.09	7.27	7.13	6.97	6.92	6.89	6.77	7.24
Field Conductivity (uS/cm)			NM	NM	NM	NM	1868	5620	2020	1859	1652	1839	1804	NM	NM	NM	1170	858	433	615	1148	425	1218
Field Temperature (°C)			NM	NM	NM	NM	9.4	9.7	12.2	12.5	12.1	14.0	13.1	NM	NM	NM	10.6	14.6	13.4	13.0	11.0	11.4	12.9
Depth to Water (ft)			NA	NA	NA	151.45	151.45	151.45	151.94	152.11	152.11	152.20	152.12	NA	NA	144.79	141.48	143.18	142.95	142.42	142.42	141.81	141.33
Total Depth (ft)			NM	NM	NM	168.00	168.00	168.00	168.00	168.00	168.00	168.00	168.00	NM	NM	182.19	182.19	182.19	182.19	182.19	182.19	182.19	182.19
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6663.00	6595.70	6595.70	6595.70	6595.70	6595.70	6595.70	6595.70	6595.70	6595.70	6595.70
WATER ELEVATION			***6515.00***	***NA***	***6511.50***	***6511.55***	***6511.55***	***6511.55***	***6511.06***	***6510.89***	***6510.89***	***6510.80***	***6510.88***	***6415.70***	***6446.30***	***6450.91***	***6454.22***	***6452.52***	***6452.75***	***6453.28***	***6453.28***	***6453.89***	***6454.37***
TRACE METALS (mg/L)																							
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0048	ND	0.0020	0.0020	0.0010	0.0010	0.0030	0.0020	0.0020	0.0020	0.0020	ND	0.0070	0.0040	0.0050	0.0040	0.0060	0.0040	0.0040	0.0040	0.0040
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.12	0.15	0.10	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND
Iron	0.03	-	ND	0.09	0.19	0.20	0.18	0.18	0.18	0.22	0.21	0.16	0.16	38.40	8.86	5.63	5.44	5.66	5.89	5.30	5.39	4.30	4.05
Lead	0.001	0.1	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.11	0.66	0.81	0.73	0.75	0.70	0.70	0.64	0.68	0.64	0.65	1.81	0.31	0.27	0.29	0.26	0.32	0.27	0.28	0.29	0.32
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	0.001	0.002	ND	0.001	ND	0.002	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		0.0050	ND	0.0012	ND	0.0008	ND	0.0007	0.0008	0.0028	0.0005	0.0004	2.0870	0.5590	0.6980	0.6380	0.6610	0.3850	0.8450	0.7180	0.6360	0.5760
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	0.02	0.01	0.02	0.04	0.04	0.04	0.05	0.10	0.02	0.05	0.24	0.01	0.02	0.04	0.14	0.06	0.20	0.02	0.16	0.03
TRACE METALS (mg/L) TOTALS																							
Iron	0.03		ND	0.09	0.19	0.20	0.18	0.21	0.22	0.82	0.55	1.91	0.35	38.40	8.86	5.63	5.44	5.70	6.97	4.86	5.24	5.30	4.56
Manganese	0.01		0.11	0.66	0.81	0.73	0.75	0.71	0.68	0.74	0.75	0.67	0.69	1.81	0.31	0.27	0.29	0.27	0.30	0.27	0.28	0.29	0.33
RADIOMETRICS (pCi/L) DISSOLVED																							
Gross Alpha		15	NM	NM	NM	NM	**21.7**	<10.6	**31.5**	**38.7**	**28.8**	**16.0**	**26.7**	NM	NM	NM	**563.0**	**731.0**	**356.0**	**742.0**	**546.0**	**651.0**	**495.0**
Gross Alpha precision (±)			NM	NM	NM	NM	5.2	6.5	5.2	6.7	4.8	6.8	7.4	NM	NM	NM	11.1	13.4	8.7	15.1	12.0	127.0	96.5
Gross Beta			NM	NM	NM	NM	NM	33.4	36.3	27.4	34.8	33.2	38.2	NM	NM	NM	NM	160.0	78.5	81.5	121.0	95.3	65.6
Gross Beta precision (±)			NM	NM	NM	NM	NM	8.7	6.7	8.1	4.2	7.4	5.8	NM	NM	NM	NM	4.8	4.0	5.0	4.9	10.1	7.3
Radium 226		5.0*	2.8	**49.0**	**6.2**	**6.2**	**6.9**	4.8	**5.1**	**5.0**	**6.7**	4.6	**5.5**	**5.3**	**9.9**	**6.8**	**8.0**	**8.6**	**7.1**	**8.0**	**8.5**	**7.6**	**9.4**
Radium 226 precision (±)			NM	NM	NM	0.5	0.6	0.4	0.4	0.4	0.5	0.9	1.1	NM	NM	0.5	0.6	0.6	0.5	0.6	0.5	1.5	1.8
Radium 228		5.0*	NM	NM	NM	NM	NM	**14.8**	**12.6**	**8.5**	**14.1**	**11.7**	**12.1**	NM	NM	NM	NM	**5.5**	4.5	3.1	**5.2**	**5.7**	4.3
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.5	1.3	0.9	1.6	2.3	2.6	NM	NM	NM	NM	1.5	1.0	0.9	0.9	1.4	1.3
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	**19.6**	**17.7**	**13.5**	**20.8**	**16.3**	**17.6**	NA	NA	NA	NA	**14.1**	**11.6**	**11.1**	**13.7**	**13.3**	**13.7**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	P-4											P-5									
			1990	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1990	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/18/1990	9/10/1996	7/24/2007	10/7/2011	10/18/2012	5/30/2013	9/25/2013	6/20/2014	9/24/2014	6/10/2015	9/23/2015	10/17/1990	7/27/2007	10/7/2011	10/19/2012	5/30/2013	9/25/2013	6/20/2014	9/24/2014	6/10/2015	9/23/2015
MAJOR IONS (mg/L)																							
Hardness as CaCO3			396	429	949	1347	1383	1382	1237	1430	1302	1243	1139	84	488	634	571	539	491	487	646	475	403
Alkalinity, Total as CaCO3			NM	232	333	397	488	NM	NM	NM	NM	NM	NM	NM	314	267	280	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		279	283	407	485	595	551	579	574	559	540	494	413	383	325	342	324	332	316	340	356	321
Calcium	1		126	138	301	432	445	438	398	449	411	394	354	25	142	196	176	168	152	149	209	144	120
Chloride	1	2,000	9.9	11.5	13.0	12.0	13.0	11.0	13.0	11.0	11.0	11.0	12.0	11.1	24.0	15.0	12.0	11.0	11.0	11.0	13.0	10.0	11.0
Fluoride	0.1	-	0.42	0.51	0.60	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	1.45	0.80	0.30	0.40	0.30	0.30	0.30	0.30	0.30	0.30
Magnesium	1		19.7	20.6	48.0	65.0	66.0	70.0	59.0	75.0	67.0	63.0	62.0	5.3	32.5	35.0	32.0	29.0	27.0	28.0	30.0	28.0	25.0
Nitrogen, Ammonia as N	0.05	-	ND	ND	0.16	0.07	0.15	0.07	0.08	ND	0.08	0.06	0.09	0.70	0.25	0.18	0.20	0.14	0.12	0.08	0.10	0.09	0.05
Nitrite as N		10.0	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.09	ND	0.10	ND	ND	ND	ND	ND	ND	0.10
Potassium	1		11.0	10.4	15.1	19.0	21.0	20.0	18.0	20.0	19.0	19.0	18.0	14.0	17.8	18.0	19.0	17.0	16.0	17.0	17.0	17.0	15.0
Silica	0.2		NM	11.8	12.9	13.3	15.1	14.5	13.6	14.2	13.4	12.9	12.4	NM	11.9	12.2	22.3	11.2	10.8	11.9	11.6	12.3	11.3
Sodium	1		142	174	222	243	313	315	283	291	305	300	315	335	389	209	225	206	213	219	190	236	275
Sulfate	2	3,000	460	617	1060	1490	1520	1550	1510	1580	1460	1430	1570	450	948	809	717	683	687	699	757	692	699
PHYSICAL PROPERITES																							
Lab Conductivity @ 25°C (umho/cm)	5		1180	1380	2440	2970	3170	3030	3140	3150	3090	3010	2890	1450	2430	1910	1840	1700	1740	1750	1820	1760	1850
Lab pH (std units)	0.01	6.5-8.5	7.79	7.65	7.21	7.71	7.15	7.06	7.13	7.01	7.00	7.06	7.32	**8.59**	7.82	7.78	7.47	7.62	7.50	7.38	7.39	7.28	7.59
Total Dissolved Solids @ 180°C	20	5000	897	946	1990	2590	2780	2770	2690	2710	2690	2570	2440	1096	1680	1420	1390	1300	1290	1280	1410	1310	1360
Field pH (std units)		6.5-8.5	NA	NA	7.02	6.92	6.70	6.87	6.78	6.89	6.99	7.04	7.08	NA	7.37	7.57	7.40	6.58	7.03	7.53	7.25	7.20	7.36
Field Conductivity (uS/cm)			NM	NM	NM	NM	3140	3140	3270	3160	3060	3140	2850	NM	NM	NM	1730	1748	1843	1757	1843	1821	1832
Field Temperature (°C)			NM	NM	NM	NM	9.6	10.6	11.2	10.1	11.3	11.5	11.3	NM	NM	NM	10.4	9.6	10.8	9.8	10.6	10.3	10.0
Depth to Water (ft)			NA	NA	NA	47.61	75.60	74.50	74.53	73.49	73.81	73.75	73.34	NA	NA	73.05	72.42	71.70	71.73	71.31	70.82	70.22	69.99
Total Depth (ft)			NM	NM	NM	261.93	261.93	261.93	261.93	261.93	261.93	261.93	261.93	NM	NM	201.35	201.35	201.35	201.35	201.35	201.35	201.35	201.35
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6475.70	6520.70	6520.70	6520.70	6520.70	6520.70	6520.70	6520.70	6520.70	6520.70	6520.70
WATER ELEVATION			***6437.10***	***NA***	***6398.60***	***6428.09***	***6400.10***	***6401.20***	***6401.17***	***6402.21***	***6401.89***	***6401.95***	***6402.36***	***6428.30***	***6443.20***	***6447.65***	***6448.28***	***6449.00***	***6448.97***	***6449.39***	***6449.88***	***6450.48***	***6450.71***
TRACE METALS (mg/L)																							
Aluminum	0.1	5.0	ND	ND	0.70	0.10	ND	ND	ND	ND	ND	ND	ND	0.24	0.90	2.00	2.00	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0014	ND	0.0030	0.0010	ND	ND	0.0030	ND	ND	ND	ND	0.0090	0.0030	0.0040	0.0050	ND	0.0020	0.0010	ND	0.0010	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.21	0.22	0.20	0.03	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.48	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	0.01	ND	ND	ND	ND	ND	ND	0.02	ND	NM	ND	ND	0.01	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.04	ND	3.85	0.28	0.19	0.10	0.16	ND	0.39	0.07	0.10	0.05	1.41	1.90	3.33	ND	ND	ND	ND	ND	0.03
Lead	0.001	0.1	ND	ND	0.023	0.001	ND	ND	ND	ND	ND	0.001	ND	0.070	ND	0.009	0.022	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.32	0.33	0.53	0.31	0.31	0.28	0.28	0.18	0.43	0.29	0.45	0.01	0.19	0.34	0.27	0.19	0.14	0.12	0.18	0.11	0.08
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	0.004	ND	ND	ND	ND	0.001	ND	0.002	ND	ND	0.001	ND	ND	ND	ND	0.001	ND	ND	ND
Uranium	0.0003		0.0110	0.1070	0.2730	0.1860	0.1960	0.1660	0.1590	0.1490	0.1260	0.1370	0.0944	0.0200	0.9330	1.4400	1.1600	0.9250	0.9260	0.8780	1.0100	0.7320	0.8390
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.07	0.20	0.09	0.02	0.03	0.03	0.02	0.04	0.02	0.18	0.03	0.06	0.04	0.09	0.06	0.01	0.01	0.01	ND	0.04	0.02
TRACE METALS (mg/L) TOTALS																							
Iron	0.03		0.04	ND	3.85	0.28	0.19	0.15	8.57	1.33	2.97	0.79	2.01	0.05	1.41	1.90	3.33	2.55	3.86	1.95	2.54	1.23	2.28
Manganese	0.01		0.32	0.33	0.53	0.31	0.31	0.25	2.00	0.72	1.21	0.74	0.78	0.01	0.19	0.34	0.27	0.22	0.21	0.16	0.26	0.16	0.13
RADIOMETRICS (pCi/L) DISSOLVED																							
Gross Alpha		15	NM	NM	NM	NM	**125.0**	**145.0**	**140.0**	**128.0**	**96.3**	**87.3**	**46.6**	NM	NM	NM	**927.0**	**745.0**	**796.0**	**584.0**	**719.0**	**511.0**	**520.0**
Gross Alpha precision (±)			NM	NM	NM	NM	9.4	10.6	10.9	11.6	10.5	21.4	12.7	NM	NM	NM	16.8	15.0	15.4	15.3	16.3	100.0	102.0
Gross Beta			NM	NM	NM	NM	NM	38.7	20.8	35.9	23.8	29.7	21.8	NM	NM	NM	NM	135.0	75.3	75.9	90.9	82.7	79.7
Gross Beta precision (±)			NM	NM	NM	NM	NM	7.6	7.3	7.8	8.3	6.9	7.2	NM	NM	NM	NM	6.0	5.1	5.3	6.3	9.2	8.9
Radium 226		5.0*	0.5	8.0	4.2	1.5	0.9	0.8	1.0	1.1	1.5	1.0	1.2	0.3	0.6	0.9	1.2	1.6	0.9	0.8	1.2	0.8	0.9
Radium 226 precision (±)			NM	NM	NM	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	NM	NM	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2
Radium 228		5.0*	NM	NM	NM	NM	NM	<1.7	<1.6	<1.1	3.5	1.3	3.3	NM	NM	NM	NM	<1.8	<1.6	<1.1	2.6	1.8	2.7
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.1	1.0	0.7	1.3	0.8	1.0	NM	NM	NM	NM	1.1	1.0	0.7	1.1	0.9	0.9
Combined Radium 226 & Radium 228		5.0*		NA	NA	NA	NA	NA	NA	NA	5.0	2.3	4.5	NA	NA	NA	NA	NA	NA	NA	3.8	2.6	3.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	P-6										DL-2										
			1990	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1990	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/18/1990	7/27/2007	10/6/2011	10/19/2012	5/30/2013	9/25/2013	6/20/2014	9/24/2014	6/10/2015	9/23/2015	10/16/1990	9/11/1996	7/27/2007	10/4/2011	10/17/2012	5/28/2013	9/23/2013	6/19/2014	9/23/2014	7/8/2015	9/22/2015
MAJOR IONS (mg/L)																							
Hardness as CaCO3			118	718	108	127	131	140	145	157	176	168	481	587	736	672	649	642	644	638	620	612	610
Alkalinity, Total as CaCO3			NM	421	218	231	NM	NM	NM	NM	NM	NM	NM	246	27	25	24	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	26.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		333	460	266	282	277	272	261	252	272	236	35	301	32	30	29	19	26	27	25	28	28
Calcium	1		33	179	30	36	36	38	40	43	49	46	150	182	217	203	199	196	200	193	189	189	185
Chloride	1	2,000	12.3	47.0	9.0	10.0	12.0	13.0	14.0	16.0	15.0	16.0	19.3	34.3	25.0	27.0	27.0	27.0	28.0	29.0	29.0	29.0	28.0
Fluoride	0.1	-	0.46	1.30	0.60	0.60	0.60	0.60	0.60	0.50	0.60	0.60	3.90	2.73	2.70	2.30	2.20	2.00	2.10	2.10	1.90	2.00	1.90
Magnesium	1		8.7	66.0	8.0	9.0	10.0	11.0	11.0	12.0	13.0	13.0	25.9	32.1	47.3	40.0	37.0	37.0	35.0	38.0	36.0	34.0	36.0
Nitrogen, Ammonia as N	0.05	-	ND	0.29	0.06	0.08	0.08	ND	ND	ND	ND	ND	0.20	ND	0.15	0.13	0.16	0.11	0.11	0.08	0.13	0.09	0.10
Nitrite as N		10.0	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND	ND	0.20	ND
Potassium	1		19.0	56.3	17.0	19.0	18.0	18.0	20.0	19.0	20.0	19.0	32.0	19.7	35.6	36.0	36.0	37.0	37.0	37.0	37.0	35.0	37.0
Silica	0.2		NM	264.0	31.5	30.7	29.8	29.1	31.5	29.6	30.0	30.1	NM	26.3	23.0	20.6	5.0	5.6	5.8	5.5	5.6	5.3	5.8
Sodium	1		207	228	205	213	216	221	244	232	237	243	137	142	197	234	224	226	206	232	217	193	212
Sulfate	2	3,000	296	218	323	346	409	407	435	461	456	486	708	665	1060	1140	1080	1040	1040	1070	1030	1050	1010
PHYSICAL PROPERITES																							
Lab Conductivity @ 25°C (umho/cm)	5		1081	1290	1120	1160	1210	1280	1340	1360	1370	1400	1470	1560	2190	2180	2150	2050	2080	2120	2040	2080	2050
Lab pH (std units)	0.01	6.5-8.5	8.03	**8.61**	8.23	8.01	8.02	7.95	7.88	7.71	7.75	7.87	7.75	7.57	8.41	**8.72**	**8.72**	7.66	7.90	8.35	7.66	7.55	7.91
Total Dissolved Solids @ 180°C	20	5000	761	876	752	794	836	861	898	943	934	974	1102	1180	1650	1730	1720	1700	1650	1630	1630	1620	1620
Field pH (std units)		6.5-8.5	NA	7.59	8.33	7.94	6.91	7.43	7.57	7.49	7.66	7.35	NA	NA	**8.66**	**8.83**	**9.25**	8.31	8.12	8.41	7.08	6.84	7.87
Field Conductivity (uS/cm)			NM	NM	NM	1120	1227	1226	1319	1334	1340	1378	NM	NM	NM	NM	2300	1763	1056	1510	1841	1164	2020
Field Temperature (°C)			NM	NM	NM	10.2	10.2	11.2	11.2	10.8	10.0	9.3	NM	NM	NM	NM	9.7	11.3	13.5	15.3	13.8	13.7	13.0
Depth to Water (ft)			NA	NA	56.53	57.20	58.00	59.33	59.67	60.50	59.19	60.89	NA	NA	NA	69.72	68.72	68.42	68.57	68.21	68.82	67.60	67.18
Total Depth (ft)			NM	NM	160.95	160.95	160.95	160.95	160.95	160.95	160.95	160.95	NM	NM	NM	103.82	103.82	103.82	103.82	103.82	103.82	103.82	103.82
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6579.90	6579.90	6579.90	6579.90	6579.90	6579.90	6579.90	6579.90	6579.90	6579.90	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00	6527.00
WATER ELEVATION			***6525.40***	***6523.00***	***6523.37***	***6522.70***	***6521.90***	***6520.57***	***6520.23***	***6519.40***	***6520.71***	***6519.01***	***6436.10***	***NA***	***6461.50***	***6457.28***	***6458.28***	***6458.58***	***6458.43***	***6458.79***	***6458.18***	***6459.40***	***6459.82***
TRACE METALS (mg/L)																							
Aluminum	0.1	5.0	0.10	**74.60**	0.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.70	3.30	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0097	0.0300	0.0040	0.0030	0.0020	0.0030	0.0020	0.0020	0.0020	0.0020	0.0165	ND	0.0100	0.0070	0.0060	0.0060	0.0070	0.0060	0.0060	0.0050	0.0060
Barium	0.1	-	ND	1.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.53	0.60	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.11	0.10	0.10	0.20	ND	0.20	ND	ND	ND	ND	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND	ND	ND	0.005	0.005
Chromium	0.05	0.05	ND	**0.120**	ND	ND	ND	ND	ND	ND	ND	ND	0.031	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	NM	0.18	ND	ND	ND	ND	ND	ND	0.01	ND	NM	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.03	51.30	0.44	ND	ND	ND	ND	ND	ND	0.03	0.04	0.09	4.17	2.18	0.04	ND	ND	ND	ND	0.03	ND
Lead	0.001	0.1	ND	**0.210**	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.10	1.12	0.08	0.07	0.07	0.07	0.07	0.08	0.09	0.08	0.10	0.66	0.08	0.05	0.04	0.04	0.04	0.03	0.04	0.03	0.04
Mercury	0.001	0.00005	**0.001**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.90	ND	7.60	10.50	9.00	8.00	8.20	8.80	7.40	6.90	7.30
Nickel	0.05	-	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	0.004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	0.002	ND	ND	0.002	ND	0.001	0.001
Uranium	0.0003		ND	0.0693	0.0014	0.0010	0.0022	0.0027	0.0032	0.0027	0.0009	0.0030	0.0510	0.0044	0.0291	0.0114	0.0053	0.0041	0.0038	0.0052	0.0029	0.0030	0.0037
Vanadium	0.1	0.1	NM	0.1	ND	ND	ND	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	1.07	0.04	ND	0.01	ND	ND	ND	0.37	0.01	0.02	0.02	0.03	0.02	ND	0.07	0.01	0.04	0.01	0.02	ND
TRACE METALS (mg/L) TOTALS																							
Iron	0.03		0.03	51.30	0.44	ND	0.92	2.04	2.09	0.88	0.71	0.64	0.04	0.09	4.17	2.18	0.04	1.30	1.00	2.06	3.53	2.41	1.20
Manganese	0.01		0.10	1.12	0.08	0.07	0.08	0.10	0.10	0.11	0.09	0.09	0.10	0.66	0.08	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.04
RADIOMETRICS (pCi/L) DISSOLVED																							
Gross Alpha		15	NM	NM	NM	6.2	4.0	9.6	7.7	<4.2	7.5	8.1	NM	NM	NM	NM	14.3	**26.4**	**23.2**	**32.6**	**25.4**	**19.5**	**30.0**
Gross Alpha precision (±)			NM	NM	NM	2.1	2.0	2.4	2.6	2.6	3.5	4.5	NM	NM	NM	NM	3.8	4.8	3.6	5.6	4.9	7.7	8.1
Gross Beta			NM	NM	NM	NM	16.0	15.3	20.4	16.4	15.1	19.6	NM	NM	NM	NM	NM	50.5	46.5	49.5	54.3	43.3	45.7
Gross Beta precision (±)			NM	NM	NM	NM	2.5	2.6	2.8	3.1	3.5	3.9	NM	NM	NM	NM	NM	4.3	4.9	5.2	5.8	6.8	6.8
Radium 226		5.0*	0.4	3.9	1.3	1.5	1.1	0.8	1.0	1.4	1.2	**13.0**	4.2	**6.6**	**8.5**	**6.9**	**6.2**	**5.7**	4.9	**5.5**	**5.5**	5.0	4.8
Radium 226 precision (±)			NM	NM	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.4	NM	NM	NM	0.5	0.5	0.5	0.4	7.1	0.4	1.0	1.0
Radium 228		5.0*	NM	NM	NM	NM	<1.9	<1.8	1.4	<2.1	2.8	3.1	NM	NM	NM	NM	NM	**13.2**	**7.1**	**6.8**	**12.6**	**8.2**	**8.4**
Radium 228 precision (±)			NM	NM	NM	NM	1.2	1.1	0.7	1.3	1.0	0.9	NM	NM	NM	NM	NM	1.7	1.1	0.8	2.0	1.8	1.7
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	2.4	NA	4.0	**16.1**	NA	NA	NA	NA	NA	**18.9**	**12.0**	**12.3**	**18.1**	**13.2**	**13.2**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	DL-5											DL-6										
			1991	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1991	1996	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/13/1991	9/11/1996	7/19/2007	10/4/2011	10/17/2012	5/29/2013	9/24/2013	6/19/2014	9/23/2014	6/9/2015	9/22/2015	11/13/1991	9/12/1996	7/20/2007	10/5/2011	10/17/2012	5/28/2013	9/23/2013	6/19/2014	9/23/2014	6/8/2015	9/22/2015
MAJOR IONS (mg/L)																								
Hardness as CaCO3			1206	1445	1269	1147	1178	1129	1135	1103	1095	1086	1046	334	374	312	290	291	293	282	295	293	295	276
Alkalinity, Total as CaCO3			316	303	220	217	247	NM	NM	NM	NM	NM	NM	206	225	200	220	222	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14.00	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		386	370	270	265	301	305	306	307	290	319	272	251	275	250	240	271	278	288	284	275	297	260
Calcium	1		366	444	392	357	371	353	354	341	343	341	328	98	110	91	85	87	86	85	85	86	87	81
Chloride	1	2,000	26.7	22.5	16.0	16.0	14.0	14.0	14.0	14.0	14.0	13.0	13.0	11.1	4.4	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Fluoride	0.1	-	0.23	0.21	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.55	0.38	0.40	0.40	0.40	0.40	0.40	0.30	0.30	0.40	0.30
Magnesium	1		70.9	81.6	70.5	62.0	61.0	60.0	61.0	61.0	58.0	57.0	55.0	21.4	24.1	20.9	19.0	18.0	19.0	17.0	20.0	19.0	19.0	18.0
Nitrogen, Ammonia as N	0.05	-	0.26	0.22	0.27	0.16	0.18	0.18	ND	0.11	0.13	0.13	0.13	0.12	0.09	0.12	0.06	0.10	0.09	0.07	ND	0.06	0.05	0.07
Nitrite as N		10.0	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	NM	NM	ND	ND	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		26.1	25.3	23.1	21.0	22.0	22.0	22.0	22.0	21.0	22.0	21.0	21.5	17.1	15.9	15.0	16.0	16.0	16.0	17.0	16.0	16.0	15.0
Silica	0.2		20.3	24.5	21.4	21.3	22.7	21.4	21.2	21.8	21.4	21.3	21.5	15.7	19.3	21.2	20.7	19.6	19.2	19.9	20.5	19.2	17.6	18.9
Sodium	1		143	114	112	104	104	106	107	107	106	110	108	84	47	49	46	48	50	46	50	50	50	48
Sulfate	2	3,000	1128	1354	1280	1200	1120	1080	1120	1090	1070	1030	993	356	253	196	189	187	193	192	197	196	186	189
PHYSICAL PROPERITES																								
Lab Conductivity @ 25°C (umho/cm)	5		2703	2840	2600	2260	2250	2180	2230	2250	2160	2190	2130	1164	873	782	755	767	754	765	796	778	780	764
Lab pH (std units)	0.01	6.5-8.5	7.21	7.27	6.70	7.37	6.86	6.84	6.90	6.86	6.80	6.86	7.02	7.90	7.93	7.59	7.90	7.68	7.64	7.56	7.52	7.50	7.49	7.75
Total Dissolved Solids @ 180°C	20	5000	2094	2260	2160	1940	1960	1970	1920	1900	1880	1830	1840	682	527	488	482	520	524	504	519	526	513	516
Field pH (std units)		6.5-8.5	NA	NA	6.73	6.79	6.98	6.78	6.82	6.62	6.63	6.77	6.79	NA	NA	7.24	7.35	7.40	7.47	7.26	7.40	7.28	7.01	7.52
Field Conductivity (uS/cm)			NM	NM	NM	NM	1169	1281	2530	2230	2190	2180	2130	NM	NM	NM	NM	749	637	382	561	504	466	779
Field Temperature (°C)			NM	NM	NM	NM	10.0	10.8	12.6	11.9	12.0	12.2	12.6	NM	NM	NM	NM	8.1	10.4	10.9	13.7	11.0	10.6	12.7
Depth to Water (ft)			NA	NA	NA	104.54	104.04	103.34	103.25	102.95	102.58	102.08	101.82	NA	NA	NA	174.78	174.00	173.82	173.40	172.91	172.82	172.81	171.95
Total Depth (ft)			NM	NM	NM	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	NM	NM	NM	238.30	238.30	238.30	238.30	283.30	238.30	238.30	238.30
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6550.10	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50	6626.50
WATER ELEVATION			***6420.20***	***NA***	***6441.50***	***6445.56***	***6446.06***	***6446.76***	***6446.85***	***6447.15***	***6447.52***	***6448.02***	***6448.28***	***6416.70***	***NA***	***6446.80***	***6451.72***	***6452.50***	***6452.68***	***6453.10***	***6453.59***	***6453.68***	***6453.69***	***6454.55***
TRACE METALS (mg/L)																								
Aluminum	0.1	5.0	ND	ND	1.00	0.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.90	0.40	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0380	0.0380	**0.3370**	0.0810	0.0830	0.0740	0.0790	0.0800	0.0800	0.0870	0.0810	ND	ND	0.0010	ND	ND	ND	0.0010	ND	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.25	0.25	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.17	0.17	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	1.06	19.90	57.80	35.00	33.00	33.30	28.00	30.30	29.30	25.20	25.00	0.07	0.60	1.44	0.90	0.32	0.43	0.40	0.49	0.48	0.44	0.49
Lead	0.001	0.1	ND	ND	0.002	ND	ND	0.002	ND	0.001	ND	ND	ND	ND	ND	0.005	0.002	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.77	0.61	1.03	0.84	0.94	0.08	0.80	0.74	0.76	0.61	0.67	0.24	0.24	0.09	0.07	0.06	0.06	0.06	0.06	0.06	0.05	0.06
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		0.69	ND	1.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	0.001	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		0.5970	0.0610	0.1120	0.0565	0.0595	0.0424	0.0451	0.0448	0.0414	0.0526	0.0446	0.0100	0.0068	0.0061	0.0034	0.0019	0.0018	0.0019	0.0018	0.0016	0.0021	0.0042
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.01	0.04	0.16	0.02	0.04	0.05	0.04	0.05	0.05	0.04	0.04	ND	0.02	0.01	0.01	0.02	0.04	0.02	0.03	0.02	0.03	0.04
TRACE METALS (mg/L) TOTALS																								
Iron	0.03		1.06	19.90	57.80	35.00	33.00	33.90	33.40	32.40	29.70	29.40	26.00	0.07	0.60	1.44	0.90	0.32	0.65	0.64	1.01	0.62	1.14	0.81
Manganese	0.01		0.77	0.61	1.03	0.84	0.94	0.82	0.79	0.82	0.78	0.71	0.66	0.24	0.24	0.09	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.06
RADIOMETRICS (pCi/L) DISSOLVED																								
Gross Alpha		15	NM	NM	NM	NM	**377.0**	**309.0**	**382.0**	**318.0**	**413.0**	**234.0**	**335.0**	NM	NM	NM	NM	11.6	**15.8**	12.3	**22.9**	14.5	11.4	11.8
Gross Alpha precision (±)			NM	NM	NM	NM	13.0	12.6	13.9	14.7	15.3	47.5	66.9	NM	NM	NM	NM	1.8	2.1	1.9	2.7	2.2	3.3	2.9
Gross Beta			NM	NM	NM	NM	NM	81.1	116.0	94.6	133.0	78.5	94.3	NM	NM	NM	NM	NM	22.9	21.4	24.0	21.0	18.7	20.3
Gross Beta precision (±)			NM	NM	NM	NM	NM	6.6	7.0	7.6	7.8	10.1	11.3	NM	NM	NM	NM	NM	1.8	2.0	2.3	2.1	2.9	3.2
Radium 226		5.0*	**90.0**	**96.3**	**102.0**	**78.0**	**101.0**	**100.0**	**99.0**	**103.0**	**91.0**	**98.0**	**94.0**	4.7	**5.0**	**7.5**	**7.4**	**6.4**	**6.4**	**5.7**	**6.3**	**7.3**	**6.1**	**6.3**
Radium 226 precision (±)			NM	NM	NM	1.7	2.0	1.8	1.9	1.9	1.7	18.0	18.0	NM	NM	NM	NM	0.5	0.5	0.5	0.5	0.6	1.2	1.3
Radium 228		5.0*	NM	NM	NM	NM	NM	**22.9**	**17.0**	**11.2**	**12.6**	**12.0**	**14.1**	NM	NM	NM	NM	NM	**7.9**	**5.3**	4.6	**6.7**	4.7	3.7
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.9	1.6	1.0	1.1	2.3	2.7	NM	NM	NM	NM	NM	1.6	1.0	0.8	1.4	1.2	1.2
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	**122.9**	**116.0**	**114.2**	**103.6**	**110.0**	**108.1**	NA	NA	NA	NA	NA	**14.3**	**11.0**	**10.9**	**14.0**	**10.8**	**10.0**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	DL-8									DL-9								
			2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			7/25/2007	10/4/2011	10/17/2012	5/29/2013	9/24/2013	6/19/2014	9/23/2014	6/8/2015	9/21/2015	7/25/2007	10/7/2011	10/18/2012	5/29/2013	9/23/2013	6/19/2014	9/23/2014	6/9/2015	9/22/2015
MAJOR IONS (mg/L)																				
Hardness as CaCO3			291	281	289	293	293	290	289	291	286	818	1427	1553	1625	1640	1637	1659	1416	1527
Alkalinity, Total as CaCO3			244	233	261	NM	NM	NM	NM	NM	NM	237	270	301	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		298	284	318	304	313	307	319	324	328	289	330	367	368	394	393	404	376	341
Calcium	1		81	83	86	86	86	85	86	87	85	262	456	495	522	543	522	534	445	491
Chloride	1	2,000	7.0	6.0	6.0	6.0	7.0	6.0	7.0	6.0	6.0	16.0	12.0	13.0	13.0	13.0	12.0	12.0	11.0	11.0
Fluoride	0.1	-	0.70	0.50	0.60	0.50	0.60	0.50	0.50	0.50	0.50	0.60	0.30	0.30	0.20	0.20	0.20	0.20	0.20	0.20
Magnesium	1		21.8	18.0	18.0	19.0	19.0	19.0	18.0	18.0	18.0	39.7	70.0	77.0	78.0	69.0	81.0	79.0	74.0	73.0
Nitrogen, Ammonia as N	0.05	-	0.06	0.06	0.07	ND	0.06	ND	ND	ND	ND	0.14	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.60	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		16.7	16.0	16.0	16.0	16.0	17.0	16.0	17.0	16.0	18.4	24.0	26.0	24.0	25.0	23.0	23.0	24.0	23.0
Silica	0.2		20.9	24.7	23.3	23.6	23.2	24.2	23.7	23.6	23.6	15.0	19.6	23.6	21.2	21.3	23.5	22.6	21.5	21.7
Sodium	1		145	130	124	133	132	134	129	131	127	152	143	145	150	130	146	142	139	142
Sulfate	2	3,000	344	343	322	321	327	326	329	321	318	840	1420	1600	1610	1600	1680	1650	1550	1570
PHYSICAL PROPERITES																				
Lab Conductivity @ 25°C (umho/cm)	5		1130	1080	1090	1080	1090	1110	1080	1110	1090	1890	2620	2910	2870	2940	2960	2920	2770	2770
Lab pH (std units)	0.01	6.5-8.5	7.66	7.85	7.60	7.58	7.53	7.49	7.57	7.44	7.69	7.55	7.71	7.26	6.72	6.58	**6.49**	**6.47**	6.51	6.69
Total Dissolved Solids @ 180°C	20	5000	760	749	761	758	752	748	763	751	758	1450	2360	2690	2730	2700	2700	2760	2590	2580
Field pH (std units)		6.5-8.5	7.32	7.22	7.37	7.25	7.08	6.98	7.33	7.18	7.16	7.21	6.77	6.62	**6.25**	**6.33**	**6.21**	**6.22**	**6.27**	**6.33**
Field Conductivity (uS/cm)			NM	NM	1069	1102	1166	1089	1077	1085	1071	NM	NM	2900	2900	3300	2920	2930	2780	2730
Field Temperature (°C)			NM	NM	9.9	10.6	11.4	11.4	11.4	11.4	11.5	NM	NM	10.9	11.2	11.0	10.8	10.5	14.3	14.2
Depth to Water (ft)			NA	235.02	235.13	234.78	235.39	234.71	234.55	233.95	233.96	NA	36.27	32.69	32.63	32.73	30.85	31.10	33.57	30.56
Total Depth (ft)			NM	308.00	308.00	308.00	308.00	308.00	308.00	308.00	308.00	NM	50.85	50.85	50.85	50.85	50.85	50.85	50.85	50.85
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6704.50	6704.50	6704.50	6704.50	6704.50	6704.50	6704.50	6704.50	6704.50	6474.70	6474.70	6474.70	6474.70	6474.70	6474.70	6474.70	6474.70	6474.70
WATER ELEVATION			***6464.60***	***6469.48***	***6469.37***	***6469.72***	***6469.11***	***6469.79***	***6469.95***	***6470.55***	***6470.54***	***6437.60***	***6438.43***	***6442.01***	***6442.07***	***6441.97***	***6443.85***	***6443.60***	***6441.13***	***6444.14***
TRACE METALS (mg/L)																				
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.80	0.40	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0080	0.0010	ND	ND	0.0010	0.0010	ND	0.0010	0.0010	0.0030	0.0010	0.0030	0.0050	0.0060	0.0050	0.0050	0.0040	0.0040
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.10	0.10	ND	0.10	0.10	0.10	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	ND	ND	0.01	ND	ND	ND	ND
Iron	0.03	-	0.04	ND	0.04	0.04	ND	ND	ND	0.04	ND	0.68	0.72	0.78	1.05	0.95	1.17	1.23	0.94	1.23
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	0.005	ND	ND	ND	ND	ND	0.004	ND
Manganese	0.01	-	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.06	0.49	0.25	0.43	0.50	0.81	1.23	1.56	1.13	1.26
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22	0.20	0.17	0.17	0.16	0.17	0.15	0.14
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.002	0.004	0.002	0.002	0.003	ND	0.008	0.003
Uranium	0.0003		0.0055	0.0006	0.0006	0.0006	0.0006	0.0005	0.0006	0.0005	0.0005	1.2300	0.8940	0.9570	0.8530	0.9190	0.6990	0.7970	0.8270	0.7780
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.04	0.01	0.06	0.11	0.03	0.03	0.01	0.05
TRACE METALS (mg/L) TOTALS																				
Iron	0.03		0.04	ND	0.04	0.06	0.13	0.07	0.07	0.47	0.06	0.68	0.72	0.78	1.36	4.19	1.71	1.78	1.52	3.62
Manganese	0.01		0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.49	0.25	0.43	0.52	0.83	1.37	1.57	1.17	1.26
RADIOMETRICS (pCi/L) DISSOLVED																				
Gross Alpha		15	NM	NM	**15.4**	14.1	**29.7**	**24.8**	**16.0**	**18.5**	**27.0**	NM	NM	**749.0**	**665.0**	**676.0**	**610.0**	**610.0**	**501.0**	**542.0**
Gross Alpha precision (±)			NM	NM	2.5	2.4	3.0	3.2	2.7	5.0	10.7	NM	NM	20.3	20.3	20.4	22.8	21.5	99.6	108.0
Gross Beta			NM	NM	NM	26.0	30.6	31.7	26.7	27.8	26.6	NM	NM	NM	146.0	83.9	76.6	137.0	92.2	92.9
Gross Beta precision (±)			NM	NM	NM	2.5	2.7	2.8	26.7	3.9	11.2	NM	NM	NM	9.7	8.7	10.6	10.2	11.3	11.4
Radium 226		5.0*	9.7	4.3	4.3	4.0	4.2	3.5	3.1	3.8	4.6	4.0	4.3	4.9	4.4	4.5	3.6	3.9	4.5	**6.5**
Radium 226 precision (±)			NM	NM	0.5	0.4	0.4	0.4	0.3	0.8	1.0	NM	0.4	0.5	0.4	0.4	0.4	0.4	0.9	1.3
Radium 228		5.0*	NM	NM	NM	**13.3**	**9.9**	**9.2**	**9.8**	**10.6**	**10.2**	NM	NM	NM	2.8	3.8	2.1	3.2	3.5	**6.0**
Radium 228 precision (±)			NM	NM	NM	1.7	1.4	0.9	1.0	2.1	2.3	NM	NM	NM	1.2	1.0	0.7	0.8	1.0	1.4
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	**17.3**	**14.1**	**12.7**	**12.9**	**14.4**	**14.8**	NA	NA	NA	**7.2**	**8.3**	**5.7**	**7.1**	**8.0**	**12.5**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	DL-10					DL-11					
			2007	2011	2012	Spring 2013	Fall 2013	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			7/24/2007	10/5/2011	10/17/2012	5/29/2013	9/25/2013	5/28/2013	9/25/2013	6/18/2014	9/23/2014	6/9/2015	9/22/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			1572	1663	1701	1702	1691	680	664	680	660	642	640
Alkalinity, Total as CaCO3			139	313	324	NM	NM	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		170	382	395	397	429	282	293	289	287	311	279
Calcium	1		483	534	546	543	545	218	218	218	213	214	205
Chloride	1	2,000	28.0	37.0	38.0	35.0	36.0	9.0	9.0	10.0	10.0	9.0	9.0
Fluoride	0.1	-	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Magnesium	1		88.8	80.0	82.0	84.0	80.0	33.0	29.0	33.0	31.0	26.0	31.0
Nitrogen, Ammonia as N	0.05	-	1.59	0.14	0.26	0.15	0.16	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		36.4	54.0	58.0	58.0	58.0	13.0	12.0	12.0	12.0	12.0	12.0
Silica	0.2		27.5	14.0	15.4	15.2	15.3	23.4	24.2	24.5	23.7	23.4	23.2
Sodium	1		202	272	271	288	264	74	61	67	67	52	68
Sulfate	2	3,000	2060	1970	1940	1920	1940	570	569	570	557	549	561
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		3580	3490	3460	3470	3510	1380	1390	1420	1380	1380	1400
Lab pH (std units)	0.01	6.5-8.5	**5.97**	7.38	6.89	6.85	6.86	7.55	7.36	7.31	7.35	7.27	7.54
Total Dissolved Solids @ 180°C	20	5000	3360	3130	3210	3210	3340	1100	1090	1080	1090	1080	1100
Field pH (std units)		6.5-8.5	**5.75**	6.70	6.62	6.67	6.88	7.24	7.09	7.09	6.91	7.14	7.28
Field Conductivity (uS/cm)			NM	NM	3630	1831	1805	1097	485	625	1187	587	1392
Field Temperature (°C)			NM	NM	10.8	10.6	12.1	11.3	9.9	10.5	11.8	11.0	11.8
Depth to Water (ft)			NA	12.62	11.90	11.71	10.60	135.82	135.68	135.25	135.08	134.50	134.30
Total Depth (ft)			NM	120.02	120.02	120.02	119.02	223.00	223.00	223.00	223.00	223.00	223.00
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6464.00	6464.00	6464.00	6464.00	6464.00	6587.76	6587.76	6587.76	6587.76	6587.76	6587.76
WATER ELEVATION			***6445.60***	***6451.38***	***6452.10***	***6452.29***	***6453.40***	***6451.94***	***6452.08***	***6452.51***	***6452.68***	***6453.26***	***6453.46***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.0210	0.0240	0.0210	0.0210	0.0240	0.0040	0.0060	0.0050	0.0040	0.0040	0.0050
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.50	ND	0.10	0.10	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	115.00	1.88	1.58	2.08	1.13	0.45	0.45	0.61	0.61	0.69	0.71
Lead	0.001	0.1	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	6.35	1.88	1.99	1.85	1.86	0.21	0.18	0.16	0.16	0.16	0.16
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		0.2560	0.5310	0.4980	0.4440	0.4470	0.0079	0.0066	0.0066	0.0049	0.0052	0.0044
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.13	0.03	ND	0.05	ND	0.14	0.02	0.06	0.03	0.03	0.03
TRACE METALS (mg/L) TOTALS													
Iron	0.03		115.00	1.88	1.58	2.09	4.23	0.59	0.68	0.88	2.31	0.81	0.75
Manganese	0.01		6.35	1.88	1.99	1.93	1.83	0.21	0.18	0.19	0.18	0.16	0.16
RADIOMETRICS (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	**643.0**	**505.0**	**512.0**	**61.4**	**16.1**	**31.2**	**24.0**	**22.9**	**26.8**
Gross Alpha precision (±)			NM	NM	22.7	19.6	18.4	4.9	2.8	4.1	3.7	6.4	6.2
Gross Beta			NM	NM	NM	132.0	121.0	35.5	21.6	23.4	23.4	22.0	23.6
Gross Beta precision (±)			NM	NM	NM	10.1	10.5	3.3	3.1	3.8	3.6	4.2	4.7
Radium 226		5.0*	**11.4**	**10.0**	**8.9**	**6.5**	**5.5**	**8.1**	**7.0**	**8.8**	**7.6**	**8.8**	**9.7**
Radium 226 precision (±)			NM	0.8	0.6	0.5	0.4	0.6	0.5	0.6	0.5	1.7	1.9
Radium 228		5.0*	NM	NM	NM	**19.5**	**15.8**	**8.5**	**7.2**	**8.6**	**10.1**	**10.4**	**9.0**
Radium 228 precision (±)			NM	NM	NM	1.6	1.3	1.4	1.1	0.9	1.0	2.1	1.9
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	**26.0**	**21.3**	**16.6**	**14.2**	**17.4**	**17.7**	**19.2**	**18.7**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	Day Loma Pit										
			1990	1998	2007	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2014	Fall 2015
ANALYTE			10/17/1990	12/2/1998	7/25/2007	10/5/2011	10/17/2012	5/28/2013	9/24/2013	6/18/2014	9/23/2014	6/10/2015	9/23/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			581	703	1364	1229	1340	1302	1311	1281	1305	1187	1286
Alkalinity, Total as CaCO3			NM	152	76	73	NM	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		164	185	92	89	100	109	92	113	119	140	94
Calcium	1		176	214	429	380	413	401	403	396	404	383	398
Chloride	1	2,000	18.1	22.6	44.0	42.0	44.0	43.0	49.0	44.0	46.0	43.0	46.0
Fluoride	0.1	-	0.45	0.56	0.70	0.60	0.60	0.60	0.60	0.50	0.50	0.50	0.60
Magnesium	1		34.4	41.0	71.1	68.0	75.0	73.0	74.0	71.0	72.0	56.0	71.0
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		31.0	29.1	42.2	42.0	45.0	43.0	44.0	43.0	45.0	40.0	44.0
Silica	0.2		NM	8.4	1.1	ND	0.7	1.1	0.9	1.7	1.5	1.8	1.2
Sodium	1		183	177	268	284	302	296	304	309	306	224	300
Sulfate	2	3,000	845	972	1750	1800	1770	1770	1910	1800	1830	1670	1860
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		1760	2070	3280	3150	3190	3040	3210	3260	3160	2890	3200
Lab pH (std units)	0.01	6.5-8.5	8.25	8.19	8.15	8.22	8.05	8.10	8.26	8.27	8.11	8.18	7.98
Total Dissolved Solids @ 180°C	20	5,000	1336	1620	2850	2650	2830	2770	2830	2740	2790	2660	2800
Field Conductivity (uS/cm)			NM	NM	NM	3210	3340	3360	3450	3250	3490	2990	3460
Field pH (std units)		6.5-8.5	NM	NM	NM	8.05	8.18	7.78	7.36	8.19	8.10	8.19	8.39
Field Temperature (°C)			NM	NM	NM	14.9	10.9	12.3	16.9	16.2	15.5	20.0	16.4
Field Turbidity (NTU)			NM	NM	NM	NM	5.8	19.8	NM	2.5	18.8	11.9	NM
Monument Height			NA	NA	NA	NA	NA	6467.74	6467.74	6467.74	6467.74	6467.74	6467.74
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	4.30	2.57	3.02	2.57	1.95
WATER SURFACE ELEVATION (MH-WL)			***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***6463.44***	***6465.17***	***6464.73***	***6465.17***	***6465.79***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	0.20	ND	ND
Arsenic	0.001	0.2	0.0077	0.0030	0.0050	0.0050	0.0040	0.0030	0.0060	0.0030	0.0040	0.0040	0.0040
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.21	ND	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	0.020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.03	ND	ND	0.04	ND	ND	ND	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.01	0.05	0.05	0.01	ND	ND	ND	0.02	ND	ND	ND
Mercury	0.001	0.00005	**0.002**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.003	0.014	0.008	0.003	0.003	0.002	0.002	0.004	0.002	0.003	0.002
Uranium (mg/L)	0.0003		0.7360	0.7410	0.5580	0.4580	0.4560	0.4470	0.4320	0.4140	0.3850	0.3420	0.4000
Vanadium	0.1	0.1	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)													
Iron	0.03		0.03	ND	ND	0.04	0.05	0.05	0.21	0.07	ND	0.45	0.09
Manganese	0.01		0.01	0.05	0.05	0.01	ND	ND	ND	0.03	ND	0.02	ND
RADIOMETRICS (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	NM	NM	**405.0**	**316.0**	**321.0**	**301.0**	**293.0**	**254.0**	**264.0**
Gross Alpha precision (±)			NM	NM	NM	NM	16.6	16.4	14.7	19.2	15.9	52.2	54.1
Gross Beta			NM	NM	NM	NM	91.1	111.0	105.0	67.3	99.2	87.6	68.0
Gross Beta precision (±)			NM	NM	NM	NM	9.5	10.6	9.1	14.6	9.6	11.3	9.6
Radium 226		5.0*	2.4	3.7	1.9	2.2	2.4	2.3	1.7	2.4	2.9	1.8	2.3
Radium 226 precision (±)			NM	NM	NM	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.5
Radium 228		5.0*	NM	NM	NM	NM	2.8	<1.9	2.0	2.0	4.9	2.9	4.2
Radium 228 precision (±)			NM	NM	NM	NM	0.8	1.3	0.9	0.7	1.8	0.9	1.0
Combined Radium 226 & 228		5.0*	NA	NA	NA	NA	**5.2**	NA	3.7	4.4	**7.8**	4.7	**6.5**

	Clyde Pit (Surface water impoundment since 2007)								
	1990 (Pit Sample)	2007	2011	2012	Spring 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
ANALYTE	10/17/1990	7/25/2007	10/5/2011	10/17/2012	5/28/2013	6/18/2014	9/24/2014	6/11/2015	9/23/2015
MAJOR IONS (mg/L)									
Hardness as CaCO3	1903	1492	4172	2539	2506	600	690	615	1721
Alkalinity, Total as CaCO3	NM	25	ND	NM	NM	NM	NM	NM	NM
Carbonate as CO3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	ND	31	ND	ND	ND	59	58	36	29
Calcium	553	494	529	653	653	194	225	200	572
Chloride	34.9	5.0	64.0	19.0	25.0	5.0	7.0	6.0	5.0
Fluoride	0.50	0.70	2.60	0.80	0.90	0.40	0.50	0.40	0.40
Magnesium	127.0	62.6	695.0	221.0	213.0	28.0	31.0	28.0	71.0
Nitrogen, Ammonia as N	0.10	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N	NM	ND	NM	NM	NM	NM	NM	NM	NM
Nitrate as N	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.23	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	34.0	27.5	206.0	83.0	84.0	15.0	16.0	15.0	30.0
Silica	NM	8.3	25.0	15.1	12.2	5.7	3.1	1.8	12.7
Sodium	204	27	314	104	123	32	39	34	40
Sulfate	2340	1430	**5280**	2850	2840	601	748	640	1770
PHYSICAL PROPERITES									
Lab Conductivity @ 25°C (umho/cm)	3825	2410	6860	3940	3980	1230	1390	1290	2690
Lab pH (std units)	**3.82**	7.69	**4.07**	**5.48**	**4.42**	8.01	8.18	**8.72**	7.47
Total Dissolved Solids @ 180°C	3342	2290	**7440**	4310	4220	955	1160	1050	2680
Field Conductivity (uS/cm)	NM	NM	6870	4350	4190	1195	1583	1311	2930
Field pH (std units)	NM	NM	**3.98**	**6.29**	**4.73**	6.75	8.41	**8.80**	7.69
Field Temperature (°C)	NM	NM	12.0	3.2	12.9	14.7	16.2	19.6	18.1
Field Turbidity (NTU)	NM	NM	NM	25.5	24.8	18.1	17.2	8.7	NM
Monument Height	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water level (Foresight SWL-backsight monument)	NM	NM	NM	NM	NM	NM	NM	NM	NM
WATER SURFACE ELEVATION (MH-WL)	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***
TRACE METALS (mg/L)									
Aluminum	**5.83**	ND	**14.30**	0.70	3.70	ND	ND	ND	ND
Arsenic	0.0061	0.0070	0.0090	0.0030	0.0070	0.0030	0.0040	0.0040	0.0050
Barium	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.31	ND	0.90	0.20	0.30	ND	ND	ND	ND
Cadmium	ND	ND	0.006	ND	ND	ND	ND	ND	ND
Chromium	**0.210**	ND	ND	ND	ND	ND	ND	ND	ND
Copper	NM	ND	0.06	ND	0.02	ND	ND	ND	ND
Iron	0.27	ND	0.52	0.12	0.23	ND	ND	ND	ND
Lead	ND	ND	0.003	ND	0.002	ND	ND	ND	ND
Manganese	4.60	0.03	7.07	2.09	5.42	ND	ND	ND	0.30
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.84	ND	2.07	0.60	0.87	ND	ND	ND	0.14
Selenium	0.003	0.017	0.025	0.036	0.015	0.032	0.024	0.022	**0.070**
Uranium (mg/L)	1.0760	0.1400	1.6600	0.1100	0.7950	0.4630	0.4440	0.2650	0.1880
Vanadium	NM	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.31	ND	0.31	0.06	0.14	ND	ND	ND	ND
TOTAL METALS (mg/L)									
Iron	0.27	ND	0.52	2.54	0.25	1.24	1.03	0.38	0.09
Manganese	4.60	0.03	7.07	2.20	5.43	0.01	ND	0.02	0.29
RADIOMETRICS (pCi/L) DISSOLVED									
Gross Alpha	NM	NM	NM	**79.3**	**611.0**	**328.0**	**401.0**	**199.0**	**128.0**
Gross Alpha precision (±)	NM	NM	NM	10.7	27.3	14.1	10.8	39.6	27.5
Gross Beta	NM	NM	NM	97.5	158.0	49.0	73.8	54.1	44.4
Gross Beta precision (±)	NM	NM	NM	11.3	16.0	8.6	4.8	6.1	6.9
Radium 226	5.0	2.0	5.5	5.0	**6.0**	1.4	2.1	1.1	3.3
Radium 226 precision (±)	NM	NM	0.5	0.5	0.5	0.3	0.3	0.3	0.7
Radium 228	NM	NM	NM	1.9	2.5	<1.1	5.1	<1.2	1.1
Radium 228 precision (±)	NM	NM	NM	0.8	1.3	0.7	1.6	0.7	0.6
Combined Radium 226 & 228	NA	NA	NA	**6.9**	**8.5**	NA	**7.2**	NA	4.4

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	Lake Day Loma							
			1990	2011	2012	Spring 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
ANALYTE			10/17/1990	10/6/2011	10/17/2012	5/28/2013	6/18/2014	9/23/2014	6/10/2015	9/23/2015
MAJOR IONS (mg/L)										
Hardness as CaCO3			83	54	57	131	101	104	70	66
Alkalinity, Total as CaCO3			NM	214	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		17	24	14	ND	ND	ND	ND	13
Bicarbonate, as HCO3	5		418	213	143	294	169	210	166	197
Calcium	1		22	15	18	41	34	35	23	20
Chloride	1	2,000	36.2	10.0	4.0	4.0	1.0	2.0	ND	4.0
Fluoride	0.1	-	1.30	1.60	0.70	0.70	0.20	0.30	0.30	0.40
Magnesium	1		6.9	4.0	3.0	7.0	4.0	4.0	3.0	4.0
Nitrogen, Ammonia as N	0.05	-	NM	0.10	ND	0.45	ND	ND	ND	ND
Nitrite as N		10.0	0.26	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	NM	ND	ND	ND	ND	ND	ND	ND
Potassium	1		18.0	6.0	6.0	9.0	6.0	7.0	5.0	7.0
Silica	0.2		NM	24.3	9.6	19.1	17.9	22.9	7.3	10.4
Sodium	1		254	125	68	68	27	40	39	70
Sulfate	2	3,000	210	79	55	25	20	17	28	38
PHYSICAL PROPERITES										
Lab Conductivity @ 25°C (umho/cm)	5		1170	624	392	498	315	358	317	412
Lab pH (std units)	0.01	6.5-8.5	**8.79**	**9.41**	**9.31**	8.19	8.35	8.36	8.26	**8.90**
Total Dissolved Solids @ 180°C	20	5,000	866	903	418	645	396	333	1350	414
Field Conductivity (uS/cm)			NA	685	401	570	295	425	333	452
Field pH (std units)		6.5-8.5	NA	**9.80**	**9.50**	8.22	8.34	8.38	8.41	**8.92**
Field Temperature (°C)			NA	8.0	6.7	12.5	12.8	14.5	21.1	13.7
Field Turbidity (NTU)			NA	NM	605.0	748.0	169.0	117.1	192.0	206.0
Monument Height			NA	NA	NA	NA	6639.71	6639.71	6639.71	6639.71
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	1.48
WATER SURFACE ELEVATION (MH-WL)			***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***6638.23***
TRACE METALS (mg/L)										
Aluminum	0.1	5.0	ND	**40.30**	0.50	0.20	0.10	ND	ND	0.30
Arsenic	0.001	0.2	0.0370	0.0480	0.0210	0.0170	0.0080	0.0130	0.0080	0.0140
Barium	0.1	-	0.31	0.40	0.10	0.10	0.10	0.20	ND	0.10
Boron	0.1	5.0	0.40	0.20	ND	0.10	ND	ND	ND	0.10
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	0.038	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	NM	0.02	ND	0.01	ND	ND	ND	ND
Iron	0.03	-	0.08	22.50	0.53	0.27	0.09	0.03	ND	0.16
Lead	0.001	0.1	ND	0.023	0.002	0.001	ND	ND	ND	ND
Manganese	0.01	-	ND	0.69	0.06	ND	0.01	ND	0.01	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Uranium (mg/L)	0.0003		0.0850	0.0350	0.0174	0.0231	0.0097	0.0085	0.0100	0.0122
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	0.06	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)										
Iron	0.03		NM	22.50	9.30	33.20	10.60	4.75	8.78	3.19
Manganese	0.01		NM	0.69	0.28	0.98	0.12	0.08	0.15	0.11
RADIOMETRICS (pCi/L) DISSOLVED										
Gross Alpha		15	**49.0**	NM	**18.4**	**22.0**	12.0	5.3	7.5	9.4
Gross Alpha precision (±)			13.0	NM	1.7	2.5	1.6	1.4	2.3	2.8
Gross Beta			NM	NM	8.6	22.3	7.2	7.6	3.4	9.9
Gross Beta precision (±)			NM	NM	1.8	1.9	1.7	1.9	1.5	2.0
Radium 226		5.0*	1.1	0.2	1.3	1.3	0.2	0.4	0.4	0.6
Radium 226 precision (±)			0.2	0.1	0.3	0.2	0.1	0.2	0.2	0.2
Radium 228		5.0*	NM	NM	0.8	2.9	<1.0	<2.5	<1.0	<1.1
Radium 228 precision (±)			NM	NM	0.8	1.4	0.6	1.5	0.6	0.6
Combined Radium 226 & 228		5.0*	NA	NA	2.1	4.2	NA	NA	NA	NA

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	SUN1						SUN 3															
			Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	2001	2002	2003	2005	2006	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			5/29/2013	9/24/2013	6/19/2014	9/24/2014	6/9/2015	9/22/2015	11/12/2001	9/26/2002	11/6/2003	11/1/2005	9/6/2006	7/26/2007	9/30/2009	10/18/2010	10/6/2011	10/17/2012	5/29/2013	9/23/2013	6/19/2014	9/22/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																								
Hardness as CaCO3			459	480	468	471	479	483	1380	1540	1760	1890	1690	1800	1830	1820	1847	1910	1990	1958	1996	1961	1933	1950
Alkalinity, Total as CaCO3			NM	NM	NM	NM	NM	NM	165	229	323	360	349	324	412	494	521	650	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		254	265	258	269	273	255	201	279	393	439	425	395	502	603	635	792	756	752	809	778	666	705
Calcium	1		126	138	125	131	134	134	458	507	570	604	551	592	595	594	601	623	645	634	641	635	629	624
Chloride	1	2000.00	8.0	9.0	9.0	10.0	9.0	10.0	138.0	32.6	7.8	16.0	13.0	13.0	14.0	14.0	15.0	13.0	12.0	10.0	11.0	13.0	10.0	10.0
Fluoride	0.1	-	0.3	0.3	0.3	0.3	0.3	0.3	1.2	0.8	0.6	0.5	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.3	0.3
Magnesium	1		35.0	33.0	38.0	35.0	35.0	36.0	56.5	67.2	80.9	93.2	77.0	79.0	83.0	82.0	84.0	86.0	92.0	91.0	96.0	91.0	88.0	95.0
Nitrogen, Ammonia as N	0.05	-	0.26	0.27	0.20	0.24	0.24	0.23	5.16	7.70	8.40	7.60	6.90	8.70	9.10	8.90	10.20	11.00	10.80	24.10	12.10	12.80	9.80	10.90
Nitrite as N		10.00	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		18.0	19.0	19.0	18.0	19.0	17.0	31.7	38.6	44.1	43.4	37.7	41.1	42.0	44.0	45.0	43.0	47.0	45.0	48.0	45.0	49.0	48.0
Silica	0.2		15.0	15.9	15.6	15.2	15.2	15.7	14.7	16.7	17.9	22.4	17.1	18.0	21.9	21.9	21.3	22.0	22.2	22.5	24.8	23.3	22.2	22.3
Sodium	1		124	117	133	127	130	127	105	63	36	40	37	38	35	37	38	39	45	45	40	39	42	43
Sulfate	2	3000.00	546	536	542	549	548	559	1270	1400	1590	1520	1450	1500	1590	1540	1520	1500	1620	1480	1550	1540	1530	1570
PHYSICAL PROPERITES																								
Lab Conductivity @ 25°C (umho/cm)	5		1320	1360	1420	1390	1400	1420	2840	2920	2950	2910	3030	2880	2890	2950	2970	3000	3010	3020	3210	3070	3120	3060
Lab pH (std units)	0.01	6.5-8.5	7.60	7.51	7.45	7.40	7.38	7.64	7.70	7.83	7.76	7.14	7.12	7.01	6.94	7.41	7.47	6.80	6.88	6.79	6.78	6.72	7.16	7.00
Total Dissolved Solids @ 180°C	20	5000.00	985	1010	1020	1030	1030	1050	2480	2620	2700	2730	2650	2580	2720	2770	2690	2860	2900	2840	2870	2890	2870	2840
Field pH (std units)		6.5-8.5	7.38	7.37	7.24	7.35	7.34	7.39	7.5	6.73	7.11	6.84	6.77	6.78	6.79	6.63	7.08	6.6	6.65	6.57	6.68	**6.05**	6.92	**6.46**
Field Conductivity (uS/cm)			1,081	648	923	1,271	956	1,403	NM	NM	NM	NM	NM	NM	NM	NM	2,950	3,150	3,140	3,080	3,090	3,150	3,090	999
Field Temperature (°C)			10.6	10.5	12.2	12.2	11.6	11.2	NM	NM	NM	NM	NM	NM	NM	NM	9.5	9.1	10.0	13.1	10.3	10.3	12.8	11.8
Depth to Water (ft)			171.01	171.00	170.89	170.94	170.60	170.55	73.93	73.68	70.4	72.06	73.25	73.19	73.34	73.4	74.72	73.9	74	74.22	73.58	73.39	76.42	72.82
Total Depth (ft)			236.5	236.50	236.50	236.50	236.50	236.50	100	100	100	100.27	100.4	100.4	99.75	99.9	100.8	100.8	100.8	100.8	100.8	100.8	100.8	100.8
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6634.71	6634.71	6634.71	6634.71	6634.71	6634.71	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9	6562.9
WATER ELEVATION			***6463.70***	***6463.71***	***6463.82***	***6463.77***	***6464.11***	***6464.16***	***6488.97***	***6489.22***	***6492.50***	***6490.84***	***6489.65***	***6489.71***	***6489.56***	***6489.50***	***6488.18***	***6489.00***	***6488.90***	***6488.68***	***6489.32***	***6489.51***	***6486.48***	***6490.08***
TRACE METALS (mg/L)																								
Aluminum	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	0.10	0.10	0.10	ND	ND	0.06	ND	ND	ND	ND
Arsenic	0.001	0.20	ND	ND	ND	ND	ND	ND	0.004	0.006	0.002	0.002	0.002	0.002	0.005	0.004	0.002	0.002	0.002	0.005	0.003	0.004	0.002	0.003
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	0.20	0.20	0.20	0.20	0.20	0.20	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	ND	ND	ND	ND	ND	ND	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.090	0.090	0.110	0.090	0.090	0.120	ND	0.087	0.074	0.190	0.050	0.160	0.680	0.290	0.460	0.230	0.310	0.290	0.310	0.310	0.410	0.350
Lead	0.001	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	0.005	0.001	0.003	ND	ND	ND	ND	ND	0.005	0.001
Manganese	0.01	-	0.05	0.05	0.04	0.04	0.04	0.05	0.29	0.58	0.48	0.49	0.45	0.5	0.46	0.42	0.53	0.51	0.51	0.53	0.53	0.55	0.53	0.52
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.0009**	ND	**0.001**	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30	0.20	0.20	0.20	0.16	0.20	0.20	0.20	0.20
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	0.015	0.002	ND	0.002	0.002	0.002	0.002	ND	0.001	ND	ND	ND	0.002	ND	0.001	ND
Uranium	0.0003		0.0007	0.0006	0.0010	0.0004	0.0015	0.0028	3.7700	7.3900	18.6000	19.3000	17.0000	12.7000	16.6000	16.2000	15.7000	18.2000	17.0000	13.0000	18.1000	16.6000	19.9000	20.0000
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	0.04	0.04	0.14	0.02	0.09	0.08	0.29	0.09	0.06	0.07	0.09	0.06	0.04	0.04	0.04	0.03	0.04	0.05	0.03	0.04	0.03	0.04
TRACE METALS (mg/L) TOTALS																								
Iron	0.03		0.18	1.00	0.21	2.19	2.56	0.46	NM	NM	NM	NM	NM	NM	NM	0.29	0.46	NM	0.86	0.74	0.83	1.37	1.02	1.36
Manganese	0.01		0.06	0.05	0.04	0.06	0.05	0.05	NM	NM	NM	NM	NM	NM	NM	0.42	0.53	NM	0.53	0.56	0.59	0.54	0.54	0.54
RADIONUCLIDES (pCi/L) DISSOLVED																								
Gross Alpha		15.00	**21.6**	**15.6**	15.0	**17.1**	10.8	**18.0**	NM	NM	NM	NM	NM	NM	NM	NM	NM	**10800.0**	**13000.0**	**9150.0**	**11000.0**	**12200.0**	**10400.0**	**11300.0**
Gross Alpha precision (±)			2.9	2.6	3.6	3.3	4.4	5.4	NM	NM	NM	NM	NM	NM	NM	NM	NM	82.3	101.0	77.2	104.0	92.8	2010.0	2180.0
Gross Beta			21.6	24.5	23.1	21.0	16.5	17.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	3590.0	1230.0	1310.0	745.0	2380.0	2100.0
Gross Beta precision (±)			2.9	3.4	3.4	3.0	3.7	3.7	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	35.8	25.2	30.0	26.2	241.0	213.0
Radium 226		5.0*	3.1	3.8	4.3	5.0	4.1	4.4	**37.5**	**54.4**	**40.4**	**44.0**	**33.8**	**35.6**	**43.0**	**35.0**	**42.0**	**50.0**	**37.0**	**40.0**	**33.0**	**36.0**	**34.0**	**36.0**
Radium 226 precision (±)			0.3	0.4	0.4	0.5	0.9	0.9	1.9	2.8	1.8	2.1	1.7	1.8	1.3	1.0	1.4	1.3	1.1	1.3	1.1	1.0	6.5	6.8
Radium 228		5.0*	3.9	2.0	3.2	3.7	2.4	1.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**29.1**	**23.2**	**17.4**	**21.0**	**21.2**	**24.9**
Radium 228 precision (±)			1.3	0.8	0.7	1.2	0.8	0.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2.2	2.0	1.3	1.4	4.0	4.6
Combined Radium 226 & Radium 228		5.0*	**7.0**	**5.8**	**7.5**	**8.7**	**6.5**	**6.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**66.1**	**63.2**	**50.4**	**57.0**	**55.2**	**60.9**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	SUN 2																	SAGE 2					
			2001	2002	2003	2004	2005	2006	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/12/2001	9/26/2002	11/5/2003	12/20/2004	11/1/2005	9/6/2006	7/26/2007	9/29/2009	10/18/2010	10/6/2011	10/18/2012	5/29/2013	9/23/2013	6/19/2014	9/24/2014	6/9/2015	9/22/2015	5/29/2013	9/24/2013	6/19/2014	9/22/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																									
Hardness as CaCO3			1490	1780	1880	1980	2080	1700	1840	1840	1810	1903	1806	1892	1869	1883	1884	1878	1880	393	367	355	355	350	350
Alkalinity, Total as CaCO3			233	238	266	294	328	290	322	223	275	338	266	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		284	290	325	359	400	354	393	272	336	412	324	337	345	357	402	288	290	331	344	336	336	355	323
Calcium	1		471	523	551	582	608	511	544	548	547	579	542	565	559	558	565	561	560	103	101	88	91	94	89
Chloride	1	2000.00	84.3	7.4	3.6	12.0	12.0	8.0	9.0	9.0	12.0	16.0	17.0	18.0	18.0	19.0	20.0	18.0	21.0	7.0	5.0	5.0	5.0	4.0	5.0
Fluoride	0.1	-	0.8	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Magnesium	1		76.3	116.0	122.0	128.0	135.0	102.0	118.0	115.0	109.0	111.0	110.0	117.0	115.0	119.0	115.0	116.0	117.0	33.0	28.0	33.0	31.0	28.0	31.0
Nitrogen, Ammonia as N	0.05	-	1.36	1.84	1.34	1.50	1.30	1.37	0.94	0.98	1.11	0.48	0.66	0.64	0.62	0.58	0.51	0.56	0.53	0.85	0.83	0.78	0.80	0.79	0.79
Nitrite as N		10.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.14	ND	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		23.5	26.5	29.4	27.8	26.5	23.7	24.0	26.0	25.0	21.0	23.0	25.0	23.0	25.0	23.0	24.0	23.0	17.0	17.0	16.0	14.0	15.0	15.0
Silica	0.2		13.3	13.1	14.7	14.3	14.6	11.1	13.4	12.7	40.0	15.0	12.3	13.5	13.2	13.5	13.6	13.4	13.4	18.8	19.7	20.5	19.0	19.1	19.2
Sodium	1		72	43	39	43	41	34	38	35	34	35	29	32	31	31	34	33	32	171	145	169	151	141	158
Sulfate	2	3000.00	1400	1560	1770	1620	1700	1500	1570	1700	1680	1660	1680	1670	1670	1750	1700	1730	1830	496	456	448	436	435	439
PHYSICAL PROPERITES																									
Lab Conductivity @ 25°C (umho/cm)	5		2530	3030	3070	2940	2990	3110	2960	2870	2890	2870	2810	2820	2850	2990	2900	2870	2900	1380	1340	1350	1310	1320	1330
Lab pH (std units)	0.01	6.5-8.5	7.30	7.46	7.07	6.53	6.65	6.63	6.54	**6.49**	6.70	7.39	6.54	6.57	6.51	6.52	6.51	6.51	6.69	7.66	7.58	7.54	7.52	7.46	7.73
Total Dissolved Solids @ 180°C	20	5000.00	2290	2660	2940	2870	2860	2800	2760	2700	2860	2770	2800	2840	2810	2820	2920	2880	2850	1010	934	917	922	921	934
Field pH (std units)		6.5-8.5	6.57	**6.15**	6.50	**6.42**	**6.34**	**6.27**	**6.10**	**6.33**	**6.16**	6.75	**6.43**	**6.36**	**6.41**	**6.42**	6.53	**6.27**	**6.26**	6.64	7.53	7.46	7.49	7.44	7.57
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	NM	NM	NM	2,780	3,020	2,970	3,020	2,850	995	2,800	727	3,370	731	1,007	1,246	1,002	1,312
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	NM	NM	NM	9.2	9.1	8.8	11.1	11.0	10.2	11.5	10.4	9.3	13.4	15.3	13.9	15.7	14.2
Depth to Water (ft)			155.80	155.27	155.50	155.00	155.45	155.70	155.30	155.71	156.90	156.26	156.77	156.59	156.26	156.82	156.84	159.87	156.80	235.74	235.87	235.69	235.80	235.31	235.53
Total Depth (ft)			180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	170.40	180.00	180.00	180.00	180.00	180.00	180.00	180.00	180.00	308.00	308.00	308.00	308.00	308.00	308.00
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	6631.30	NA	NA	NA	NA	NA	NA
WATER ELEVATION			***6475.50***	***6476.03***	***6475.80***	***6476.30***	***6475.85***	***6475.60***	***6476.00***	***6475.59***	***6474.40***	***6475.04***	***6474.53***	***6474.71***	***6475.04***	***6474.48***	***6474.46***	***6471.43***	***6474.50***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
TRACE METALS (mg/L)																									
Aluminum	0.1	5.00	ND	ND	ND	ND	ND	ND	0.40	ND	ND	0.40	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.20	0.004	0.016	0.015	0.021	0.009	0.010	0.029	0.034	ND	0.016	0.024	0.021	0.025	0.028	0.020	0.027	0.029	0.002	0.002	0.001	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	0.14	ND	ND	0.10	0.10	ND	0.20	ND	ND	0.10	ND	ND	0.06	ND	ND	ND	ND	0.20	0.10	0.20	0.10	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03	0.02	ND
Iron	0.03	-	0.510	38.200	38.500	40.600	27.200	28.800	33.000	44.100	46.800	22.500	41.400	43.600	43.800	45.300	40.700	44.800	43.300	0.060	0.060	0.080	0.080	0.090	0.040
Lead	0.001	0.10	ND	ND	ND	ND	ND	ND	0.03	0.00	ND	0.00	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	0.00	ND	ND
Manganese	0.01	-	1.39	3.68	3.43	3.30	3.22	3.00	3.34	3.13	ND	2.93	2.86	2.88	2.88	2.65	2.90	2.76	2.79	0.11	0.10	0.08	0.09	0.09	0.08
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.00**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.18	0.11	0.10	0.13	0.11	0.10	0.08	0.09	ND	0.09	0.08	0.08	0.08	0.08	0.07	0.08	0.08	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.022	0.003	ND	0.003	0.003	0.002	0.003	0.001	ND	0.002	ND	ND	0.002	0.002	ND	0.002	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		4.4800	11.9000	13.9000	12.9000	13.2000	10.3000	12.0000	6.5900	ND	15.8000	5.5900	4.9000	5.0000	5.3100	7.2000	4.6000	4.8000	0.0073	0.0040	0.0029	0.0026	0.0073	0.0028
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	2.96	0.30	0.28	0.24	0.14	0.12	0.15	0.08	ND	0.16	0.06	0.06	0.06	0.05	0.09	0.17	0.04	0.04	0.04	0.05	0.29	0.17	0.03
TRACE METALS (mg/L) TOTALS																									
Iron	0.03		NM	NM	NM	NM	NM	NM	NM	NM	46.80	22.50	NM	45.60	49.90	50.50	43.80	49.30	45.90	4.96	0.35	0.24	0.23	0.35	5.19
Manganese	0.01		NM	NM	NM	NM	NM	NM	NM	NM	ND	2.93	NM	2.98	3.01	2.92	3.06	2.82	2.69	0.15	0.10	0.09	0.08	0.09	0.14
RADIONUCLIDES (pCi/L) DISSOLVED																									
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**4680.0**	**4570.0**	**4240.0**	**4260.0**	**5600.0**	**3450.0**	**3550.0**	**33.8**	**22.5**	**24.7**	**27.7**	**17.5**	**19.3**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	54.0	56.7	51.1	61.2	65.5	669.0	689.0	3.6	2.9	3.5	3.3	5.4	4.7
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1160.0	499.0	446.0	673.0	685.0	418.0	24.1	19.3	19.3	20.8	18.3	18.3
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	19.7	16.3	18.3	20.9	70.5	43.3	3.3	2.9	3.1	2.9	3.6	3.6
Radium 226		5.0*	**70.8**	**91.8**	**105.0**	**112.0**	**93.1**	**91.9**	**115.0**	**79.0**	**113.0**	**94.0**	**89.0**	**76.0**	**96.0**	**89.0**	**89.0**	**78.0**	**75.0**	3.1	4.0	4.5	3.9	4.5	4.3
Radium 226 precision (±)			2.8	3.6	3.8	3.4	3.3	2.9	3.3	1.8	1.9	2.2	1.6	1.6	2.0	1.9	1.8	15.0	14.0	0.3	0.4	0.4	0.4	0.9	0.9
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**14.3**	**13.6**	**12.6**	**15.7**	**12.4**	**13.2**	6.1	1.4	2.8	<1.3	1.8	<1.5
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.7	1.6	1.3	1.9	2.5	2.6	1.4	0.8	0.7	0.8	1.0	0.9
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**90.3**	**109.6**	**101.6**	**104.7**	**90.4**	**88.2**	**9.2**	**5.4**	**7.3**	NA	**6.3**	NA

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	K2 Pit Well												
			2005	2006	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/1/2005	9/6/2006	7/24/2007	9/29/2009	10/18/2010	10/6/2011	10/18/2012	5/29/2013	9/23/2013	6/19/2014	9/24/2014	6/9/2015	9/22/2015
MAJOR IONS (mg/L)															
Hardness as CaCO3			1370	1450	1580	1470	1460	1488	1544	1602	1582	1549	1548	1566	1576
Alkalinity, Total as CaCO3			295	390	320	297	296	290	306	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		360	476	390	362	361	354	374	366	360	372	342	300	257
Calcium	1		423	448	497	461	456	459	480	498	490	467	475	482	478
Chloride	1	2000.00	19.0	4.0	5.0	6.0	6.0	7.0	6.0	7.0	7.0	8.0	8.0	8.0	11.0
Fluoride	0.1	-	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.3
Magnesium	1		77.3	81.1	83.3	77.0	78.0	83.0	84.0	87.0	87.0	93.0	88.0	88.0	93.0
Nitrogen, Ammonia as N	0.05	-	0.56	0.43	0.23	0.14	0.32	0.16	0.20	0.18	0.16	0.11	0.16	0.16	0.16
Nitrite as N		10.00	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		23.2	18.6	19.1	19.0	19.0	19.0	20.0	21.0	19.0	21.0	19.0	21.0	19.0
Silica	0.2		17.1	16.3	17.7	14.3	36.5	20.1	22.1	21.3	19.6	20.7	21.2	18.7	18.2
Sodium	1		130	61	59	57	58	57	61	65	64	63	62	67	67
Sulfate	2	3000.00	1290	1240	1300	1380	1360	1330	1370	1330	1400	1470	1430	1450	1540
PHYSICAL PROPERITES															
Lab Conductivity @ 25°C (umho/cm)	5		2550	2690	2560	2480	2460	2450	2460	2490	2530	2660	2580	2580	2540
Lab pH (std units)	0.01	6.5-8.5	7.24	7.22	7.05	7.40	7.63	7.60	6.99	6.98	6.90	6.90	6.91	6.98	7.13
Total Dissolved Solids @ 180°C	20	5000.00	2140	2260	2310	2190	2320	2250	2400	2410	2370	2400	2460	2430	2400
Field pH (std units)		6.5-8.5	6.90	6.65	6.73	6.83	6.62	6.75	6.83	6.88	6.73	6.68	6.67	6.73	**6.42**
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	2,780	2,620	2,610	2,630	2,660	1,029	2,650	675
Field Temperature (°C)			NM	NM	NM	NM	NM	9.2	9.5	9.3	10.1	10.2	10.1	10.9	9.8
Depth to Water (ft)			67.15	65.27	62.53	56.70	55.30	54.63	54.20	53.88	53.94	53.09	52.33	54.54	50.81
Total Depth (ft)			109.43	107.90	107.90	107.33	107.00	107.90	107.90	107.90	107.91	107.91	107.91	107.91	107.91
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00	6488.00
WATER ELEVATION			***6420.85***	***6422.73***	***6425.47***	***6431.30***	***6432.70***	***6433.37***	***6433.80***	***6434.12***	***6434.06***	***6434.91***	***6435.67***	***6433.46***	***6437.19***
TRACE METALS (mg/L)															**3.1**
Aluminum	0.1	5.00	ND	ND	0.50	0.20	3.50	0.70	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.20	ND	0.001	0.003	0.002	0.005	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.240	0.500	3.290	2.280	5.640	4.940	5.050	4.910	4.580	4.770	5.060	4.470	4.550
Lead	0.001	0.10	ND	ND	0.01	0.00	0.01	0.01	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.68	0.55	0.53	0.48	0.44	0.49	0.45	0.45	0.45	0.44	0.44	0.44	0.44
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	0.00	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND
Selenium	0.001	0.05	0.001	0.001	0.002	ND	0.002	ND	ND	ND	ND	0.001	ND	ND	ND
Uranium	0.0003		1.1800	1.4200	0.5770	2.2700	1.2600	2.1700	1.3300	1.5900	1.9200	1.5500	0.9390	1.1000	0.6590
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND
Zinc	0.01	25.00	0.03	0.06	0.04	ND	0.03	0.01	ND	ND	ND	ND	0.02	ND	ND
TRACE METALS (mg/L) TOTALS															
Iron	0.03		NM	NM	NM	NM	5.64	4.94	NM	5.33	5.20	5.27	5.55	4.76	4.46
Manganese	0.01		NM	NM	NM	NM	0.44	0.49	NM	0.46	0.46	0.47	0.48	0.45	0.44
RADIONUCLIDES (pCi/L) DISSOLVED															
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	**1430.0**	**1590.0**	**1770.0**	**1440.0**	**963.0**	**869.0**	**699.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	26.6	30.8	29.3	33.0	25.1	171.0	138.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	387.0	183.0	148.0	109.0	137.0	90.5
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	11.2	10.1	11.1	10.1	15.2	10.6
Radium 226		5.0*	**19.0**	**17.8**	**30.7**	**34.0**	**32.0**	**49.0**	**44.0**	**38.0**	**50.0**	**43.0**	**49.0**	**41.0**	**41.0**
Radium 226 precision (±)			1.4	1.3	1.9	1.2	1.0	1.6	1.1	1.1	1.4	1.3	1.3	7.7	7.9
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	**17.0**	**14.1**	**11.1**	**17.2**	**15.0**	**18.5**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	1.8	1.7	1.2	1.9	2.9	3.6
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	**55.0**	**64.1**	**54.1**	**66.2**	**56.0**	**59.5**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	P-2 (Replaced in 2006 approximately 550 feet northeast)																
			2001	2002	2003	2004 (REDUCED)	2005 (REDUCED)	2006 (REPLACED)	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/12/2001	9/26/2002	11/5/2003	12/20/2004	11/1/2005	9/6/2006	7/26/2007	9/30/2009	10/18/2010	10/6/2011	10/17/2012	5/29/2013	9/24/2013	6/19/2014	9/24/2014	6/9/2015	9/22/2015
MAJOR IONS (mg/L)																			
Hardness as CaCO3			977	888	942	1020	1070	1010	1170	938	987	1016	1062	1043	972	1001	992	1005	1001
Alkalinity, Total as CaCO3			268	273	268	294	288	287	312	300	310	284	308	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		326	332	326	359	351	351	381	365	378	346	375	372	393	380	373	414	358
Calcium	1		327	296	317	337	356	347	413	331	349	359	374	368	351	353	351	356	353
Chloride	1	2000.00	13.5	15.1	3.5	20.0	30.0	9.0	8.0	10.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	6.0	8.0
Fluoride	0.1	-	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Magnesium	1		38.9	36.4	36.6	42.5	44.5	33.8	34.0	27.0	28.0	29.0	31.0	30.0	23.0	29.0	28.0	28.0	29.0
Nitrogen, Ammonia as N	0.05	-	0.28	0.34	0.25	0.31	0.29	0.23	0.06	0.18	0.18	ND	0.07	0.06	0.05	ND	ND	ND	ND
Nitrite as N		10.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		11.9	11.1	12.8	13.1	11.7	10.3	8.5	8.0	8.0	9.0	9.0	9.0	8.0	9.0	9.0	9.0	8.0
Silica	0.2		30.4	28.6	31.3	31.0	32.2	25.8	32.6	39.0	38.6	39.6	40.5	37.2	36.9	37.9	35.9	36.8	36.9
Sodium	1		40	42	39	47	44	40	32	27	30	28	32	33	25	32	32	33	33
Sulfate	2	3000.00	779	715	759	760	789	819	842	732	762	770	753	766	760	790	760	755	755
PHYSICAL PROPERITES																			
Lab Conductivity @ 25°C (umho/cm)	5		1690	1706	1720	1730	1830	2080	1950	1660	1740	1700	1710	1700	1740	1780	1730	1730	1710
Lab pH (std units)	0.01	6.5-8.5	7.60	7.85	7.72	7.18	7.30	7.21	7.05	7.05	7.86	7.74	6.98	7.10	7.03	7.04	7.02	7.04	7.10
Total Dissolved Solids @ 180°C	20	5000.00	1430	1420	1400	1470	1500	1620	1560	1410	1450	1430	1500	1500	1490	1480	1500	1490	1470
Field pH (std units)		6.5-8.5	6.92	6.76	7.22	7.03	6.93	6.70	6.77	6.98	6.73	6.96	7.04	**6.03**	6.67	6.66	6.88	7.54	**6.46**
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	NM	NM	NM	1,663	1,933	1,777	1,683	1,710	705	1,691	518
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	NM	NM	NM	11.0	9.6	9.8	6.7	10.0	10.3	10.3	10.0
Depth to Water (ft)			198.16	198.00	199.80	174.01	150.05	162.22	161.82	159.15	158.65	157.87	157.95	156.88	156.90	156.44	156.18	158.84	155.60
Total Depth (ft)			218.70	218.70	218.70	201.95	194.70	203.90	203.90	204.05	204.10	231.80	231.80	231.80	231.80	231.80	231.80	231.80	231.80
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6613.00	6613.00	6613.00	6596.25	6573.00	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52	6590.52
WATER ELEVATION			***6414.84***	***6415.00***	***6413.20***	***6422.24***	***6422.95***	***6428.30***	***6428.70***	***6431.37***	***6431.87***	***6432.65***	***6432.57***	***6433.64***	***6433.62***	***6434.08***	***6434.34***	***6431.68***	***6434.92***
TRACE METALS (mg/L)																			
Aluminum	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.20	ND	ND	ND	ND	ND	ND	0.003	0.005	0.003	0.002	0.001	0.001	0.003	0.002	0.001	0.001	0.002
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.240	0.476	0.202	0.240	0.450	0.650	1.060	1.030	1.150	0.990	1.010	1.090	1.010	1.030	1.030	1.050	1.050
Lead	0.001	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.36	0.36	0.36	0.42	0.43	1.08	1.45	1.21	1.12	1.27	1.41	1.29	1.30	1.24	1.25	1.28	1.25
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.006	0.001	ND	0.002	0.001	0.001	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND
Uranium	0.0003		0.3990	1.2000	0.4030	1.4400	3.0600	0.0197	0.0098	0.0027	0.0160	0.0033	ND	0.0018	0.0019	0.0018	0.0018	0.0023	0.0073
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	0.05	0.01	0.02	ND	0.03	0.01	ND	ND	ND	ND	0.00	ND	ND	ND	ND	ND	ND
TRACE METALS (mg/L) TOTALS																			
Iron	0.03		NM	NM	NM	NM	NM	NM	NM	NM	1.15	0.99	NM	1.09	1.06	1.08	1.07	1.06	1.08
Manganese	0.01		NM	NM	NM	NM	NM	NM	NM	NM	1.12	1.27	NM	1.34	1.24	1.32	1.35	1.28	1.31
RADIONUCLIDES (pCi/L) DISSOLVED																			
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**19.6**	**34.7**	**40.3**	**51.0**	**38.7**	**27.8**	**31.4**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	4.0	4.8	4.9	6.3	6.0	7.6	9.6
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	19.6	26.2	49.8	20.5	17.8	20.4
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	4.2	4.5	6.1	5.2	4.4	6.9
Radium 226		5.0*	**5.7**	**8.9**	**5.5**	**11.8**	**8.1**	**9.9**	**8.1**	**10.0**	**8.5**	**11.0**	**12.0**	**7.1**	**10.0**	**9.7**	**13.0**	**11.0**	**10.0**
Radium 226 precision (±)			0.4	1.2	0.4	1.1	0.9	1.0	0.9	0.7	0.5	0.8	0.6	0.5	0.6	0.6	0.7	2.1	2.0
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**10.9**	**10.5**	**8.1**	**12.6**	**9.8**	**9.3**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.6	1.5	1.0	1.7	2.0	1.9
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**18.0**	**20.5**	**17.8**	**25.6**	**20.8**	3.9

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	SAGE 1																
			2001	2002	2003	2004	2005 (EXTENDED)	2006	2007 (EXTENDED)	2009 (EXTENDED)	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/13/2001	9/26/2002	11/5/2003	12/20/2004	11/1/2005	9/6/2006	7/24/2007	9/29/2009	10/18/2010	10/6/2011	10/18/2012	5/29/2013	9/23/2013	6/19/2014	9/24/2014	6/9/2015	9/22/2015
MAJOR IONS (mg/L)																			
Hardness as CaCO3			2210	1370	1930	895	889	793	1950	2000	1950	2054	2039	2194	2145	2177	2241	2247	2311
Alkalinity, Total as CaCO3			291	231	261	219	220	206	288	308	317	303	324	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		354	282	318	267	268	251	351	376	386	370	396	418	426	436	433	403	379
Calcium	1		653	389	564	243	241	215	569	592	573	602	591	635	622	605	647	651	667
Chloride	1	2000.00	16.6	9.8	7.8	7.0	8.0	4.0	32.0	24.0	24.0	26.0	26.0	26.0	26.0	29.0	30.0	30.0	35.0
Fluoride	0.1	-	0.5	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Magnesium	1		140.0	96.6	127.0	70.0	69.9	62.3	128.0	126.0	127.0	134.0	137.0	148.0	144.0	162.0	152.0	151.0	157.0
Nitrogen, Ammonia as N	0.05	-	0.60	1.22	1.09	1.12	1.27	1.11	0.73	0.55	0.75	0.45	0.45	0.42	0.42	0.38	0.41	0.38	0.37
Nitrite as N		10.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		21.2	20.1	24.3	22.1	21.4	19.2	22.2	21.0	23.0	22.0	22.0	24.0	21.0	24.0	23.0	24.0	23.0
Silica	0.2		18.9	17.8	21.0	16.2	16.5	14.8	21.3	21.1	24.1	23.7	22.6	24.1	23.5	24.4	24.5	24.8	25.1
Sodium	1		42	131	57	223	213	203	73	48	52	49	49	58	54	54	56	58	56
Sulfate	2	3000.00	1900	1350	1830	1080	1080	1010	1680	1830	1860	1830	1870	1880	1900	2040	1990	2070	2160
PHYSICAL PROPERITES																			
Lab Conductivity @ 25°C (umho/cm)	5		3110	2790	3140	2240	2290	2390	3060	3080	3160	3080	3150	3190	3240	3450	3370	3470	3320
Lab pH (std units)	0.01	6.5-8.5	7.50	7.81	7.58	7.48	7.56	7.69	6.87	6.86	7.44	7.44	6.77	6.79	6.71	6.71	6.71	6.67	6.80
Total Dissolved Solids @ 180°C	20	5000.00	3080	2420	2970	1830	1820	1770	2910	2880	3090	3030	3150	3220	3270	3350	3480	3500	3540
Field pH (std units)		6.5-8.5	6.79	6.62	7.02	7.27	7.22	7.12	6.71	6.65	6.65	7.06	6.64	6.63	6.56	6.52	6.75	6.57	**6.28**
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	NM	NM	NM	3,080	3,370	3,360	3,350	3,360	922	3,380	675
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	NM	NM	NM	9.8	9.3	9.2	9.2	9.9	9.8	10.1	9.7
Depth to Water (ft)			35.31	35.5	35.2	33.34	52.91	52.35	66.72	72.52	71.26	69.73	69.4	69.74	68.56	68.19	67.91	70.14	69.82
Total Depth (ft)			66.73	66.73	67	67	90.1	88.4	104.44	114.38	114.6	104.44	104.44	104.44	104.44	104.44	104.44	104.44	104.44
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6451.2	6451.2	6451.2	6451.2	6475.22	6475.22	6492.01	6501.73	6501.73	6501.73	6501.73	6501.73	6501.73	6501.73	6501.73	6501.73	6501.73
WATER ELEVATION			***6415.89***	***6415.70***	***6416.00***	***6417.86***	***6422.31***	***6422.87***	***6425.29***	***6429.21***	***6430.47***	***6432.00***	***6432.33***	***6431.99***	***6433.17***	***6433.54***	***6433.82***	***6431.59***	***6431.91***
TRACE METALS (mg/L)																			
Aluminum	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.20	0.002	0.001	ND	ND	ND	ND	0.001	0.001	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.003
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	ND	0.14	0.12	0.20	0.30	0.30	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	4.740	3.480	3.970	0.090	0.120	0.060	12.800	27.200	27.100	28.000	31.400	37.000	35.200	38.300	40.200	41.500	42.900
Lead	0.001	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	3.01	1.40	3.06	0.15	0.13	0.12	2.15	2.98	2.72	3.47	3.55	3.80	3.79	3.86	4.08	4.01	4.17
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND
Nickel	0.05	-	0.07	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	0.06	0.06	0.06	0.07	0.06
Selenium	0.001	0.05	0.003	0.001	ND	0.002	ND	ND	0.002	ND	ND	ND	ND	ND	0.001	0.002	ND	ND	ND
Uranium	0.0003		10.5000	1.8400	0.8940	0.0576	0.0102	0.0356	1.6000	7.2700	7.0000	7.4600	7.8200	7.0000	7.0000	7.7300	7.1000	6.9000	6.8800
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	0.12	0.03	0.05	ND	ND	0.01	0.03	0.04	0.04	0.07	0.03	0.07	0.03	0.03	0.04	0.03	0.03
TRACE METALS (mg/L) TOTALS																			
Iron	0.03		NM	NM	NM	NM	NM	NM	NM	NM	27.10	28.00	NM	33.90	36.90	40.10	40.00	42.90	43.90
Manganese	0.01		NM	NM	NM	NM	NM	NM	NM	NM	2.72	3.47	NM	3.86	3.98	4.18	4.26	4.16	4.14
RADIONUCLIDES (pCi/L) DISSOLVED																			
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**6050.0**	**6250.0**	**8130.0**	**6720.0**	**5780.0**	**5530.0**	**4380.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	61.9	67.4	75.0	84.2	71.7	1070.0	851.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2190.0	657.0	599.0	637.0	892.0	550.0
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	31.1	21.2	23.8	23.2	91.4	57.1
Radium 226		5.0*	**41.0**	**27.0**	**22.1**	**26.3**	4.7	3.1	**16.9**	**53.0**	**58.0**	**81.0**	**73.0**	**74.0**	**84.0**	**71.0**	**85.0**	**72.0**	**71.0**
Radium 226 precision (±)			2.0	2.0	1.3	2.1	0.7	0.6	1.4	1.7	1.3	2.0	1.4	1.6	1.8	1.7	1.8	14.0	13.0
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**22.8**	**19.3**	**13.2**	**22.8**	**21.9**	**15.8**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.8	1.6	1.1	2.1	4.1	3.1
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**96.8**	**103.3**	**84.2**	**107.8**	**93.9**	**86.8**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	P-4 (Replaced in 2006 approximately 1600 ft east)													
			2001	2002	2006 (REPLACED)	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/1/2001	9/26/2002	9/6/2006	7/26/2007	9/30/2009	10/18/2010	10/6/2011	10/17/2012	5/29/2013	9/24/2013	6/18/2014	9/24/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																
Hardness as CaCO3			NA	385	594	713	588	591	530	538	499	476	430	419	423	444
Alkalinity, Total as CaCO3			NA	104	150	211	177	182	147	128	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		NA	126	183	257	216	222	179	157	144	149	142	145	157	140
Calcium	1		NA	124	191	231	194	197	176	179	165	156	139	138	138	143
Chloride	1	2000.00	NA	4.0	30.0	25.0	12.0	17.0	29.0	38.0	39.0	36.0	24.0	21.0	10.0	8.0
Fluoride	0.1	-	NA	0.6	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Magnesium	1		NA	18.4	28.4	33.0	25.0	24.0	22.0	22.0	21.0	21.0	20.0	18.0	19.0	21.0
Nitrogen, Ammonia as N	0.05	-	NA	0.19	0.23	0.21	0.21	0.21	0.14	0.18	0.15	0.15	0.10	0.16	0.13	0.14
Nitrite as N		10.00	NA	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NA	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	NA	ND	0.40	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		NA	8.3	12.5	11.6	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	9.0
Silica	0.2		NA	24.0	17.5	27.2	31.8	30.5	29.2	29.4	27.2	25.7	26.6	25.7	25.8	25.8
Sodium	1		NA	18	45	38	33	33	35	37	37	35	33	33	33	35
Sulfate	2	3000.00	NA	309	521	547	501	495	428	388	388	382	350	347	360	381
PHYSICAL PROPERITES																
Lab Conductivity @ 25°C (umho/cm)	5		NA	781	1440	1430	1200	1220	1110	1060	1040	1030	972	919	911	953
Lab pH (std units)	0.01	6.5-8.5	NA	8.01	7.72	7.36	7.47	7.78	7.81	7.58	7.62	7.61	7.63	7.58	7.57	7.79
Total Dissolved Solids @ 180°C	20	5000.00	NA	576	1010	1030	947	969	832	825	788	761	695	690	679	722
Field pH (std units)		6.5-8.5	NA	7.20	7.14	7.16	7.28	7.13	7.24	7.59	**6.18**	7.26	7.11	7.32	7.09	6.79
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	1,094	1,212	1,058	3,240	986	562	1,034	551
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	9.3	9.1	10.0	10.2	9.6	9.6	10.2	9.9
Depth to Water (ft)			194.90	194.10	173.80	172.88	169.30	168.59	167.61	166.69	166.30	166.52	166.52	166.19	166.52	166.52
Total Depth (ft)			209	209	231.80	231.80	231.61	231.60	261.00	261.00	261.00	261.00	261.00	261.00	261.00	261.00
Casing ID (in. dia.)			5" pvc	5" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6604.60	6604.60	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07	6595.07
WATER ELEVATION			***6409.70***	***6410.50***	***6421.27***	***6422.19***	***6425.77***	***6426.48***	***6427.46***	***6428.38***	***6428.77***	***6428.55***	***6428.55***	***6428.88***	***6428.55***	***6428.55***
TRACE METALS (mg/L)																
Aluminum	0.1	5.00	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.20	NA	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND	ND	ND
Barium	0.1	-	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND
Cadmium	0.005	0.05	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	NA	0.048	ND	ND	0.130	0.180	0.160	0.140	0.140	0.120	0.130	0.110	0.120	0.130
Lead	0.001	0.10	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00	ND
Manganese	0.01	-	NA	0.09	0.11	0.21	0.16	0.15	0.15	0.14	0.13	0.13	0.11	0.11	0.12	0.12
Mercury	0.001	0.00005	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	NA	ND	0.002	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND
Uranium	0.0003		NA	0.0334	0.0268	0.0124	0.0027	0.0023	0.0017	0.0011	0.0011	0.0012	0.0016	0.0016	0.0010	0.0009
Vanadium	0.1	0.10	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	NA	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TRACE METALS (mg/L) TOTALS																
Iron	0.03		NM	NM	NM	NM	NM	0.18	0.16	NM	0.13	0.15	0.15	0.13	0.13	0.13
Manganese	0.01		NM	NM	NM	NM	NM	0.15	0.02	NM	0.13	0.12	0.11	0.11	0.11	0.12
RADIONUCLIDES (pCi/L) DISSOLVED																
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	NM	9.4	**15.4**	**23.0**	**19.8**	**19.8**	11.6	14.2
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	2.3	3.4	2.6	2.9	2.6	3.3	4.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	12.8	17.7	14.0	16.5	14.8	15.6
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	4.6	2.3	2.5	2.7	2.6	2.8
Radium 226		5.0*	NA	**22.0**	4.2	**5.4**	3.7	4.1	**5.6**	3.8	3.2	3.1	3.2	3.4	2.5	3.1
Radium 226 precision (±)			NA	1.8	0.7	0.8	0.6	0.4	0.6	0.4	0.4	0.4	0.4	0.4	0.6	0.7
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	**8.0**	**5.7**	3.3	4.7	**5.3**	**7.8**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	1.6	1.1	0.8	1.4	1.4	1.8
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	**11.2**	**8.8**	**6.5**	**8.1**	**7.8**	**10.9**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	JOHNNY POTATOES SOUTH													
			2003	2004	2006	2007	2009	2010	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/5/2003	12/20/2004	9/6/2006	7/24/2007	9/29/2009	10/18/2010	10/6/2011	10/17/2012	5/29/2013	9/24/2013	6/18/2014	9/24/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																
Hardness as CaCO3			615	911	633	753	840	883	940	938	978	1896	1899	1746	1869	1908
Alkalinity, Total as CaCO3			180	338	234	253	309	347	325	316	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		219	412	285	309	377	423	397	386	423	903	900	773	832	754
Calcium	1		195	283	200	239	267	281	299	298	309	637	622	569	618	614
Chloride	1	2000.00	23.4	79.0	40.0	40.0	56.0	63.0	69.0	56.0	63.0	232.0	180.0	150.0	157.0	172.0
Fluoride	0.1	-	0.5	0.3	0.3	0.5	0.4	0.3	0.4	0.4	0.4	0.2	0.1	0.2	0.2	0.2
Magnesium	1		31.1	49.7	32.3	37.9	42.0	44.0	47.0	47.0	50.0	74.0	84.0	79.0	79.0	91.0
Nitrogen, Ammonia as N	0.05	-	0.27	0.54	0.37	0.34	0.39	0.47	0.45	0.48	0.46	0.23	0.24	0.33	0.33	0.38
Nitrite as N		10.00	ND	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	2.10	3.00	3.00	2.00	3.10	4.80	4.50	ND	ND	0.40	ND	ND
Potassium	1		16.9	21.1	14.2	16.3	17.0	18.0	19.0	19.0	19.0	22.0	22.0	23.0	21.0	21.0
Silica	0.2		16.4	22.1	19.4	19.8	21.2	15.2	24.5	25.0	23.2	34.1	29.2	30.7	29.6	30.3
Sodium	1		82	117	90	99	102	114	118	119	119	275	320	242	275	300
Sulfate	2	3000.00	614	705	556	644	729	760	797	734	785	1570	1660	1490	1600	1660
PHYSICAL PROPERITES																
Lab Conductivity @ 25°C (umho/cm)	5		1480	1910	1670	1700	1850	1980	2070	1920	2020	3970	4090	3650	3820	3760
Lab pH (std units)	0.01	6.5-8.5	8.02	6.99	7.55	6.86	7.65	7.66	7.63	6.93	7.01	6.68	6.69	6.66	6.69	6.87
Total Dissolved Solids @ 180°C	20	5000.00	1100	1480	1200	1280	1390	1550	1620	1550	1660	3460	3420	3110	3280	3180
Field pH (std units)		6.5-8.5	NA	NA	6.86	6.80	6.84	**6.17**	6.80	7.24	6.75	**6.45**	**6.47**	**6.29**	7.33	6.58
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	2,020	2,160	1,405	2,639	3,930	3,670	3,450	1,441
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	10.7	10.2	13.2	12.0	10.4	10.8	12.8	10.2
Depth to Water (ft)			114.10	114.10	114.00	114.00	115.00	115.75	NM	NM	NM	NM	NM	NM	NM	NM
Total Depth (ft)			365.00	365.00	365.00	365.00	364.40	364.40	364.40	364.40	364.40	364.40	364.40	364.40	364.40	364.40
Casing ID (in. dia.)			9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel	9" steel
TOC Elevation			6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70	6507.70
WATER ELEVATION			***6393.60***	***6393.60***	***6393.70***	***6393.70***	***6392.70***	***6391.95***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***
TRACE METALS (mg/L)																
Aluminum	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND
Arsenic	0.001	0.20	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.008	0.006	0.004	0.008	0.010
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.594	4.070	0.220	0.600	1.060	1.600	1.480	1.020	1.540	8.940	21.900	3.170	9.070	8.630
Lead	0.001	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.19	0.35	0.18	0.21	0.28	0.27	0.33	0.30	0.31	0.94	0.90	0.67	0.85	0.90
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		0.20	ND	0.10	0.10	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	0.002	0.001	ND	ND	ND	ND	ND	ND	ND	0.002	ND	0.003	ND
Uranium	0.0003		0.0156	0.0158	0.0055	0.0062	0.0075	0.0120	0.0098	0.0063	0.0073	0.0119	0.0078	0.0130	0.0071	0.0054
Vanadium	0.1	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.00	0.16	0.01	0.01	0.01	0.02	0.04	0.03	0.01	0.01	0.02	0.01	0.01	ND	ND
TRACE METALS (mg/L) TOTALS																
Iron	0.03		NM	NM	NM	NM	NM	1.60	1.48	NM	1.58	9.73	22.40	3.37	9.15	8.86
Manganese	0.01		NM	NM	NM	NM	NM	0.27	0.33	NM	0.33	0.90	0.99	0.72	0.86	0.88
RADIONUCLIDES (pCi/L) DISSOLVED																
Gross Alpha		15.00	NM	NM	NM	NM	NM	NM	NM	**41.4**	**51.5**	**48.9**	**94.0**	**103.0**	**64.9**	**70.9**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	4.8	6.6	11.2	13.9	11.9	18.9	19.2
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	51.3	59.2	58.7	67.6	49.3	61.0
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	5.3	10.7	14.9	10.2	10.8	11.4
Radium 226		5.0*	**8.4**	**18.9**	**9.2**	**12.8**	**10.0**	**11.0**	**15.0**	**13.0**	**11.0**	**18.0**	**17.0**	**24.0**	**14.0**	**16.0**
Radium 226 precision (±)			0.8	1.4	1.3	1.2	0.9	0.6	0.9	0.7	0.6	0.8	0.8	0.9	2.7	3.0
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	**20.2**	**19.9**	**19.7**	**36.3**	**20.8**	**22.4**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	1.7	1.4	1.3	2.4	2.9	4.2
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	**31.2**	**37.9**	**36.7**	**60.3**	**34.8**	**38.4**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	Sunset Stormwater Impoundment (Pit reclaimed ~2001)				Sagebrush/ Tablestakes Stormwater Impoundment (Pits reclaimed ~2002)					2 RS PIT							
			2001 (Pit Sample)	Spring 2014	Fall 2014	Spring 2015	2001 (Pit Sample)	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			11/3/2001	6/19/2014	9/24/2014	6/11/2015	11/13/2001	6/19/2014	9/24/2014	6/11/2015	9/21/2015	10/5/2011	10/17/2012	5/29/2013	9/25/2013	6/19/2014	9/25/2014	6/8/2015	9/22/2015
MAJOR IONS (mg/L)																			
Hardness as CaCO3			3646	258	210	166	2400	209	287	234	1199	574	606	615	629	558	566	538	578
Alkalinity as CaCO3			ND	NM	NM	NM	85	NM	NM	NM	NM	35	NM	NM	NM	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		ND	78	111	100	103	63	81	57	88	42	52	60	50	56	50	58	41
Calcium	1		645	90	74	60	650	67	95	77	381	182	193	195	199	179	179	171	182
Chloride	1	2,000	70.7	ND	ND	ND	67.1	ND	ND	ND	4.0	7.0	7.0	7.0	9.0	6.0	7.0	6.0	7.0
Fluoride	0.10	-	2.1	0.1	0.1	0.1	0.5	0.2	0.2	0.1	0.6	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Magnesium	1		496	8	6	4	189	10	12	10	60	29	30	31	32	27	29	27	30
Nitrogen, Ammonia as N	0.05	-	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	ND	NM	NM	NM	ND	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM
Potassium	1		79	11	8	5	40	6	9	5	46	20	20	20	20	19	20	20	20
Silica	0.2		46.4	1.1	1.9	4.9	1.8	5.1	1.2	5.9	4.3	ND	0.3	1.0	0.3	2.6	0.7	3.2	0.5
Sodium	1		159	2	2	1	135	3	3	4	25	85	86	90	93	82	85	84	87
Sulfate	2	3,000	**4140**	206	124	90	2590	165	223	190	1150	750	716	725	816	674	720	643	738
PHYSICAL PROPERITES																			
Lab Conductivity (umhos/cm)	5		5440	555	427	347	3850	456	578	492	2000	1430	1430	1410	1530	1390	1390	1310	1420
Lab pH	0.01	6.5-8.5	**3.80**	8.24	8.21	7.97	7.70	7.98	8.44	7.68	**8.51**	7.94	8.11	8.05	8.10	8.29	**8.62**	8.05	8.50
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	**6010**	378	290	238	3820	297	417	366	1850	1120	1150	1160	1240	1060	1100	1010	1110
Field Conductivity (µS)			NM	548	384	364	NM	467	697	506	1931	1446	1369	1494	1611	1330	1586	1353	1447
Field pH		6.5-8.5	NM	8.24	8.11	8.05	NM	7.99	8.20	7.96	**9.27**	6.80	8.13	7.16	6.86	8.26	**8.66**	**8.51**	**9.03**
Field Temperature (°C)			NM	18.7	21.0	15.4	NM	11.2	18.5	16.5	23.6	15.5	8.5	13.5	11.4	16.5	17.9	20.4	18.1
Field Turbidity (NTU)			NM	6.3	10.1	69.0	NM	9.6	4.2	52.7	12.6	NM	2.8	29.1	NM	6.6	NM	5.7	NM
Monument Height			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6502.91	6502.91	6502.91	6502.91	6502.91
Water level (Foresight SWL-backsight monument)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NM	NM	NM	5.50	1.87	3.01	1.40	3.06
WATER SURFACE ELEVATION (MH-WL)			***6489.90***	***NA***	***NA***	***NA***	***6410.00***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***6497.41***	***6501.04***	***6499.90***	***6501.51***	***6499.85***
TRACE METALS (mg/L)																			
Aluminum	0.1	5.0	**21.4**	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.001	0.002	0.003	0.001	0.002	0.002	0.001	0.001	0.009	0.003	0.001	ND	0.002	0.001	0.001	0.001	0.001
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.15	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	0.12	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	6.41	ND	ND	ND	0.14	ND	ND	ND	0.18	1.09	ND	ND	ND	ND	ND	0.04	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	25.40	ND	ND	ND	0.20	ND	ND	ND	0.50	0.06	ND	ND	ND	ND	ND	0.01	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	2.58	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	**0.210**	0.010	0.009	0.012	0.014	0.006	0.006	0.013	0.005	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002
Uranium	0.0003		46.300	0.302	0.387	0.340	3.930	0.158	0.265	0.154	0.344	0.570	0.487	0.515	0.498	0.429	0.385	0.378	0.379
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.93	ND	ND	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																			
Iron	0.03		NM	0.30	0.36	3.30	NM	0.29	0.18	2.10	1.71	1.09	ND	0.42	0.88	1.28	1.16	ND	0.04
Manganese	0.01		NM	ND	0.01	0.02	NM	0.01	ND	0.06	0.61	0.06	ND	0.01	ND	0.03	0.01	ND	ND
RADIONUCLIDES (pCi/L) DISSOLVED																			
Gross Alpha		15	NM	**179.0**	**201.0**	**170.0**	NM	**101.0**	**186.0**	**71.2**	**226.0**	NM	**331.0**	**385.0**	**375.0**	**233.0**	**261.0**	**239.0**	**225.0**
Gross Alpha precision (±)			NM	6.7	4.9	33.2	NM	3.9	5.1	14.2	45.7	NM	7.7	10.3	10.7	8.1	8.7	47.2	44.5
Gross Beta			NM	27.9	48.2	78.7	NM	19.2	39.9	34.8	64.0	NM	84.4	96.4	102.0	35.8	43.1	62.6	57.1
Gross Beta precision (±)			NM	3.8	2.7	8.3	NM	2.1	2.6	4.0	8.0	NM	3.0	4.2	5.8	3.9	4.3	7.1	6.4
Radium 226		5.0*	43.0	6.8	5.2	3.7	4.9	2.8	3.7	3.1	5.3	6.8	3.8	3.9	3.4	3.8	5.0	3.1	3.5
Radium 226 precision (±)			2.0	0.6	0.5	0.8	0.4	0.4	0.4	0.7	1.1	0.5	0.5	0.4	0.4	0.4	0.5	0.7	0.8
Radium 228		5.0*	NM	1.5	<2.7	<1.2	NM	<1.1	4.8	2.0	3.0	NM	1.4	<2.0	3.3	1.2	3.3	1.7	2.2
Radium 228 precision (±)			NM	0.7	1.6	0.8	NM	0.7	1.6	0.9	0.9	NM	0.8	1.3	0.9	0.7	1.2	0.9	0.9
Combined Radium 226 & Radium 228		5.0*	NA	**8.3**	NA	NA	NA	NA	**8.5**	**5.1**	**8.3**	NA	**5.2**	NA	**6.7**	**5.0**	**8.3**	**4.8**	**5.7**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	Andrea Hunter				
			Fall 2012	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/17/2012	6/19/2014	9/24/2014	6/8/2015	9/22/2015
MAJOR IONS (mg/L)							
Hardness as CaCO3			750	149	124	214	698
Alkalinity as CaCO3			NM	NM	NM	NM	NM
Carbonate	5		ND	17	ND	ND	ND
Bicarbonate	5		101	18	32	73	135
Calcium	1		269	53	43	74	243
Chloride	1	2,000	7.0	ND	ND	ND	8.0
Fluoride	0.10	-	0.6	0.2	0.3	0.2	0.5
Magnesium	1		19	4	4	7	22
Nitrogen, Ammonia as N	0.05	-	0.13	ND	ND	ND	0.08
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	NM	NM	NM	NM
Potassium	1		25	6	8	8	31
Silica	0.2		2.3	3.5	7.6	6.6	7.5
Sodium	1		10	2	1	3	14
Sulfate	2	3,000	623	114	92	175	617
PHYSICAL PROPERITES							
Lab Conductivity (umhos/cm)	5		1290	327	273	467	1310
Lab pH	0.01	6.5-8.5	7.44	**9.68**	**9.57**	7.96	7.16
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	1080	219	201	318	1100
Field Conductivity (µS)			1284	325	343	4456	1336
Field pH		6.5-8.5	7.80	9.73	9.71	8.36	7.33
Field Temperature (°C)			5.2	16.3	15.2	27.0	27.3
Field Turbidity (NTU)			217.0	3.1	4.5	4.3	346.0
Monument Height			NA	6517.40	6517.40	6517.40	6517.40
Water level (Foresight SWL-backsight monument)			NM	3.09	NM	3.66	NM
WATER SURFACE ELEVATION (MH-WL)			***NA***	***6514.31***	***NA***	***6513.74***	***NA***
TRACE METALS (mg/L)							
Aluminum	0.1	5.0	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.004	0.009	0.036	0.008	0.029
Barium	0.1	-	0.2	ND	ND	ND	0.3
Boron	0.1	5.0	ND	ND	ND	ND	0.10
Cadmium	0.005	0.05	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND
Iron	0.03	-	ND	0.06	0.17	ND	0.46
Lead	0.001	0.1	ND	ND	ND	ND	ND
Manganese	0.01	-	1.36	ND	ND	0.02	2.10
Mercury	0.001	0.00005	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.002	0.005	0.004	0.008	0.005
Uranium	0.0003		0.181	0.065	0.082	0.216	0.315
Vanadium	0.1	0.1	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)							
Iron	0.03		5.03	0.38	0.65	0.21	35.90
Manganese	0.01		1.46	0.02	0.04	0.03	2.40
RADIONUCLIDES (pCi/L) DISSOLVED							
Gross Alpha		15	**162.0**	**36.5**	**55.4**	**120.0**	**239.0**
Gross Alpha precision (±)			6.4	2.5	2.7	23.6	47.4
Gross Beta			68.6	22.6	17.7	30.6	59.5
Gross Beta precision (±)			3.8	2.0	2.1	3.6	6.8
Radium 226		5.0*	11.0	1.4	0.4	4.6	25.0
Radium 226 precision (±)			0.8	0.3	0.1	1.0	4.8
Radium 228		5.0*	1.9	<1.2	<2.1	<1.5	3.7
Radium 228 precision (±)			0.8	0.7	1.3	0.8	1.1
Combined Radium 226 & Radium 228		5.0*	**12.9**	NA	NA	NA	**28.7**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines (Livestock)	Area 5 North Pit (5F-1)								Area 4 South Pit (4-R Pit)							
			Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/5/2011	10/17/2012	6/4/2013	9/25/2013	6/24/2014	9/24/2014	6/9/2015	9/21/2015	10/5/2011	10/17/2012	6/4/2013	9/24/2013	6/24/2014	9/24/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																		
Hardness as CaCO3			1735	1870	1860	1871	1779	1809	1845	1882	863	869	880	904	799	825	804	829
Alkalinity as CaCO3			114	NM	NM	NM	NM	NM	NM	NM	59	NM	NM	NM	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		139	159	176	151	170	154	180	144	72	81	83	885	78	76	86	74
Calcium	1		548	589	585	586	559	566	579	592	278	282	283	291	259	266	261	266
Chloride	1	2,000	24	25	24	28	25	26	24	28	13	14	12	15	13	13	12	13
Fluoride	0.1	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Magnesium	1		89	97	97	99	93	96	97	98	41	40	42	43	37	39	37	40
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		29	31	29	28	27	28	30	32	25	24	24	24	22	24	24	23
Silica	0.2		1.4	2.4	2.8	2.2	2.5	2.2	2.5	2.1	9.4	9.1	9.1	8.3	8.5	8.4	8.5	7.2
Sodium	1		205	218	221	221	207	212	224	221	166	159	165	172	151	162	159	166
Sulfate	2	3,000	2050	2220	2100	2230	2170	2190	2070	2280	1190	1160	1110	1240	1090	1090	1030	1080
PHYSICAL PROPERITES																		
Lab Conductivity (umhos/cm)	5		3370	3420	3280	3510	3400	3470	3390	3600	2150	2130	2050	2180	2000	2020	1980	2050
Lab pH	0.01	6.5-8.5	8.24	8.03	8.16	8.09	8.17	8.15	8.06	8.03	8.11	8.06	8.02	8.09	8.01	8.04	7.83	8.04
Total Dissolved Solids @ 180°C	20	5,000	3160	3310	3310	3520	3290	3390	3280	3440	1760	1860	1780	1850	1670	1700	1630	1690
Field Conductivity (µS)			3430	3630	3590	3800	3760	3840	3700	3830	2200	2300	2235	2400	2270	2120	2130	2270
Field pH		6.5-8.5	7.80	8.15	7.64	7.76	8.20	8.21	8.17	8.28	7.81	8.31	7.36	7.31	8.32	7.95	7.83	8.27
Field Temperature (°C)			14.4	9.2	13.1	14.8	19.2	14.8	19.5	16.3	14.2	10.6	13.0	15.0	16.7	14.0	20.6	14.7
Field Turbidity (NTU)			NM	3.42	12.20	NM	20.70	0.80	3.38	NM	NM	3.40	23.50	NM	3.10	1.30	2.84	NM
Monument Height			NA	NA	NA	6397.97	6397.97	6397.97	6401.34	6401.34	NA	NA	NA	6450.08	6450.08	6450.08	6462.08	6462.08
Water level (Foresight SWL-backsight monument)			NM	NM	NM	3.80	1.48	2.00	3.56	4.42	NM	NM	NM	4.50	NM	NM	9.30	10.60
WATER SURFACE ELEVATION (MH-WL)			***NA***	***NA***	***NA***	***6394.17***	***6396.49***	***6395.97***	***6397.78***	***6396.92***	***NA***	***NA***	***NA***	***6445.58***	***NA***	***NA***	***6452.78***	***6451.48***
TRACE METALS (mg/L)																		
Aluminum	0.1	5.0	ND	ND	1.00	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.003	0.001	0.002	0.004	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.2	ND	0.1	ND	0.1	0.1	ND	0.1	0.1	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.06	ND	0.20	ND	ND	ND	ND	ND	0.04	ND	0.05	ND	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.10	0.16	0.23	0.09	0.22	0.12	0.22	0.08	ND	ND	0.01	ND	0.02	ND	0.02	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.018	0.014	0.017	0.014	0.013	0.012	0.014	0.013	0.017	0.014	0.016	0.015	0.013	0.012	0.013	0.013
Uranium	0.0003		0.812	0.824	0.962	0.907	0.924	0.892	0.940	0.927	0.308	0.280	0.296	0.289	0.271	0.252	0.263	0.261
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	0.01	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																		
Iron	0.03		0.06	0.07	0.09	0.58	0.05	0.04	0.08	0.19	0.04	0.06	0.05	0.10	0.10	ND	0.12	ND
Manganese	0.01		0.10	0.16	0.25	0.10	0.24	0.13	0.23	0.09	ND	ND	0.01	ND	0.02	ND	0.02	ND
RADIOMETRICS (pCi/L) DISSOLVED																		
Gross Alpha		15	NM	**919.0**	**731.0**	**911.0**	**656.0**	**717.0**	**679.0**	**655.0**	NM	**290.0**	**251.0**	**248.0**	**221.0**	**205.0**	**173.0**	**172.0**
Gross Alpha precision (±)			NM	25.6	25.8	26.2	30.0	24.2	135.0	130.0	NM	10.9	12.0	10.3	10.3	9.6	35.3	35.0
Gross Beta			NM	154.0	179.0	155.0	232.0	134.0	97.9	110.0	NM	68.9	102.0	62.2	38.5	57.5	42.4	36.0
Gross Beta precision (±)			NM	11.2	12.9	11.5	22.1	11.7	12.0	13.4	NM	5.7	7.6	6.2	5.7	5.8	5.9	4.9
Radium 226		5.0*	2.0	1.7	1.7	1.8	1.9	1.9	1.5	1.8	1.3	1.4	1.3	1.8	1.9	1.4	1.5	1.7
Radium 226 precision (±)			0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.2	0.2	0.2	0.3	0.4	0.3	0.4	0.4
Radium 228		5.0*	NM	0.9	<1.8	<1.5	1.4	<2.3	<1.3	2.4	NM	1.6	2.1	1.6	<1.8	<2.3	1.6	1.9
Radium 228 precision (±)			NM	0.7	1.1	1.0	0.7	1.4	0.8	1.0	NM	0.8	1.2	0.8	1.2	1.5	0.9	0.8
Combined Radium 226/228		5.0*	NA	2.6	NA	NA	3.3	NA	NA	4.2	NA	3.0	3.4	3.4	NA	NA	3.1	3.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines (Livestock)	Area 5 North Pit (5F-1)								Area 4 South Pit (4-R Pit)							
			Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/5/2011	10/17/2012	6/4/2013	9/25/2013	6/24/2014	9/24/2014	6/9/2015	9/21/2015	10/5/2011	10/17/2012	6/4/2013	9/24/2013	6/24/2014	9/24/2014	6/9/2015	9/21/2015
MAJOR IONS (mg/L)																		
Hardness as CaCO3			1735	1870	1860	1871	1779	1809	1845	1882	863	869	880	904	799	825	804	829
Alkalinity as CaCO3			114	NM	NM	NM	NM	NM	NM	NM	59	NM	NM	NM	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		139	159	176	151	170	154	180	144	72	81	83	885	78	76	86	74
Calcium	1		548	589	585	586	559	566	579	592	278	282	283	291	259	266	261	266
Chloride	1	2,000	24	25	24	28	25	26	24	28	13	14	12	15	13	13	12	13
Fluoride	0.1	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Magnesium	1		89	97	97	99	93	96	97	98	41	40	42	43	37	39	37	40
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		29	31	29	28	27	28	30	32	25	24	24	24	22	24	24	23
Silica	0.2		1.4	2.4	2.8	2.2	2.5	2.2	2.5	2.1	9.4	9.1	9.1	8.3	8.5	8.4	8.5	7.2
Sodium	1		205	218	221	221	207	212	224	221	166	159	165	172	151	162	159	166
Sulfate	2	3,000	2050	2220	2100	2230	2170	2190	2070	2280	1190	1160	1110	1240	1090	1090	1030	1080
PHYSICAL PROPERITES																		
Lab Conductivity (umhos/cm)	5		3370	3420	3280	3510	3400	3470	3390	3600	2150	2130	2050	2180	2000	2020	1980	2050
Lab pH	0.01	6.5-8.5	8.24	8.03	8.16	8.09	8.17	8.15	8.06	8.03	8.11	8.06	8.02	8.09	8.01	8.04	7.83	8.04
Total Dissolved Solids @ 180°C	20	5,000	3160	3310	3310	3520	3290	3390	3280	3440	1760	1860	1780	1850	1670	1700	1630	1690
Field Conductivity (µS)			3430	3630	3590	3800	3760	3840	3700	3830	2200	2300	2235	2400	2270	2120	2130	2270
Field pH		6.5-8.5	7.80	8.15	7.64	7.76	8.20	8.21	8.17	8.28	7.81	8.31	7.36	7.31	8.32	7.95	7.83	8.27
Field Temperature (°C)			14.4	9.2	13.1	14.8	19.2	14.8	19.5	16.3	14.2	10.6	13.0	15.0	16.7	14.0	20.6	14.7
Field Turbidity (NTU)			NM	3.42	12.20	NM	20.70	0.80	3.38	NM	NM	3.40	23.50	NM	3.10	1.30	2.84	NM
Monument Height			NA	NA	NA	6397.97	6397.97	6397.97	6401.34	6401.34	NA	NA	NA	6450.08	6450.08	6450.08	6462.08	6462.08
Water level (Foresight SWL-backsight monument)			NM	NM	NM	3.80	1.48	2.00	3.56	4.42	NM	NM	NM	4.50	NM	NM	9.30	10.60
WATER SURFACE ELEVATION (MH-WL)			***NA***	***NA***	***NA***	***6394.17***	***6396.49***	***6395.97***	***6397.78***	***6396.92***	***NA***	***NA***	***NA***	***6445.58***	***NA***	***NA***	***6452.78***	***6451.48***
TRACE METALS (mg/L)																		
Aluminum	0.1	5.0	ND	ND	1.00	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.003	0.001	0.002	0.004	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.2	ND	0.1	ND	0.1	0.1	ND	0.1	0.1	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.06	ND	0.20	ND	ND	ND	ND	ND	0.04	ND	0.05	ND	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.10	0.16	0.23	0.09	0.22	0.12	0.22	0.08	ND	ND	0.01	ND	0.02	ND	0.02	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.018	0.014	0.017	0.014	0.013	0.012	0.014	0.013	0.017	0.014	0.016	0.015	0.013	0.012	0.013	0.013
Uranium	0.0003		0.812	0.824	0.962	0.907	0.924	0.892	0.940	0.927	0.308	0.280	0.296	0.289	0.271	0.252	0.263	0.261
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	0.01	ND	ND	ND	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																		
Iron	0.03		0.06	0.07	0.09	0.58	0.05	0.04	0.08	0.19	0.04	0.06	0.05	0.10	0.10	ND	0.12	ND
Manganese	0.01		0.10	0.16	0.25	0.10	0.24	0.13	0.23	0.09	ND	ND	0.01	ND	0.02	ND	0.02	ND
RADIOMETRICS (pCi/L) DISSOLVED																		
Gross Alpha		15	NM	**919.0**	**731.0**	**911.0**	**656.0**	**717.0**	**679.0**	**655.0**	NM	**290.0**	**251.0**	**248.0**	**221.0**	**205.0**	**173.0**	**172.0**
Gross Alpha precision (±)			NM	25.6	25.8	26.2	30.0	24.2	135.0	130.0	NM	10.9	12.0	10.3	10.3	9.6	35.3	35.0
Gross Beta			NM	154.0	179.0	155.0	232.0	134.0	97.9	110.0	NM	68.9	102.0	62.2	38.5	57.5	42.4	36.0
Gross Beta precision (±)			NM	11.2	12.9	11.5	22.1	11.7	12.0	13.4	NM	5.7	7.6	6.2	5.7	5.8	5.9	4.9
Radium 226		5.0*	2.0	1.7	1.7	1.8	1.9	1.9	1.5	1.8	1.3	1.4	1.3	1.8	1.9	1.4	1.5	1.7
Radium 226 precision (±)			0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.2	0.2	0.2	0.3	0.4	0.3	0.4	0.4
Radium 228		5.0*	NM	0.9	<1.8	<1.5	1.4	<2.3	<1.3	2.4	NM	1.6	2.1	1.6	<1.8	<2.3	1.6	1.9
Radium 228 precision (±)			NM	0.7	1.1	1.0	0.7	1.4	0.8	1.0	NM	0.8	1.2	0.8	1.2	1.5	0.9	0.8
Combined Radium 226/228		5.0*	NA	2.6	NA	NA	3.3	NA	NA	4.2	NA	3.0	3.4	3.4	NA	NA	3.1	3.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-1										
			1989	1993	1996	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			9/21/1989	12/16/1993	6/18/1996	12/15/2011	10/24/2012	5/31/2013	10/1/2013	6/24/2014	9/25/2014	6/9/2015	9/23/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			823	698	739	742	716	731	719	730	729	696	731
Alkalinity, Total as CaCO3			198	213	223	1554	201	NM	NM		NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		242	260	272	187	245	246	235	235	218	239	233
Calcium	1		228	197	209	205	193	199	204	197	193	188	199
Chloride	1	2,000	18.8	15.5	18.2	18.0	18.0	17.0	18.0	19.0	19.0	19.0	20.0
Fluoride	0.1	-	0.40	0.46	0.60	0.40	0.50	0.40	0.40	0.30	0.30	0.40	0.40
Magnesium	1		61.6	50.0	52.7	56.0	57.0	57.0	51.0	58.0	60.0	55.0	57.0
Nitrogen, Ammonia as N	0.05	-	0.18	ND	0.08	0.05	0.08	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	0.02	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			0.01	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		22.0	20.3	19.3	23.0	22.0	22.0	23.0	21.0	21.0	21.0	20.0
Silica	0.2		15.8	13.3	14.3	21.2	17.3	16.6	15.5	15.5	14.4	14.4	15.3
Sodium	1		147	124	128	125	137	137	119	128	128	124	135
Sulfate	2	3,000	894	729	799	893	826	805	827	847	843	838	799
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		1873	1783	1700	1840	1820	1740	1800	1810	1800	1820	1820
Lab pH (std units)	0.01	6.5-8.5	6.86	7.35	7.82	7.47	7.27	7.06	6.94	7.02	6.88	7.06	7.21
Total Dissolved Solids @ 180°C	20	5,000	1504	1307	1390	1460	1390	1430	1420	1440	1460	1460	1440
Field pH (std units)		6.5-8.5	NM	NM	NM	6.79	6.69	**6.38**	6.84	6.94	7.29	7.09	7.79
Field Conductivity (uS/cm)			NM	NM	NM	1858	1847	1875	1734	1821	1813	2990	1760
Field Temperature (°C)			NM	NM	NM	8.7	7.6	10.5	11.9	8.2	8.9	9.5	8.7
Depth to Water (ft)			43.50	46.30	44.36	44.29	43.72	43.27	43.56	43.87	44.29	46.44	43.48
Total Depth (ft)			60.20	60.20	60.20	60.20	60.20	60.20	60.20	60.20	60.20	60.20	60.20
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6971.20	6971.20	6969.56	6969.56	6969.56	6969.56	6969.56	6969.56	6969.56	6969.56	6969.56
WATER ELEVATION			***6927.70***	***6924.90***	***6925.20***	***6925.27***	***6925.84***	***6926.29***	***6926.00***	***6925.69***	***6925.27***	***6923.12***	***6926.08***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	ND	ND	0.009	ND	ND	0.001	ND	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.21	0.19	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND
Iron	0.03	-	0.32	ND	ND	1.35	ND	0.06	0.10	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	0.011	ND	ND	0.001	ND	ND	ND	ND
Manganese	0.01	-	0.89	0.46	0.55	1.00	0.54	0.32	0.14	0.28	0.06	0.08	0.09
Mercury	0.001	0.00005	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND
Uranium	0.0003		0.0310	0.0070	0.0848	0.0183	0.0118	0.0073	0.0077	0.0073	0.0078	0.0086	0.0057
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.07	0.01	ND	0.04	0.02	0.05	0.05	0.02	0.02	0.02	ND
TRACE METALS (mg/L) TOTALS													
Iron	0.03		0.32	ND	ND	1.35	ND	11.60	3.34	19.00	2.37	3.84	4.37
Manganese	0.01		0.89	0.46	0.55	1.00	0.54	1.52	0.26	1.40	0.31	0.57	0.56
RADIONUCLIDES (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	NM	NM	**22.4**	14.6	**21.7**	**18.0**	13.6	**19.8**	12.3
Gross Alpha precision (±)			NM	NM	NM	NM	3.9	4.4	3.9	4.5	3.1	6.6	5.3
Gross Beta			NM	NM	NM	NM	NM	20.9	25.0	24.5	19.4	19.8	23.4
Gross Beta precision (±)			NM	NM	NM	NM	NM	4.4	5.0	4.8	3.9	4.4	5.3
Radium 226		5.0*	3.6	**9.3**	**7.6**	**6.4**	3.4	2.2	1.9	3.8	2.0	2.0	1.6
Radium 226 precision (±)			NM	NM	NM	0.5	0.4	0.3	0.3	0.5	0.3	0.4	0.4
Radium 228		5.0*	NM	NM	NM	NM	NM	3.8	2.0	1.9	4.9	<1.2	1.8
Radium 228 precision (±)			NM	NM	NM	NM	NM	0.9	0.6	0.9	1.5	0.8	0.8
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	**6.0**	3.9	**5.7**	**6.9**	NA	3.4

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-2										
			1989	1993	1996	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			9/9/1989	12/16/1993	6/18/1996	12/15/2011	10/22/2012	5/31/2013	9/24/2013	6/23/2014	9/25/2014	6/9/2015	9/23/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			1178	1095	1174	976	1007	1011	1006	997	992	1018	1013
Alkalinity, Total as CaCO3			339	340	360	331	369	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		414	415	439	404	450	451	473	472	449	453	415
Calcium	1		350	327	357	292	306	301	299	297	295	304	302
Chloride	1	2,000	23.6	21.1	26.0	24.0	25.0	25.0	25.0	27.0	27.0	29.0	29.0
Fluoride	0.1	-	0.30	0.24	0.30	0.30	0.30	0.30	0.30	0.20	0.20	0.30	0.30
Magnesium	1		74.0	67.7	68.6	60.0	59.0	63.0	63.0	62.0	62.0	63.0	63.0
Nitrogen, Ammonia as N	0.05	-	0.48	0.11	0.15	0.11	0.13	0.10	0.13	0.06	0.09	0.07	0.10
Nitrite as N		10.0	0.05	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			0.01	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		20.0	17.4	18.1	19.0	20.0	21.0	19.0	18.0	18.0	20.0	18.0
Silica	0.2		38.5	33.9	39.9	40.7	38.9	39.3	38.7	38.9	38.3	33.6	39.7
Sodium	1		54	51	46	43	46	50	49	48	47	50	48
Sulfate	2	3,000	904	780	793	712	700	707	697	717	728	755	727
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		2003	1967	1790	1750	1810	1780	1820	1830	1820	1840	1860
Lab pH (std units)	0.01	6.5-8.5	6.78	6.79	7.26	7.79	6.90	6.87	6.92	6.83	6.89	6.89	6.86
Total Dissolved Solids @ 180°C	20	5,000	1762	1614	1420	1450	1490	1500	1480	1530	1520	1570	1550
Field pH (std units)		6.5-8.5	NM	NM	NM	6.80	**6.47**	6.74	6.69	6.63	6.63	6.72	6.57
Field Conductivity (uS/cm)			NM	NM	NM	1858	1860	1849	2320	1847	1847	1904	1832
Field Temperature (°C)			NM	NM	NM	9.1	9.4	10.3	10.7	11.0	11.0	10.4	12.0
Depth to Water (ft)			128.40	117.30	109.58	78.02	76.25	76.48	73.24	77.00	76.51	76.85	76.62
Total Depth (ft)			165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00	165.00
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			7016.50	7016.50	7015.18	7015.18	7015.18	7015.18	7015.18	7015.18	7015.18	7015.18	7015.18
WATER ELEVATION			***6888.10***	***6899.20***	***6905.60***	***6937.16***	***6938.93***	***6938.70***	***6941.94***	***6938.18***	***6938.67***	***6938.33***	***6938.56***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.001	ND	ND	0.005	ND	ND	0.002	0.001	ND	ND	ND
Barium	0.1	-	ND	ND	ND	nd	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.12	0.16	0.14	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	9.30	5.98	11.10	15.60	9.54	10.40	9.48	8.40	10.10	8.33	10.00
Lead	0.001	0.1	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	1.10	0.90	1.18	1.20	1.03	1.04	0.99	0.90	0.99	1.03	1.00
Mercury	0.001	0.00005	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.008	ND	ND	0.005	ND	ND	ND	ND	0.001	0.002	ND
Uranium	0.0003		0.0840	0.0760	0.0584	0.0646	0.0404	0.0379	0.0364	0.0319	0.0382	0.0352	0.0325
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.20	ND	0.02	0.09	0.04	0.04	0.03	0.02	0.06	0.02	0.02
TRACE METALS (mg/L) TOTALS													
Iron	0.03		9.30	5.98	11.10	15.60	9.54	12.10	13.80	12.60	13.00	12.70	12.70
Manganese	0.01		ND	ND	ND	NA	ND	1.09	1.01	1.12	1.04	1.07	1.03
RADIONUCLIDES (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	NM	NM	**70.8**	**49.2**	**86.5**	**63.5**	**57.0**	**43.2**	**41.1**
Gross Alpha precision (±)			NM	NM	NM	NM	5.7	5.4	6.7	7.4	6.5	10.0	11.7
Gross Beta			NM	NM	NM	NM	NM	40.6	37.6	32.9	38.1	4.4	38.4
Gross Beta precision (±)			NM	NM	NM	NM	NM	5.7	4.8	7.8	5.4	31.2	6.8
Radium 226		5.0*	**16.2**	**14.9**	**16.8**	**25.0**	**23.0**	**14.0**	**17.0**	**16.0**	**18.0**	**6.0**	**17.0**
Radium 226 precision (±)			NM	NM	NM	1.0	1.1	0.7	0.8	0.7	0.8	8.3	3.2
Radium 228		5.0*	NM	NM	NM	NM	NM	**14.0**	**9.8**	**9.3**	**15.7**	**15.0**	**7.7**
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.7	1.4	1.0	1.9	2.9	1.7
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	**28.0**	**26.8**	**25.3**	**33.7**	**21.0**	**24.7**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-3										
			1989	1993	1996	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			9/20/1989	12/17/1993	6/18/1996	12/15/2011	10/24/2012	5/31/2013	10/1/2013	6/25/2014	9/26/2014	6/9/2015	9/23/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			1455	820	414	922	1065	1283	1067	1957	1243	1102	1061
Alkalinity, Total as CaCO3			262	222	184	221	252	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		320	271	224	270	307	313	304	807	341	272	322
Calcium	1		449	251	116	282	321	390	335	632	384	339	321
Chloride	1	2,000	11.9	5.1	6.2	10.0	15.0	17.0	17.0	21.0	24.0	18.0	21.0
Fluoride	0.1	-	0.40	0.30	1.22	0.40	0.40	0.40	0.40	0.20	0.40	0.40	0.40
Magnesium	1		81.0	46.9	30.3	53.0	64.0	75.0	56.0	92.0	69.0	62.0	63.0
Nitrogen, Ammonia as N	0.05	-	0.43	0.17	nd	0.24	0.18	0.15	0.08	0.28	0.12	ND	0.11
Nitrite as N		10.0	0.02	ND	nd	0.40	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.02	ND	ND	NM	ND	ND	0.20	ND	ND	ND	ND
Potassium	1		23.0	16.0	15.2	18.0	18.0	19.0	18.0	35.0	19.0	19.0	18.0
Silica	0.2		15.6	20.6	10.6	22.3	21.1	19.2	19.3	19.1	21.9	20.6	24.4
Sodium	1		67	60	34	48	54	57	48	38	51	52	52
Sulfate	2	3,000	1249	738	312	815	963	975	950	1420	1090	952	883
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		2332	1708	874	1720	1980	2000	1960	2960	2110	1930	1930
Lab pH (std units)	0.01	6.5-8.5	6.66	7.12	7.80	7.01	7.02	7.09	6.97	6.60	6.93	7.13	6.99
Total Dissolved Solids @ 180°C	20	5,000	2222	1303	633	1400	1680	1780	1650	2770	1880	1670	1670
Field pH (std units)		6.5-8.5	NM	NM	NM	6.86	6.58	6.52	6.83	**6.42**	7.30	7.08	7.02
Field Conductivity (uS/cm)			NM	NM	NM	1770	2060	2040	2020	2960	2100	2400	1871
Field Temperature (°C)			NM	NM	NM	8.9	7.1	10.0	12.2	17.3	17.4	14.4	14.5
Depth to Water (ft)			174.60	166.10	161.78	139.12	134.25	134.22	134.06	135.69	136.35	135.94	136.63
Total Depth (ft)			198.00	198.00	197.50	197.50	197.50	197.50	197.50	197.50	197.50	197.50	197.50
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			7037.40	7037.40	7035.38	7035.38	7035.38	7035.38	7035.38	7035.38	7035.38	7035.38	7035.38
WATER ELEVATION			***6862.80***	***6871.30***	***6873.60***	***6896.26***	***6901.13***	***6901.16***	***6901.32***	***6899.69***	***6899.03***	***6899.44***	***6898.75***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	ND	ND	0.3	ND	ND	ND	ND	0.2	ND	ND
Arsenic	0.001	0.2	0.002	ND	ND	0.004	ND	ND	0.002	0.001	0.002	0.001	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.12	0.12	0.20	0.10	0.10	0.10	0.10	ND	0.10	0.10	0.10
Cadmium	0.005	0.05	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.85	ND	0.05	1.45	1.62	0.16	0.04	8.52	2.61	ND	0.91
Lead	0.001	0.1	ND	ND	ND	0.015	ND	0.003	ND	ND	0.003	ND	ND
Manganese	0.01	-	1.80	0.60	0.07	0.85	1.12	1.05	0.99	3.60	1.20	0.85	1.08
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		0.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.14	ND	ND	ND	ND	ND	ND	0.19	0.06	0.06	ND
Selenium	0.001	0.05	0.003	ND	ND	ND	ND	ND	ND	0.002	ND	0.001	ND
Uranium	0.0003		0.2780	0.0120	0.0124	0.0086	0.0084	0.0082	0.0057	2.9100	0.0137	0.0117	0.0296
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.72	0.04	ND	0.14	0.76	0.22	0.03	0.07	0.06	0.28	0.27
TRACE METALS (mg/L) TOTALS													
Iron	0.03		0.85	ND	0.05	1.45	1.62	10.80	0.03	14.60	6.16	7.40	6.49
Manganese	0.01		1.80	0.60	0.07	0.85	1.12	1.11	0.01	3.73	1.21	0.94	1.08
RADIONUCLIDES (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	NM	NM	**24.1**	**27.6**	**14.2**	**2130.0**	**96.8**	**18.2**	**39.2**
Gross Alpha precision (±)			NM	NM	NM	NM	4.4	5.2	4.1	41.8	8.6	6.8	10.4
Gross Beta			NM	NM	NM	NM	NM	25.8	22.1	272.0	96.4	24.1	29.6
Gross Beta precision (±)			NM	NM	NM	NM	NM	5.3	4.9	15.9	6.9	5.6	5.8
Radium 226		5.0*	**6.3**	**5.6**	1.4	**45.0**	3.9	**6.3**	3.2	**20.0**	**20.0**	5.0	**10.0**
Radium 226 precision (±)			NM	NM	NM	1.3	0.4	0.5	0.3	1.1	0.7	1.0	2.0
Radium 228		5.0*	NM	NM	NM	NM	NM	**11.4**	**7.2**	**7.1**	**12.1**	4.4	**6.4**
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.2	0.8	1.0	1.4	1.1	1.5
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	**17.7**	**10.4**	**27.1**	**32.1**	**9.4**	**16.4**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-7										
			1989	1993	1996	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			9/21/1989	12/17/1993	6/18/1996	12/15/2011	10/24/2012	5/31/2013	10/1/2013	6/25/2014	9/26/2014	6/9/2015	9/23/2015
MAJOR IONS (mg/L)													
Hardness as CaCO3			520	357	435	399	401	420	411	404	422	437	420
Alkalinity, Total as CaCO3			156	168	187	165	181	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		191	205	228	201	221	220	230	230	217	222	206
Calcium	1		150	99	122	112	111	117	115	114	118	124	117
Chloride	1	2,000	12.5	6.3	7.2	10.0	9.0	9.0	10.0	11.0	10.0	10.0	11.0
Fluoride	0.1	-	1.20	1.35	1.17	1.20	1.20	1.30	1.20	1.10	1.20	1.20	1.20
Magnesium	1		35.4	26.7	31.7	29.0	30.0	31.0	30.0	29.0	31.0	31.0	31.0
Nitrogen, Ammonia as N	0.05	-	0.09	ND	0.15	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N		10.0	0.06	ND	ND	0.20	ND	NM	NM	NM	NM	NM	NM
Nitrate as N			ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.06	ND	ND	NM	NM	ND	ND	ND	ND	ND	ND
Potassium	1		31.1	17.1	16.5	17.0	17.0	18.0	16.0	16.0	18.0	18.0	16.0
Silica	0.2		10.7	9.9	11.8	10.0	9.9	9.4	10.3	9.9	10.0	10.8	10.0
Sodium	1		37	44	31	30	33	34	30	31	33	32	34
Sulfate	2	3,000	429	329	301	309	303	305	308	312	306	312	318
PHYSICAL PROPERITES													
Lab Conductivity @ 25°C (umho/cm)	5		1056	962	905	904	933	900	919	928	926	919	945
Lab pH (std units)	0.01	6.5-8.5	7.76	7.65	7.89	7.92	7.69	7.61	7.57	7.54	7.57	7.46	7.61
Total Dissolved Solids @ 180°C	20	5,000	760	684	520	630	652	652	647	654	667	655	670
Field pH (std units)		6.5-8.5	NM	NM	NM	7.71	6.67	**6.32**	7.17	7.72	8.14	7.57	8.04
Field Conductivity (uS/cm)			NM	NM	NM	968	906	953	929	903	916	900	906
Field Temperature (°C)			NM	NM	NM	9.9	8.2	9.8	9.7	11.0	10.3	10.4	10.7
Depth to Water (ft)			77.80	83.70	78.16	77.42	77.50	78.29	78.35	77.93	78.88	81.88	78.35
Total Depth (ft)			105.20	105.20	104.40	104.40	104.40	104.40	104.40	104.40	104.40	104.40	104.40
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			7087.40	7087.40	7086.16	7086.16	7086.16	7086.16	7086.16	7086.16	7086.16	7086.16	7086.16
WATER ELEVATION			***7009.60***	***7003.70***	***7008.00***	***7008.74***	***7008.66***	***7007.87***	***7007.81***	***7008.23***	***7007.28***	***7004.28***	***7007.81***
TRACE METALS (mg/L)													
Aluminum	0.1	5.0	ND	0.1	0.2	0.3	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.004	ND	ND	0.009	0.002	0.003	0.004	0.003	0.002	0.004	0.003
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.14	0.16	0.17	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	0.02	ND	ND
Iron	0.03	-	0.11	0.05	0.27	0.37	ND	0.06	0.06	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.08	0.04	0.07	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.08
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		0.0050	0.0080	0.0017	0.0010	0.0025	0.0023	0.0007	0.0118	0.0050	0.0330	0.0115
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.04	ND	ND	ND	ND	0.18	0.01	0.03	0.16	0.01	0.06
TRACE METALS (mg/L) TOTALS													
Iron	0.03		0.11	0.05	0.27	0.37	ND	12.40	5.68	39.70	4.51	5.07	17.30
Manganese	0.01		ND	ND	ND	ND	ND	0.15	0.08	0.47	0.26	0.08	0.30
RADIONUCLIDES (pCi/L) DISSOLVED													
Gross Alpha		15	NM	NM	NM	NM	3.7	3.6	<2.5	11.4	6.5	12.5	11.1
Gross Alpha precision (±)			NM	NM	NM	NM	1.6	1.7	1.6	2.4	1.8	3.8	3.6
Gross Beta			NM	NM	NM	NM	NM	16.4	17.6	18.3	16.9	19.4	14.9
Gross Beta precision (±)			NM	NM	NM	NM	NM	2.3	2.1	2.8	2.3	3.2	3.3
Radium 226		5.0*	1.4	1.3	2.0	0.6	0.5	0.4	0.4	1.0	0.7	0.0	0.7
Radium 226 precision (±)			NM	NM	NM	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.2
Radium 228		5.0*	NM	NM	NM	NM	NM	3.4	2.2	1.8	3.9	<1.2	1.9
Radium 228 precision (±)			NM	NM	NM	NM	NM	1.0	0.6	0.9	1.4	0.7	0.9
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	3.8	2.6	2.8	4.6	NA	2.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-8										LA-5			LA-9 (Replacement of LA-5)					
			1994	1996	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1989	1993	1996	Spring 2013	Fall 2103	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			1/19/1994	6/18/1996	10/11/2011	10/23/2012	5/30/2013	9/26/2013	8/18/2014	9/24/2014	6/9/2015	9/23/2015	9/19/1989	12/16/1993		5/30/2013	10/1/2013	6/23/2014	9/25/2014	6/9/2015	9/23/2015
MAJOR IONS (mg/L)																					
Hardness as CaCO3			1834	2010	1955	2030	2069	1941	1922	1913	1880	1946	576	848	1195	2045	2093	2049	2071	2027	2119
Alkalinity, Total as CaCO3			472	672	648	686	NM	NM	NM	NM	NM	NM	208	274	349	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		576	820	790	837	852	791	831	798	786	747	254	344	426	451	446	464	429	428	408
Calcium	1		591	640	636	661	670	632	621	616	616	629	185	275	387	644	670	644	653	650	667
Chloride	1	2,000	19.3	21.7	20.0	21.0	19.0	19.0	21.0	21.0	20.0	23.0	2.9	3.2	4.7	24.0	24.0	26.0	28.0	27.0	31.0
Fluoride	0.1	-	0.35	0.26	0.30	0.30	0.30	0.30	0.20	0.20	0.30	0.20	0.60	0.40	0.50	0.40	0.40	0.40	0.40	0.40	0.40
Magnesium	1		86.9	100.0	89.0	92.0	96.0	88.0	90.0	91.0	83.0	91.0	27.7	39.1	55.5	106.0	102.0	107.0	107.0	98.0	110.0
Nitrogen, Ammonia as N	0.05	-	0.58	0.39	0.37	0.34	0.36	0.28	0.26	0.23	0.26	0.39	0	ND	0	0.18	0.17	0.12	0.17	0.17	0.18
Nitrite as N		10.0	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	0	ND	ND	NM	NM	NM	NM	NM	NM
Nitrate as N			ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	0	ND	ND	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	<0.1	ND	ND	ND	ND	0	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		27.1	29.0	34.0	34.0	36.0	34.0	32.0	34.0	32.0	33.0	14.3	9.9	11.3	17.0	17.0	16.0	17.0	18.0	17.0
Silica	0.2		16.1	18.8	18.7	20.1	20.1	17.8	18.3	18.6	18.1	18.9	21.4	27.3	30.1	27.9	27.1	27.7	28.3	27.6	28.3
Sodium	1		34	33	32	36	39	37	34	37	33	36	14	17	19	39	37	37	40	35	39
Sulfate	2	3,000	1489	1430	1410	1420	1410	1400	1440	1400	1370	1480	401	580	839	1740	1730	1700	1800	1770	1990
PHYSICAL PROPERITES																					
Lab Conductivity @ 25°C (umho/cm)	5		2973	2770	2990	3050	2990	2970	2970	2950	2970	3020	1119	1478	1730	2990	3030	3080	3100	3120	3200
Lab pH (std units)	0.01	6.5-8.5	6.77	6.85	7.50	**6.47**	6.77	**6.43**	**6.43**	**6.41**	**6.47**	**6.43**	7.36	7.05	7.58	6.70	6.68	6.64	6.64	6.68	6.69
Total Dissolved Solids @ 180°C	20	5,000	2813	2900	2760	2740	2820	2760	2780	2770	2750	2800	848	1173	1460	3020	2990	3110	3090	3130	3190
Field pH (std units)		6.5-8.5	NM	NM	**6.30**	**6.20**	**6.39**	**6.35**	**6.27**	6.53	**6.31**	**6.28**	NA	NA	NA	6.56	**6.47**	**6.39**	6.57	**6.35**	**6.49**
Field Conductivity (uS/cm)			NM	NM	3160	2790	3120	548	2960	1106	2920	2910	NA	NA	NA	3080	3020	3090	1497	3050	3110
Field Temperature (°C)			NM	NM	9.1	11.2	9.1	7.9	13.7	13.8	13.4	16.0	NA	NA	NA	11.2	14.4	13.5	13.5	12.9	14.1
Depth to Water (ft)			73.70	81.09	32.29	31.15	30.82	30.80	30.42	30.50	30.52	30.38	115.3	105.7	104.9	86.68	86.57	86.10	85.39	85.55	85.35
Total Depth (ft)			163.80	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00	128.00	128.00	128.00	164.80	164.80	164.80	164.80	164.80	164.80
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	NA	NA	NA	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc
TOC Elevation			6949.00	6947.59	6947.59	6947.59	6947.59	6947.59	6947.59	6947.59	6947.59	6947.59	6965.50	6965.50	6965.50	6961.08	6961.08	6961.08	6961.08	6961.08	6961.08
WATER ELEVATION			***6875.30***	***6866.50***	***6915.30***	***6916.44***	***6916.77***	***6916.79***	***6917.17***	***6917.09***	***6917.07***	***6917.21***	***6850.20***	***6859.80***	***6860.60***	***6874.40***	***6874.51***	***6874.98***	***6875.69***	***6875.53***	***6875.73***
TRACE METALS (mg/L)																					
Aluminum	0.1	5.0	0.2	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	ND	0.011	0.003	0.002	0.003	ND	ND	0.001	0.001	0.006	ND	ND	0.012	0.016	0.013	0.011	0.013	0.013
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	3.97	14.70	3.16	1.82	2.49	15.00	3.52	21.10	5.15	15.30	1.20	3.57	8.02	31.30	31.90	28.90	34.20	32.00	35.10
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND	ND	ND	ND
Manganese	0.01	-	3.82	4.20	3.99	3.79	3.75	3.71	3.67	3.82	3.89	3.78	0.63	0.69	0.99	1.97	2.17	2.01	2.04	2.06	2.12
Mercury	0.001	0.00005	ND	ND	ND	**0.001**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.32	0.24	0.52	0.50	0.20	0.29	0.21	0.20	0.21	0.20	ND	ND	ND	0.18	0.20	0.18	0.18	0.21	0.19
Selenium	0.001	0.05	ND	ND	ND	ND	0.004	0.002	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Uranium	0.0003		3.9800	5.8960	4.3900	4.1400	3.5800	2.8000	2.8200	2.7200	2.5600	2.7300	0.0700	0.0490	0.0928	0.0215	0.0279	0.0197	0.0246	0.0214	0.0195
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.06	ND	0.06	0.11	0.15	0.45	0.08	0.09	0.09	0.05	0.05	0.01	0.04	0.05	0.10	0.04	0.06	0.16	0.04
TRACE METALS (mg/L) TOTALS																					
Iron	0.03		3.97	14.70	3.16	1.82	2.49	16.40	3.80	24.20	6.93	16.10	NM	NM	NM	32.40	33.30	33.30	34.20	34.90	34.40
Manganese	0.01		3.82	4.20	3.99	3.79	3.75	4.01	3.74	4.03	3.91	3.88	NM	NM	NM	2.01	2.00	2.02	2.04	2.08	2.04
RADIONUCLIDES (pCi/L) DISSOLVED																					
Gross Alpha		15	NM	NM	NM	**3310.0**	**1780.0**	**1800.0**	**1920.0**	**1970.0**	**1230.0**	**1440.0**	NM	NM	NM	**111.0**	**121.0**	**155.0**	**170.0**	**146.0**	**111.0**
Gross Alpha precision (±)			NM	NM	NM	46.2	37.6	33.9	40.3	42.2	240.0	282.0	NM	NM	NM	NM	11.0	13.6	13.2	32.2	25.3
Gross Beta			NM	NM	NM	NM	508.0	379.0	40.3	282.0	431.0	331.0	NM	NM	NM	47.2	49.7	55.1	66.4	57.2	50.2
Gross Beta precision (±)			NM	NM	NM	NM	15.1	14.4	13.9	14.0	45.9	35.1	NM	NM	NM	NM	8.8	11.8	10.0	9.8	9.9
Radium 226		5.0*	10.3	11.1	**16.0**	**23.0**	13.0	13.0	**16.0**	15.0	11.0	11.0	**13.9**	**20.9**	**42.7**	**44.0**	**47.0**	**46.0**	**53.0**	**49.0**	**48.0**
Radium 226 precision (±)			NM	NM	0.8	1.2	0.8	0.7	0.9	0.8	2.2	2.2	NM	NM	NM	NM	1.3	1.2	1.3	9.2	9.1
Radium 228		5.0*	NM	NM	NM	NM	4.9	**7.8**	**5.3**	**8.0**	**5.6**	**5.2**	NM	NM	NM	**15.9**	**11.1**	**10.6**	**18.9**	**11.8**	**13.0**
Radium 228 precision (±)			NM	NM	NM	NM	0.9	1.3	1.1	1.4	1.4	1.3	NM	NM	NM	NM	1.1	1.0	1.9	2.3	2.6
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	**17.9**	**20.8**	**21.3**	**23.0**	**16.6**	**16.2**	NM	NM	NM	**59.9**	**58.1**	**56.6**	**71.9**	**60.8**	**61.0**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	LA-10						MW-3A (Power Resources Inc. (PRI) Well)								
			Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	1989	1993	1996	2011	2012	Spring 2013	Fall 2013	Spring 2015	Fall 2015
Analyte			6/3/2013	10/1/2013	6/23/2014	9/25/2014	6/9/2015	9/23/2015	5/17/1989	12/16/1993	9/20/1996	10/14/2011	10/30/2012	6/3/2013	10/1/2013	6/15/2015	9/25/2015
MAJOR IONS (mg/L)																	
Hardness as CaCO3			1170	1250	1241	1196	1206	1219	772	969	1072	1699	1615	1641	1610	1608	1628
Alkalinity, Total as CaCO3			NM	NM	NM	NM	NM	NM	1545	179	185	NM	NM	NM	NM	NM	NM
Carbonate as CO3	5		ND	ND	ND	ND	ND	ND	0	0	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		378	402	396	391	393	388	188	218	226	261	287	301	302	292	304
Calcium	1		376	413	403	385	389	394	248	314	344	532	505	512	511	512	510
Chloride	1	2,000	25.0	26.0	25.0	25.0	24.0	24.0	7.9	43.4	55.3	100.0	103.0	105.0	117.0	119.0	137.0
Fluoride	0.1	-	0.60	0.60	0.60	0.60	0.60	0.60	0.90	0.66	0.86	1.00	0.70	0.70	0.70	0.70	0.70
Magnesium	1		56.0	53.0	57.0	57.0	57.0	57.0	37.0	44.9	51.8	90.0	86.0	88.0	81.0	80.0	86.0
Nitrogen, Ammonia as N	0.05	-	0.11	0.10	0.07	0.09	0.08	0.10	0.15	ND	ND	ND	0.06	0.10	0.08	ND	0.06
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	0.11	ND	ND	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	0.20	ND	NM	NM	NM	ND	ND	ND	ND	ND	ND
Potassium	1		14.0	15.0	14.0	13.0	14.0	27.0	13.0	12.6	12.9	18.0	18.0	18.0	18.0	18.0	17.0
Silica	0.2		25.1	25.0	25.5	25.3	24.3	26.1	NM	16.7	19.8	25.9	23.3	23.3	22.0	24.5	23.0
Sodium	1		26	25	26	26	27	27	78	41	39	61	56	61	55	55	60
Sulfate	2	3,000	846	916	887	904	907	901	744	804	871	1380	1370	1340	1430	1390	1500
PHYSICAL PROPERITES																	
Lab Conductivity @ 25°C (umho/cm)	5		1850	1980	2000	1980	1970	1990	1617	1811	1710	2660	2630	2620	2770	2750	2890
Lab pH (std units)	0.01	6.5-8.5	6.97	6.88	6.78	6.87	6.88	6.94	7.30	7.32	7.42	7.40	6.99	6.91	6.96	6.89	6.98
Total Dissolved Solids @ 180°C	20	5,000	1630	1690	1760	1750	1720	1750	1248	1501	1560	2400	2410	2440	2490	2750	2700
Field pH (std units)		6.5-8.5	6.79	6.63	6.53	6.57	6.61	6.62	NA	NA	NM	7.09	NM	NM	6.81	7.08	7.15
Field Conductivity (uS/cm)			1989	2000	2010	2000	1923	1975	NA	NA	NM	4300	NM	NM	2800	2980	2590
Field Temperature (°C)			10.5	10.9	10.4	10.4	10.5	11.0	NA	NA	NM	11.3	NM	NM	11.9	11.5	10.3
Depth to Water (ft)			93.48	93.18	92.64	92.37	91.90	91.65	114.50	110.00	98.40	126.65	NM	NM	127.70	131.84	127.00
Total Depth (ft)			191.40	191.40	191.40	191.40	191.40	191.40	155.00	155.00	153.30	153.30	153.30	153.30	153.30	153.30	153.30
Casing ID (in. dia.)			4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	4" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6901.85	6901.85	6901.85	6901.85	6901.85	6901.85	6851.23	6851.20	6851.20	6848.91	6848.91	6848.91	6848.91	6848.91	6848.91
WATER ELEVATION			***6808.37***	***6808.67***	***6809.21***	***6809.48***	***6809.95***	***6810.20***	***6736.73***	***6741.20***	***6752.80***	***6722.26***	***NA***	***NA***	***6721.21***	***6717.07***	***6721.91***
TRACE METALS (mg/L)																	
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.006	0.009	0.006	0.005	0.006	0.011	0.009	0.029	0.025	0.070	0.087	0.106	0.084	0.078	0.079
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	5.57	6.13	5.06	5.63	5.10	5.71	3.20	2.13	2.89	12.10	13.60	13.90	13.00	12.60	12.80
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND
Manganese	0.01	-	1.05	1.19	0.92	1.04	1.07	1.07	0.75	0.57	0.67	1.15	0.93	1.06	1.13	1.10	1.08
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.001	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	0.005	ND
Uranium	0.0003		0.0340	0.0304	0.0201	0.0208	0.0206	0.0189	0.1800	0.0780	0.1840	0.1730	0.1410	0.1750	0.1700	0.1720	0.1480
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.03	0.03	0.09	0.03	0.03	0.04	0.07	ND	ND	0.03	0.05	0.01	0.01	0.01	ND
TRACE METALS (mg/L) TOTALS																	
Iron	0.03		5.67	6.20	6.10	5.89	5.87	6.03	3.20	2.13	2.89	12.10	13.60	13.90	15.50	14.40	13.90
Manganese	0.01		1.08	1.13	1.10	1.05	1.08	1.06	0.75	0.57	0.67	1.15	0.93	1.06	1.12	1.09	1.15
RADIONUCLIDES (pCi/L) DISSOLVED																	
Gross Alpha		15	**191.0**	**233.0**	**221.0**	**241.0**	**142.0**	**164.0**	NM	NM	NM	NM	**126.0**	**194.0**	**152.0**	**136.0**	**132.0**
Gross Alpha precision (±)			9.3	10.2	11.7	11.3	29.0	33.9	NM	NM	NM	NM	NM	NM	10.7	29.9	29.4
Gross Beta			34.5	46.4	56.8	49.0	58.2	29.6	NM	NM	NM	NM	62.0	72.0	63.7	49.5	48.7
Gross Beta precision (±)			5.9	5.5	7.5	6.5	8.4	5.1	NM	NM	NM	NM	NM	NM	8.4	8.4	8.7
Radium 226		5.0*	**75.0**	**78.0**	**86.0**	**84.0**	**75.0**	**71.0**	**13.0**	**11.1**	0.9	**16.0**	**17.0**	**17.0**	**14.0**	**15.0**	**14.0**
Radium 226 precision (±)			1.6	1.6	1.7	1.6	14.0	13.0	NM	NM	NM	NM	NM	NM	0.7	2.9	2.8
Radium 228		5.0*	**8.3**	**8.0**	**7.8**	**14.3**	**6.3**	**9.7**	NM	NM	NM	NM	NM	**11.0**	**6.6**	**8.2**	**5.8**
Radium 228 precision (±)			1.1	1.0	0.9	1.7	1.4	2.1	NM	NM	NM	NM	NM	NM	0.8	1.7	1.4
Combined Radium 226 & Radium 228		5.0*	**83.3**	**86.0**	**93.8**	**98.3**	**81.3**	**80.7**	NA	NA	NA	NA	NA	**28.0**	**20.6**	**23.2**	**19.8**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	GW10A (Power Resources Inc.(PRI) Well)												
			1997	1998	1998	1998	1999	2006	2011	2012	Spring 2013	Fall 2013	Fall 2014	Spring 2015	Fall 2015
Analyte			10/20/1997	1/27/1998	6/23/1998	7/13/1998	8/3/1999	9/5/2006	10/12/2011	10/18/2012	5/31/2013	9/24/2013	9/25/2014	6/15/2015	9/24/2015
MAJOR IONS (mg/L)															
Hardness as CaCO3			1317	1298	1214	1237	1200	997	1004	1008	1009	1022	993	948	988
Alkalinity, Total as CaCO3			243	247	245	248	NA	250	NA	NA	NA	NA	NA	NM	NM
Carbonate as CO3	5		ND	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		296	301	299	303	298	305	267	296	292	300	291	318	291
Calcium	1		409	400	367	375	367	303	305	303	305	322	302	297	300
Chloride	1	2,000	5.2	5.5	7.9	6.0	8.0	4.0	5.0	5.0	5.0	6.0	6.0	5.0	6.0
Fluoride	0.1	-	1.22	1.19	1.11	1.11	1.16	0.90	1.30	1.20	1.10	1.20	1.10	1.10	1.10
Magnesium	1		71.8	72.7	72.2	73.0	69.0	58.5	59.0	61.0	60.0	53.0	58.0	50.0	58.0
Nitrogen, Ammonia as N	0.05	-	0.22	0.27	0.18	0.16	0.19	0.13	0.09	0.13	0.10	0.10	0.10	0.06	0.09
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	0.05	0.05	0.05	ND	0.20	ND	ND	ND	ND	ND	0.20	ND
Potassium	1		19.4	19.6	16.9	19.1	21.0	16.8	19.0	19.0	19.0	20.0	19.0	20.0	17.0
Silica	0.2		23.4	23.7	22.8	22.9	NA	20.6	25.6	24.9	23.4	24.7	23.3	25.0	23.1
Sodium	1		27	28	24	29	29	24	26	26	27	25	27	23	26
Sulfate	2	3,000	1040	1000	1000	1000	1010	807	818	799	799	804	792	801	807
PHYSICAL PROPERITES															
Lab Conductivity @ 25°C (umho/cm)	5		2030	1950	1790	2010	2000	1910	1680	1670	1680	1700	1700	1700	1710
Lab pH (std units)	0.01	6.5-8.5	7.80	7.62	7.61	7.71	7.80	7.20	7.81	7.20	7.12	7.09	7.06	7.07	7.23
Total Dissolved Solids @ 180°C	20	5,000	1760	1750	1750	1810	1790	1500	1420	1470	1470	1450	1470	1470	1470
Field pH (std units)		6.5-8.5	NM	NM	NM	NM	NM	NM	6.78	NM	NM	6.99	6.88	6.88	7.08
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	1759	NM	NM	536	1118	1142	1697
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	9.4	NM	NM	10.0	11.0	11.1	11.5
Depth to Water (ft)			186.70	183.30	183.30	183.60	NM	185.60	188.10	NM	NM	188.36	188.69	188.81	189.00
Total Depth (ft)			312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00	312.00
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30	6811.30
WATER ELEVATION			***6624.60***	***6628.00***	***6628.00***	***6627.70***	***NA***	***6625.70***	***6623.20***	***NA***	***NA***	***6622.94***	***6622.61***	***6622.49***	***6622.30***
TRACE METALS (mg/L)															
Aluminum	0.1	5.0	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.009	0.010	0.009	0.009	0.010	0.006	0.010	0.010	0.010	0.012	0.010	0.011	0.010
Barium	0.1	-	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	4.10	4.85	4.75	4.80	4.50	2.45	4.19	4.10	4.27	4.05	4.14	4.06	4.03
Lead	0.001	0.1	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	1.09	1.07	1.04	1.05	0.99	0.91	0.91	0.86	0.88	0.88	0.87	0.83	0.88
Mercury	0.001	0.00005	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	0.002	0.002	0.002	ND	0.001	ND	ND	0.001	ND	ND	0.001	ND
Uranium	0.0003		0.0210	0.0234	0.0226	0.0256	0.0260	0.0199	0.1790	0.0170	0.0213	0.0216	0.0190	0.0168	0.0176
Vanadium	0.1	0.1	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	0.02	0.05	NA	ND	ND	0.05	0.03	0.20	0.03	0.03	0.02
TRACE METALS (mg/L) TOTALS															
Iron	0.03		NM	NM	NM	NM	NM	NM	4.25	4.38	4.41	4.09	4.34	4.16	4.07
Manganese	0.01		NM	NM	NM	NM	NM	NM	0.91	0.86	0.88	0.85	0.88	0.88	0.89
RADIONUCLIDES (pCi/L) DISSOLVED															
Gross Alpha		15	NM	NM	NM	NM	NM	NM	**70.2**	**40.6**	**45.5**	**36.6**	**39.0**	**33.0**	**31.8**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	5.0	4.4	7.8	9.1
Gross Beta			NM	NM	NM	NM	NM	NM	49.6	34.4	30.3	29.3	38.0	32.5	32.1
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	4.4	5.3	5.5	6.3
Radium 226		5.0*	**9.2**	**53.7**	**51.6**	**21.2**	**12.4**	**6.8**	**18.0**	**8.9**	**8.7**	**8.1**	**11.0**	**8.5**	**7.8**
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	0.5	0.7	1.7	1.6
Radium 228		5.0*	NM	NM	NM	NM	**11.9**	NM	**9.3**	**10.9**	**10.3**	**9.2**	**10.3**	**10.6**	**9.1**
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	1.1	2.0	2.2	2.0
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	**24.3**	NA	**27.3**	**19.8**	**19.0**	**17.3**	**21.3**	**19.1**	**16.9**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	PRI-1 (Power Resources Inc. (PRI) well)																	
			1993	1996	1996	1997	1997	1997	1997	1998	1999	2006	2011	2012	2012	Spring 2013	Fall 2013	Fall 2014	Spring 2015	Fall 2015
Analyte			10/11/1993	9/27/1996	11/12/1996	3/4/1997	4/28/1997	8/25/1997	10/30/1997	8/25/1998	8/4/1999	9/5/2006	10/12/2011	4/4/2012	10/23/2012	5/31/2013	10/1/2013	9/26/2014	6/15/2015	9/24/2015
MAJOR IONS (mg/L)																				
Hardness as CaCO3			1760	2163	1255	2164	2044	2310	2106	1941	2141	1922	1888	2030	1909	1984	1996	1943	1890	1924
Alkalinity, Total as CaCO3			320	328	328	325	328	333	332	NA	NA	292	NA	NA	NA	NA	NA	NA	NA	NA
Carbonate as CO3	5		ND	ND	ND	0	0	0	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5		390	400	400	397	400	406	405	398	394	356	337	365	381	359	368	354	353	327
Calcium	1		547	670	459	672	629	747	675	601	645	595	583	630	598	615	628	600	600	594
Chloride	1	2,000	6.2	9.0	50.8	8.4	10.3	9.3	8.5	8.0	10.0	6.0	8.0	8.0	9.0	9.0	9.0	11.0	11.0	12.0
Fluoride	0.1	-	0.62	0.51	0.50	0.47	0.46	0.50	0.51	0.48	0.47	0.40	0.60	0.40	0.50	0.50	0.40	0.40	0.40	0.40
Magnesium	1		95.7	119.0	26.3	118.0	115.0	108.0	102.0	107.0	129.0	106.0	105.0	111.0	101.0	109.0	104.0	108.0	95.0	107.0
Nitrogen, Ammonia as N	0.05	-	NA	0.13	0.12	0.15	0.12	0.11	0.18	0.23	0.13	0.26	0.08	0.09	0.11	0.08	0.07	0.07	ND	0.07
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		23.0	24.4	5.5	24.1	25.7	26.7	24.2	24.0	26.0	22.9	24.0	25.0	25.0	25.0	26.0	26.0	26.0	24.0
Silica	0.2		NA	33.4	22.8	29.6	56.4	30.4	29.6	NA	NA	26.1	30.2	28.7	29.4	28.7	28.1	29.3	31.4	28.9
Sodium	1		26	22	77	22	29	22	22	22	23	21	23	25	23	24	24	27	22	25
Sulfate	2	3,000	1548	1850	972	1710	1883	1870	1730	1680	1701	1610	1690	1640	1670	1660	1710	1700	1710	1770
PHYSICAL PROPERITES																				
Lab Conductivity @ 25°C (umho/cm)	5		NA	2810	2540	3390	2988	3040	2930	3030	3010	3100	2800	2730	2870	2810	2810	2860	2860	2880
Lab pH (std units)	0.01	6.5-8.5	6.80	7.18	7.16	7.57	7.57	7.69	7.58	7.85	7.54	6.95	7.89	6.98	6.88	6.96	6.85	6.89	6.87	6.88
Total Dissolved Solids @ 180°C	20	5,000	2468	3070	1940	2975	3018	3070	3060	2950	3000	2840	2770	2820	2840	2800	2800	2840	2820	2870
Field pH (std units)		6.5-8.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.82	6.68	NM	NM	6.62	6.77	6.77	6.81
Field Conductivity (uS/cm)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2960	2910	NM	NM	2830	1474	2690	2920
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	8.8	10.8	NM	NM	10.5	12.8	12.3	13.4
Depth to Water (ft)			153.65	163.20	164.10	163.20	NM	NM	165.20	165.50	NM	174.40	177.25	177.50	NM	NM	178.36	178.43	178.60	178.92
Total Depth (ft)			289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00	289.00
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6814.60	6814.60	6814.60	6814.60	6814.60	6814.60	6814.60	6814.60	6814.60	6814.60	6819.76	6819.76	6820.76	6821.76	6819.76	6819.76	6819.76	6819.76
WATER ELEVATION			***6660.95***	***6651.40***	***6650.50***	***6651.40***	***NA***	***NA***	***6649.40***	***6649.10***	***NA***	***6640.20***	***6642.51***	***6642.26***	***NA***	***NA***	***6641.40***	***6641.33***	***6641.16***	***6640.84***
TRACE METALS (mg/L)																				
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.004	ND	0.004	0.001	0.001	ND	ND	0.002	ND	ND	ND	ND	ND	0.002	0.004	ND	0.001	0.001
Barium	0.1	-	ND	ND	ND	0.1	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	3.07	3.40	0.81	2.95	0.05	3.60	2.10	3.30	2.69	3.00	3.55	3.56	3.40	3.68	3.85	4.29	4.12	3.93
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.87	0.91	0.32	0.81	0.86	0.84	0.85	0.82	0.70	0.88	0.88	0.88	0.89	0.86	0.98	0.90	0.89	0.91
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.17	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.023	ND	ND	ND	ND	ND	ND	0.003	ND	0.002	ND	ND	ND	ND	ND	ND	0.001	ND
Uranium	0.0003		0.0120	0.0068	0.0058	0.0080	0.0060	0.0060	0.0080	0.0080	0.0090	0.0065	0.0059	0.0054	0.0061	0.0070	0.0071	0.0056	0.0059	0.0054
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.01	ND	0.03	0.02	ND	ND	ND	NA	NA	0.04	0.03	0.05	0.04	0.02	0.03	0.03	0.03	0.03
TRACE METALS (mg/L) TOTALS																				
Iron	0.03		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.10	5.43	6.32	5.96	4.93	5.76	4.62	3.84
Manganese	0.01		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.98	0.95	0.85	0.89	0.92	0.91	0.90	0.90
RADIONUCLIDES (pCi/L) DISSOLVED																				
Gross Alpha		15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**57.6**	**70.7**	**62.5**	**52.2**	**50.0**	**59.0**	**52.4**	**35.9**
Gross Alpha precision (±)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.1	NA	NA	7.9	9.2	12.6	12.4
Gross Beta			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52.2	48.6	36.7	27.2	36.3	38.1	35.4	34.8
Gross Beta precision (±)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.8	NA	NA	7.5	8.5	8.7	8.6
Radium 226		5.0*	**20.1**	**21.5**	**2.1**	**26.1**	**18.0**	**16.4**	**14.5**	**56.1**	**43.5**	**12.1**	**14.0**	**16.0**	**15.0**	**13.0**	**14.0**	**16.0**	**13.0**	**13.0**
Radium 226 precision (±)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.9	NA	NA	0.7	0.8	2.6	2.4
Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	**9.7**	**8.7**	NA	**6.5**	**8.5**	**8.2**	4.4	4.2	**13.5**	**6.3**	**5.8**
Radium 228 precision (±)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0	NA	NA	0.8	1.7	1.4	1.4
Combined Radium 226 & Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	**65.8**	**52.2**	NM	**20.5**	**24.5**	**23.2**	**17.4**	**18.2**	**29.5**	**19.3**	**18.8**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	PC Pit																	Cap Pit				
			Fall 1996	Winter 1996	Spring 1997	Summer 1997	Fall 1997	Winter 1997	Summer 1998	Fall 1998	1999	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2014	Fall 2014	Spring 2015	Fall 1996	Winter 1996
ANALYTE			9/20/1996	11/12/1996	3/18/1997	4/29/1997	8/25/1997	11/5/1997	6/22/1998	7/11/1998	8/10/1999	10/5/2011	10/18/2012	5/31/2013	9/25/2013	6/24/2014	9/26/2014	6/12/2015	9/24/2015	6/24/2014	9/26/2014	6/12/2015	9/20/1996	11/12/1996
MAJOR IONS (mg/L)																								
Hardness as CaCO3			1749	1723	803	1784	1652	1881	1529	1634	1806	1902	2001	1989	2067	1920	1968	1769	2042	125	96	137	841	831
Alkalinity as CaCO3			41	44	26	53	36	41	46	49	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6	46	46
Carbonate	5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		51	53	32	65	44	50	56	59	57	72	67	83	50	55	54	78	55	53	13	ND	56	56
Calcium	1		534	530	252	552	510	582	459	465	529	554	579	574	594	553	564	537	584	40	32	45	279	275
Chloride	1	2,000	30.0	26.7	14.0	28.1	31.7	34.0	27.2	28.0	38.0	35.0	37.0	34.0	42.0	36.0	39.0	36.0	40.0	ND	ND	ND	2.6	2.4
Fluoride	0.1	-	0.49	0.54	0.30	0.50	0.57	0.63	0.56	0.57	0.60	1.00	0.80	0.80	0.90	0.70	0.80	0.80	0.90	0.30	0.10	0.10	0.48	0.54
Magnesium	1		101.0	97.0	42.1	98.5	92.0	104.0	93.0	115.0	118.0	126.0	135.0	135.0	142.0	131.0	136.0	104.0	142.0	6.0	4.0	6.0	35.0	34.9
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	0.06	0.16	0.06	0.11	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Potassium	1		33.0	33.9	16.0	35.7	35.2	36.1	33.0	33.8	38.0	46.0	48.0	48.0	47.0	46.0	43.0	46.0	49.0	10.0	9.0	8.0	18.5	19.8
Silica	0.2		ND	ND	1.5	1.3	ND	ND	2.0	1.0	ND	ND	1.5	1.8	2.3	1.8	2.4	3.0	3.5	21.1	15.2	8.2	3.0	3.3
Sodium	1		91	95	41	96	95	100	94	97	99	131	133	140	143	138	135	106	152	2	ND	2	11	13
Sulfate	2	3,000	1980	1910	919	1844	1800	1900	1750	1750	1770	2180	2200	2110	2340	2150	2190	2020	2270	100	97	137	793	808
PHYSICAL PROPERITES																								
Lab Conductivity (umhos/cm)	5		2710	2530	1650	2784	3000	3060	2680	2950	3030	3260	3360	3220	3450	3280	3430	3370	3530	309	243	328	1100	1250
Lab pH	0.01	6.5-8.5	7.65	7.82	7.62	7.86	7.71	7.64	7.92	7.61	7.82	8.13	7.97	7.99	8.03	8.24	8.03	8.05	7.64	6.74	6.91	**6.14**	7.66	7.99
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	2920	2850	1280	2814	2950	2940	2850	2880	2900	3180	3380	3290	3500	3260	3410	3370	3420	241	169	227	1190	1150
Field Conductivity (µS)			NA	NA	NA	NA	NA	NA	NA	NA	NA	3320	3530	3450	3720	3730	3770	3430	3710	339	290	363	NA	NA
Field pH		6.5-8.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.05	7.78	7.22	7.66	**8.58**	7.90	8.05	8.34	**6.47**	**6.10**	**5.84**	NA	NA
Field Temperature (°C)			NA	NA	NA	NA	NA	NA	NA	NA	NA	14.0	9.0	13.1	15.2	16.5	15.0	17.8	16.5	17.9	19.8	18.3	NA	NA
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	18.5	3.1	NM	0.0	NM	9.4	0.8	4.0	NM	75.0	NM	NM
Monument Height			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6622.54	6622.54	6622.54	6622.54	6622.54	NA	NA	NA	NA	NA
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	4.40	3.09	3.95	2.60	3.90	NM	NM	NM	NM	NM
WATER SURFACE ELEVATION (MH-WL)			***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***6618.14***	***6619.45***	***6618.59***	***6619.94***	***6618.64***	***NA***	***NA***	***NA***	***NM***	***NM***
TRACE METALS (mg/L)																								
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	0.10	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	ND	ND	ND	ND	ND	0.002	0.002	0.003	0.004	0.003	0.002	0.005	0.003	0.004	0.003	0.006	0.010	0.004	0.002	ND	0.002
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	0.1	NM	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	0.1	NM	ND	ND	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	0.01	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	0.05	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	0.01	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.28	ND	ND	ND	ND	ND	ND	ND	1.04	0.06	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	0.050	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	ND	0.03	0.06	0.03	0.05	0.01	0.03	ND	ND	0.11	0.02	0.03	0.03	0.03	0.01	0.05	0.02	0.09	0.01	0.21	ND	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	**0.001**	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		0.35	0.35	0.14	0.30	0.31	0.36	0.31	0.34	NM	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	0.05	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.005	0.005	0.002	0.001	0.006	0.002	0.007	0.007	0.004	0.002	0.002	0.002	0.002	0.003	ND	0.002	0.001	0.001	0.002	0.003	0.004	ND
Uranium	0.0003		0.4930	0.4700	0.2090	0.5220	0.4340	0.5000	0.4750	0.5610	0.5080	0.3460	0.3480	0.3910	0.3690	0.3710	0.3280	0.3090	0.3410	0.0008	0.0003	0.0009	0.2190	0.1930
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	ND	ND	ND	ND	0.01	NM	0.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																								
Iron	0.03		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.38	0.14	0.05	0.18	0.05	0.03	0.34	0.30	1.73	0.33	3.89	ND	ND
Manganese	0.01		ND	0.03	0.06	0.03	0.05	0.01	0.03	ND	ND	0.12	0.02	0.04	0.01	0.03	0.02	0.05	0.05	0.09	0.01	0.23	ND	ND
RADIOMETRICS (pCi/L) DISSOLVED																								
Gross Alpha		15	NM	NM	NM	NM	NM	NM	NM	NM	NM	**439.0**	**418.0**	**359.0**	**387.0**	**368.0**	**326.0**	**242.0**	**294.0**	3.5	<1.5	2.1	NM	NM
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	26.7	17.2	18.8	17.6	18.6	17.8	50.5	60.4	1.3	1.0	1.4	NM	NM
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	190.0	78.2	82.8	97.3	66.4	75.2	69.3	59.6	10.9	8.4	7.2	NM	NM
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	12.9	9.9	12.0	10.5	10.6	10.2	10.2	8.8	1.8	1.9	1.9	NM	NM
Radium 226		5.0*	0.9	1.1	1.7	1.3	2.1	1.2	1.1	1.2	0.6	2.5	4.2	1.9	0.9	1.6	1.2	1.0	0.6	1.6	0.4	0.9	2.1	1.8
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	0.3	0.4	0.3	0.2	0.3	0.2	0.2	0.2	0.4	0.2	0.2	NM	NM
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	1.5	0.4	1.0	<2.0	<1.3	<1.4	3.5	<1.1	1.8	<1.3	<2.1	<1.2	NM	NM
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	0.7	0.7	1.2	0.8	0.8	1.4	0.7	0.8	0.8	1.2	0.7	NM	NM
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	2.1	2.9	**5.2**	NA	NA	NA	4.7	NA	2.4	NA	NA	NA	NA	NA

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	Veca Pit														
			Spring 1997	Summer 1997	Fall 1997	Summer 1998	Fall 1998	1999	2006	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
ANALYTE			3/18/1997	4/25/1997	10/29/1997	6/22/1998	7/11/1998	8/5/1999	10/17/2006	10/6/2011	10/18/2012	5/31/2013	9/25/2013	6/24/2014	9/26/2014	6/12/2015	9/24/2015
MAJOR IONS (mg/L)																	
Hardness as CaCO3			510	721	728	395	453	437	396	369	409	450	501	455	429	447	526
Alkalinity as CaCO3			46	49	60	52	48	NM	39	NM	NM	NM	NM	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	1	ND	2	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		56	60	73	63	58	54	45	62	40	61	56	82	34	51	27
Calcium	1		172	242	243	135	155	147	130	113	121	134	148	136	124	128	143
Chloride	1	2,000	1.6	1.8	2.8	1.0	1.6	4.0	4.0	9.0	9.0	10.0	13.0	11.0	11.0	13.0	14.0
Fluoride	0.1	-	0.36	0.42	0.57	0.33	0.34	0.39	0.50	0.50	0.30	0.40	0.40	0.30	0.30	0.30	0.40
Magnesium	1		19.4	28.4	29.4	14.1	15.9	17.0	17.2	21.0	26.0	28.0	32.0	28.0	29.0	31.0	41.0
Nitrogen, Ammonia as N	0.05	-	0.05	0.81	ND	ND	0.09	0.05	0.12	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Potassium	1		13.7	17.6	21.3	11.5	11.6	15.0	23.0	15.0	18.0	19.0	21.0	17.0	16.0	20.0	20.0
Silica	0.2		5.6	4.0	1.4	2.9	1.7	NM	1.6	2.0	0.7	0.7	1.6	3.6	1.6	2.4	ND
Sodium	1		7	10	11	6	6	9	8	21	24	27	32	27	27	32	45
Sulfate	2	3,000	466	659	693	344	379	387	350	371	391	425	501	452	451	462	545
PHYSICAL PROPERITES																	
Lab Conductivity (umhos/cm)	5		989	1152	1320	751	846	819	697	828	872	926	1070	964	950	1030	1170
Lab pH	0.01	6.5-8.5	7.84	7.93	7.86	7.93	7.90	7.88	**8.83**	8.20	8.42	7.75	8.42	8.23	**8.57**	7.89	**8.71**
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	745	983	1110	614	673	594	506	578	664	710	828	736	725	813	914
Field Conductivity (µS)			NA	NA	NA	NA	NA	NA	NA	851	850	930	1146	1024	1125	1069	1199
Field pH		6.5-8.5	NA	NA	NA	NA	NA	NA	NA	8.47	8.04	8.17	8.06	8.22	**8.72**	7.99	**9.15**
Field Temperature (°C)			NA	NA	NA	NA	NA	NA	NA	12.9	7.7	11.1	13.7	17.2	15.4	17.9	15.5
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM	NM	NM	132.0	28.1	NM	0.5	N/A	3.1	0.7
Monument Height			NA	NA	NA	NA	NA	NA	NA	NA	NA	6833.38	6833.38	6833.38	6833.38	6833.38	6833.38
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	6.19	7.71	6.14	9.70
WATER SURFACE ELEVATION (MH-WL)			***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***6827.19***	***6825.67***	***6827.24***	***6823.68***
TRACE METALS (mg/L)																	
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.001	0.001	0.001	0.002	0.002	0.040	0.005	0.007	0.004	0.003	0.007	0.004	0.005	0.003	0.006
Barium	0.1	-	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	0.01	0.01	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.09	0.11	ND	ND	ND	ND	0.08	ND	ND	ND	ND	0.03	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.05	0.04	ND	0.01	0.04	ND	0.03	ND	ND	0.03	0.02	0.03	ND	0.01	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.015	0.002	ND	0.004	0.003	0.005	0.011	0.003	0.002	0.002	0.002	0.004	0.003	0.006	0.003
Uranium	0.0003		0.1760	0.2210	0.1920	0.1000	0.1170	0.1260	0.1370	0.1320	0.1010	0.1220	0.0877	0.1750	0.1130	0.1620	0.1010
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	0.01	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																	
Iron	0.03		0.09	0.11	ND	ND	ND	ND	0.14	0.11	0.08	0.18	0.10	0.12	0.06	0.50	0.14
Manganese	0.01		0.05	0.04	ND	0.01	0.04	ND	0.03	0.01	ND	0.03	0.02	0.03	ND	0.02	ND
RADIOMETRICS (pCi/L) DISSOLVED																	
Gross Alpha		15	NM	NM	NM	NM	NM	NM	**55.7**	**201.0**	**63.8**	**102.0**	**79.2**	**122.0**	**101.0**	**103.0**	**81.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	7.6	3.0	4.5	4.5	5.3	4.5	20.9	16.7
Gross Beta			NM	NM	NM	NM	NM	NM	146.0	73.9	26.1	34.2	41.3	39.0	29.3	33.8	25.3
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	2.5	2.2	2.5	3.9	3.4	2.4	4.1	3.4
Radium 226		5.0*	1.7	2.2	2.6	1.0	2.0	3.0	0.7	2.8	2.2	4.3	3.4	1.6	2.1	1.8	2.2
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	NM	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.5
Radium 228		5.0*	NM	NM	NM	NM	NM	1.0	3.7	0.5	0.1	<2.1	<1.5	<1.5	2.1	<1.2	2.4
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	0.8	0.7	1.3	0.9	0.9	1.3	0.7	0.8
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	4.0	4.4	3.3	2.3	NA	NA	NA	4.2	NA	4.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	Buss Pit																			WCC-2 (West Canyon Creek Weir ne	
			Fall 1996	Spring 1997	Summer 1997	Fall 1997	Winter 1997	Spring 1998	Fall 1998	1999	2006	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	2013	Spring 2014
ANALYTE			11/13/1996	3/18/1997	5/5/1997	8/25/1997	10/30/1997	6/23/1998	7/11/1998	8/4/1999	9/5/2006	8/30/2011	10/6/2011	4/4/2012	9/21/2012	6/5/2013	9/25/2013	6/24/2014	9/26/2014	6/12/2015	9/24/2015	6/5/2013	6/23/2014
MAJOR IONS (mg/L)																						dry	dry
Hardness as CaCO3			2091	481	1657	1881	2004	1916	1958	2060	2344	2119	2346	779	2426	2467	2670	2366	2513	2413	2591	-	-
Alkalinity as CaCO3			31	18	18	15	15	5	8	1	ND	NM	140	NM	113	NM	189	NM	NM	129	NM	-	-
Carbonate	5		ND	ND	ND	ND	ND	ND	1	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Bicarbonate	5		37	22	22	19	19	6	10	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Calcium	1		615	160	497	572	618	553	570	573	575	495	558	205	572	562	630	525	559	534	569	-	-
Chloride	1	2,000	11.1	2.2	<1	10.9	10.2	14.8	11.2	14.0	15.0	15.0	17.0	5.0	18.0	17.0	23.0	19.0	20.0	21.0	20.0	-	-
Fluoride	0.1	-	0.92	0.35	0.77	1.07	1.10	0.98	1.03	1.12	1.40	1.80	5.00	1.00	1.80	1.90	0.80	2.40	1.30	2.90	2.60	-	-
Magnesium	1		135.0	19.8	101.0	110.0	112.0	130.0	130.0	153.0	221.0	215.0	232.0	65.0	243.0	259.0	267.0	257.0	272.0	263.0	285.0	-	-
Nitrogen, Ammonia as N	0.05	-	ND	0.08	ND	0.06	0.01	0.12	0.10	ND	0.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	0.21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Nitrogen, Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-	-
Potassium	1		35.2	9.5	32.4	35.9	36.4	33.5	37.0	39.0	52.3	63.0	59.0	18.0	62.0	65.0	77.0	62.0	67.0	69.0	73.0	-	-
Silica	0.2		5.7	4.4	5.5	4.8	5.1	6.1	6.1	6.9	20.0	23.0	28.7	9.3	30.5	27.2	27.8	27.2	29.7	33.4	29.7	-	-
Sodium	1		40	9	37	41	41	44	44	43	60	69	69	20	69	75	75	74	78	78	83	-	-
Sulfate	2	3,000	2094	488	1678	1870	2010	2100	2060	2040	2470	2360	2670	861	2860	2720	**3220**	2780	2940	2790	2970	-	-
PHYSICAL PROPERITES																							
Lab Conductivity (umhos/cm)	5		2630	973	2260	3000	2920	2700	3000	3100	3970	3700	3730	1420	3930	3660	3980	3860	3970	4040	4160	-	-
Lab pH	0.01	6.5-8.5	7.61	7.46	7.28	7.19	7.14	**6.20**	**5.54**	**4.67**	**3.83**	**4.00**	**4.08**	**4.90**	**3.87**	**3.94**	**3.78**	**3.88**	**4.03**	**3.80**	**3.47**	-	-
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	2980	712	2540	3080	3070	2980	3070	3080	3830	3930	3910	1280	4040	3840	4200	4030	4210	4530	4350	-	-
Field Conductivity (µS)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3750	1491	NA	3854	4250	4300	4390	4120	4340	-	-
Field pH		6.5-8.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.07**	**4.91**	**3.74**	**3.72**	**3.78**	**3.73**	**3.83**	**3.74**	**4.20**	-	-
Field Temperature (°C)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13.1	11.7	16.4	16.1	15.0	16.1	17.3	16.7	17.0	-	-
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	37.7	NM	0.4	N/A	1.7	0.4	-	-
Monument Height			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6650.18	6650.18	6650.18	6650.18	6650.18	-	-
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5.50	4.73	5.22	4.41	5.75	-	-
WATER SURFACE ELEVATION (MH-WL)			***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***NM***	***6644.68***	***6645.45***	***6644.96***	***6645.77***	***6644.43***	***Dry***	***Dry***
TRACE METALS (mg/L)																							
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	0.15	0.24	1.85	**11.00**	**15.10**	**17.70**	**5.60**	**17.40**	**18.00**	**17.80**	**16.60**	**18.70**	**17.40**	**17.40**	-	-
Arsenic	0.001	0.2	0.004	ND	ND	ND	ND	0.001	ND	ND	0.001	0.000	0.001	0.002	0.001	0.004	0.004	0.001	0.002	0.002	0.003	-	-
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	0.1	0.2	ND	ND	ND	0.1	-	-
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	0.01	0.01	NM	ND	0.00	ND	ND	0.01	ND	ND	ND	0.01	0.01	ND	-	-
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	0.04	0.04	ND	ND	0.04	0.04	0.06	0.04	0.05	0.04	0.04	-	-
Iron	0.03	-	1.00	ND	ND	ND	ND	ND	ND	0.80	1.30	0.42	0.60	1.37	0.58	1.39	0.91	1.39	1.08	1.43	0.79	-	-
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	0.002	0.002	0.002	0.002	0.003	0.002	0.001	-	-
Manganese	0.01	-	1.42	0.19	1.24	1.50	1.98	2.02	2.32	2.64	7.76	8.59	9.94	2.79	10.40	10.40	10.90	10.70	11.30	12.20	11.90	-	-
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Nickel	0.05	-	ND	ND	0.12	0.11	0.13	ND	0.17	0.19	0.55	0.59	0.67	0.19	0.73	0.75	0.79	0.68	0.75	0.81	0.78	-	-
Selenium	0.001	0.05	0.013	0.002	0.015	0.015	0.014	0.015	0.014	0.012	0.017	0.020	0.017	0.005	0.018	0.015	0.014	0.015	0.014	0.016	0.015	-	-
Uranium	0.0003		0.1130	0.0410	0.1070	0.0870	0.0920	0.0685	0.0550	0.1020	0.2620	0.2170	0.2250	0.0731	0.2570	0.2390	0.2540	0.2460	0.2520	0.2570	0.2610	-	-
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Zinc	0.01	25.0	0.01	NC	0.03	0.02	0.03	0.07	0.07	0.09	0.25	0.27	0.82	0.09	0.33	0.34	0.33	0.29	0.33	0.32	0.32	-	-
TOTAL METALS (mg/L)																							
Iron	0.03		1.00	ND	ND	ND	ND	ND	ND	0.80	1.30	0.47	0.72	0.93	0.70	1.55	0.97	1.52	2.42	1.45	0.84	-	-
Manganese	0.01		1.42	0.19	1.24	1.50	1.98	2.02	2.32	2.64	7.76	8.04	10.20	2.64	11.10	11.60	11.20	11.30	11.90	11.30	11.70	-	-
RADIOMETRICS (pCi/L) DISSOLVED																							
Gross Alpha		15	NM	NM	NM	NM	NM	NM	NM	NM	NM	**194.0**	**339.0**	**90.4**	**243.0**	**238.0**	**295.0**	**238.0**	**245.0**	**210.0**	**240.0**	-	-
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	26.2	NM	15.5	NM	17.8	16.8	18.5	45.2	51.3	-	-
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	160.0	182.0	32.1	127.0	136.0	14.1	138.0	126.0	133.0	155.0	-	-
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	12.6	NM	13.0	NM	153.0	12.1	12.8	17.3	19.4	-	-
Radium 226		5.0*	1.8	0.2	3.2	3.7	**5.7**	2.3	0.8	2.4	1.9	1.6	1.6	0.4	4.5	4.2	1.0	1.8	1.7	1.0	1.3	-	-
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.2	NM	0.4	NM	0.2	0.3	0.3	0.2	0.3	-	-
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	NM	1.3	1.5	1.2	1.1	<1.6	1.5	<1.0	<1.4	2.5	1.4	-	-
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.6	NM	0.8	NM	0.9	0.7	0.9	0.8	0.6	-	-
Combined Radium 226 & Radium 228		5.0*	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9	3.1	1.6	**5.6**	NA	2.5	NA	NA	3.5	2.7	#VALUE!	#VALUE!

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guidelines	ar Carol Shop)	WCC at road Culvert, SE of WCC2 - Culvert has been used as a replacement for WCC2 when it is dry.		WCC-1 (upstream of WCC-2 appx 2 miles, near a spring)				GH SW Blank	Duplicates				
			Fall 2014	Spring 2014	Fall 2014	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Fall 2013 Blank	Fall 2013-GHSW Dup	Spring 2013-SW-1 Dup	Fall 2015-Dup BP2	Fall 2014-Dup (WCC2)	Fall 2015-Dup BP2
ANALYTE			9/26/2014	6/23/2014	9/26/2014	6/5/2013				9/25/2013	9/25/2013	5/31/2013	9/25/2015	9/26/2014	9/25/2015
MAJOR IONS (mg/L)						Weir at 2.2									
Hardness as CaCO3			155	166	136	NM	NM	NM	NM	#VALUE!	2037	450	2603	152	2603
Alkalinity as CaCO3			NM			NM	NM	NM	NM	NM	NM	NM	134	NM	134
Carbonate	5		8	ND	11	NM	NM	NM	NM	<5.0	ND	ND	ND	9	ND
Bicarbonate	5		231	276	195	NM	NM	NM	NM	<5.0	50	61	ND	225	ND
Calcium	1		52	58	48	NM	NM	NM	NM	<1.0	587	134	572	51	572
Chloride	1	2,000	5	4	5	NM	NM	NM	NM	<1.0	41	9	22	5	22
Fluoride	0.1	-	0	0.30	0.40	NM	NM	NM	NM	<0.1	0.90	0.4	2.8	0	2.8
Magnesium	1		6	5.00	4.00	NM	NM	NM	NM	<1.0	139	28	286	6	286
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	NM	NM	NM	NM	<0.05	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	NM	NM	NM	NM	<0.1	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM		NM	NM	NM	NM	NM
Potassium	1		13	12	11	NM	NM	NM	NM	<1.0	46	19	71	13	71
Silica	0.2		37.1	43.4	46.4	NM	NM	NM	NM	<0.2	2.4	0.7	30.0	36.9	30.0
Sodium	1		30	29	27	NM	NM	NM	NM	<1.0	142	27	84	30	84
Sulfate	2	3,000	26	18	25	NM	NM	NM	NM	<1.0	2250	420	3010	26	3010
PHYSICAL PROPERITES															
Lab Conductivity (umhos/cm)	5		428.000	452.00	386	NM	NM	NM	NM	<5.0	3450	924	3960	423.000	3960
Lab pH	0.01	6.5-8.5	8.49	8.01	8.56	NM	NM	NM	NM	5.99	8.10	7.91	3.51	8.5	3.51
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	283	307	261	NM	NM	NM	NM	<10	3460	713	4360	283	4360
Field Conductivity (µS)			509	469.00	449	484	NM	NM	NM	NM	3720	930	4340	509	4340
Field pH		6.5-8.5	8.15	7.51	8.28	7.91	NM	NM	NM	NM	7.7	8.2	4.20	8.15	4.20
Field Temperature (°C)			21.9	21.8	20	10.3	NM	NM	NM	NM	15.2	11.1	17.0	21.9	17.0
Field Turbidity (NTU)			NM	7.2	N/A	140.5	NM	NM	NM	NM	NM	28.1	0.4	NM	0.4
Monument Height			NM	NA	NA	NM	NM	NM	NM	NM	6623	6833	6650.2	NM	6650.2
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	NM	4.4	NM	5.8	NM	5.8
WATER SURFACE ELEVATION (MH-WL)			***NM***	***#VALUE!***	***#VALUE!***	***NM***	***NM***	***NM***	***NM***	***NM***	***6618***	***#VALUE!***	***6644***	***NM***	***6644***
TRACE METALS (mg/L)															
Aluminum	0.1	5.0	ND	ND	ND	NM	NM	NM	NM	<0.10	ND	ND	17.1	ND	17.1
Arsenic	0.001	0.2	0.011	0.015	0.016	NM	NM	NM	NM	<0.001	0.006	0.003	0.003	0.012	0.003
Barium	0.1	-	0.2	0.2	0.1	NM	NM	NM	NM	<0.10	ND	ND	ND	0.2	ND
Boron	0.1	5.0	ND	ND	ND	NM	NM	NM	NM	<0.10	0.1	ND	0.1	ND	0.1
Cadmium	0.005	0.05	ND	ND	ND	NM	NM	NM	NM	<0.005	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	NM	NM	NM	NM	<0.05	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	NM	NM	NM	NM	<0.01	ND	ND	0.04	ND	0.04
Iron	0.03	-	ND	ND	ND	NM	NM	NM	NM	<0.03	ND	ND	0.79	ND	0.79
Lead	0.001	0.1	ND	ND	ND	NM	NM	NM	NM	<0.001	ND	ND	0.001	ND	0.001
Manganese	0.01	-	ND	0.02	ND	NM	NM	NM	NM	<0.01	0.03	0.03	11.6	ND	11.6
Mercury	0.001	0.00005	ND	ND	ND	NM	NM	NM	NM	<0.001	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	NM	NM	NM	NM	<0.10	0.30	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	NM	NM	NM	NM	<0.05	ND	ND	0.78	ND	0.78
Selenium	0.001	0.05	ND	ND	ND	NM	NM	NM	NM	<0.001	0.001	0.003	0.015	ND	0.015
Uranium	0.0003		0.013	0.014	0.0131	NM	NM	NM	NM	0.0003	0.361	0.123	0.266	0.013	0.266
Vanadium	0.1	0.1	ND	ND	ND	NM	NM	NM	NM	<0.10	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	NM	NM	NM	NM	<0.01	ND	ND	0.32	ND	0.32
TOTAL METALS (mg/L)															
Iron	0.03		0.580	0.320	0.140	NM	NM	NM	NM	<0.03	0.42	0.120	0.79	0.780	0.79
Manganese	0.01		0.010	0.020	ND	NM	NM	NM	NM	<0.01	0.02	0.030	11.7	0.010	11.7
RADIOMETRICS (pCi/L) DISSOLVED															
Gross Alpha		15	10.4	11.2	6.2	NM	NM	NM	NM	<1.2	389.0	96.9	249	6.2	249
Gross Alpha precision (±)			1.7	2	1.5	NM	NM	NM	NM		17.5	4.5	53.6	1.5	53.6
Gross Beta			12	11.6	10.3	NM	NM	NM	NM	<2.4	96.2	34.0	156	11.3	156
Gross Beta precision (±)			2	2	1.9	NM	NM	NM	NM		10	2.4	19.9	1.9	19.9
Radium 226		5.0*	0.37	0.65	0.36	NM	NM	NM	NM	<0.16	1.10	3.0	1.2	0.57	1.2
Radium 226 precision (±)			0.21	0.26	0.22	NM	NM	NM	NM		0.22	0.4	0.32	0.25	0.32
Radium 228		5.0*	<2.5	<1.3	<2.7	NM	NM	NM	NM	<1.4	<1.4	4.1	1.8	<2.7	1.8
Radium 228 precision (±)			1.6	0.8	1.6	NM	NM	NM	NM		0.8	1.2	0.7	1.6	0.7
Combined Radium 226 & Radium 228		5.0*	#VALUE!	#VALUE!	#VALUE!						#VALUE!	7.1	3.0	#VALUE!	3.0

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-LQD Class III Guidelines (Livestock)	#1-SE												#2-NE												
			1989	1990	1992	1998	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Summer 2015	Fall 2015	1989	1990	Spring 1992	Winter 1992	1998	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Fall 2015
Analyte			7/13/1989	11/14/1990	5/26/1992	5/26/1998	10/13/2011	10/24/2012	5/21/2013	9/16/2013	7/7/2014	10/7/2014	6/25/2015	10/7/2015	7/13/1989	11/14/1990	5/26/1992	12/29/1992	5/26/1998	10/12/2011	10/24/2012	5/21/2013	9/16/2013	7/7/2014	10/8/2014	6/25/2015	10/7/2015
MAJOR IONS (mg/L)																											
Hardness as CaCO3			NA	NA	NA	NA	2183	2326	2350	2253	2205	2214	2270	2202	NA	NA	NA	NA	2603	2184	2201	2315	2180	2235	2157	2228	2177
Alkalinity, Total as CaCO3			NM	NM	NM	NM	670	743	753	753	NM	NM	NM	NM	NM	NM	NM	NM	NM	620	728	744	761	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		272	158	703	817	817	906	919	919	916	898	894	844	211	195	700	764	725	757	888	908	928	926	930	924	896
Calcium	1		216	106	586	711	578	632	622	601	585	587	598	579	141	183	590	573	741	621	626	652	616	630	607	627	610
Chloride	1	2,000	15.7	33.4	40.5	50.0	33.0	35.0	34.0	32.0	31.0	31.0	33.0	35.0	13.2	49.9	46.2	42.4	39.0	18.0	19.0	18.0	19.0	16.0	15.0	17.0	17.0
Fluoride	0.1	-	0.17	0.42	0.21	0.18	0.20	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.24	0.14	0.13	0.17	0.12	0.10	0.10	0.10	ND	ND	0.10	ND	ND
Magnesium	1		NM	NM	NM	NM	180.0	182.0	194.0	183.0	181.0	182.0	189.0	184.0	NM	NM	NM	NM	183.0	154.0	155.0	167.0	156.0	161.0	156.0	161.0	159.0
Nitrogen, Ammonia as N	0.05	-	0.90	0.13	ND	0.92	0.60	0.46	0.46	0.73	0.46	0.32	0.27	0.43	0.50	0.33	0.80	0.36	0.80	0.31	0.50	0.42	0.64	0.28	0.29	0.35	0.35
Nitrite as N		10.0	NM	NM	NM	ND	NM	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	ND	ND	NM	NM	NM	NM
Nitrate as N			0.79	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	0.93	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	NM	NM	NM	NM	ND	ND	ND	ND	0.10	0.20	ND	ND	NM	NM	NM	NM	NM	ND	ND	ND	ND	0.10	0.20	0.20	ND
Potassium	1		11.8	8.8	16.2	18.2	20.0	20.0	18.0	19.0	18.0	18.0	19.0	19.0	9.6	13.8	15.0	14.5	14.7	15.0	15.0	14.0	16.0	15.0	16.0	15.0	15.0
Silica	0.2		NM	NM	NM	NM	20.3	19.8	19.4	18.2	16.9	16.9	17.4	17.8	NM	NM	NM	NM	NM	13.9	16.1	16.1	14.4	15.4	14.5	15.3	15.2
Sodium	1		172	122	157	174	181	175	190	172	174	170	180	174	140	110	122	140	114	105	109	121	108	116	105	114	112
Sulfate	2	3,000	1000	458	NM	1980	1930	1900	1870	1860	1860	1830	1850	1920	580	680	1700	1820	1920	1740	1730	1690	1670	1700	1670	1720	1690
PHYSICAL PROPERITES																											
Lab Conductivity @ 25°C (umho/cm)	5		1966	1192	2664	3780	3720	3760	3820	3750	3770	3850	3860	3730	1425	1680	2408	2741	3470	3340	3470	3440	3440	3460	3460	3580	3450
Lab pH (std units)	0.01	6.5-8.5	7.01	7.92	7.32	7.65	6.71	**6.38**	**6.29**	**6.42**	**6.33**	6.55	6.51	**6.29**	7.32	7.81	7.19	7.44	7.83	7.45	6.54	6.54	6.73	6.55	6.68	6.72	6.56
Total Dissolved Solids @ 180°C	20	5,000	1719	813	3483	3600	3540	3610	3580	3600	3590	3540	3540	3550	1104	1272	3292	3337	3310	3140	3260	3300	3290	3300	3310	3250	3310
Field pH (std units)		6.5-8.5	6.70	6.60	**6.35**	**6.22**	**6.36**	**6.27**	**6.26**	**6.25**	**6.41**	**6.39**	**6.40**	**6.43**	6.75	6.78	**6.47**	7.40	**6.37**	6.58	**6.48**	6.61	**6.46**	6.63	6.63	**6.47**	6.66
Field Conductivity (uS/cm)			1783	2110	3030	2660	3930	3950	4200	4080	4290	4180	4250	4170	1471	1800	2670	3025	2380	3550	3630	3830	3950	3920	3810	3940	3850
Field Temperature (°C)			NM	NM	NM	NM	8.8	8.0	10.7	10.0	9.0	9.0	9.6	10.5	NM	NM	NM	NM	NM	9.1	8.2	11.0	9.7	11.3	9.7	9.9	10.8
Depth to Water (ft)			48.28	26.35	21.98	9.41	4.40	4.25	4.32	4.57	4.75	4.60	4.80	4.56	48.48	29.10	24.89	23.97	16.23	12.45	11.73	12.55	12.82	12.68	12.68	12.66	12.40
Total Depth (ft)			NM	NM	NM	NM	82.20	82.06	82.06	82.06	82.05	81.60	82.00	81.80	63.10	63.10	63.10	63.10	63.10	63.10	63.10	63.10	63.10	63.12	63.00	63.00	63.10
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6935.10	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40	6948.40
WATER ELEVATION			***6886.82***	***6908.75***	***6913.12***	***6925.69***	***6930.70***	***6930.85***	***6930.78***	***6930.53***	***6930.35***	***6930.50***	***6930.30***	***6930.54***	***6899.92***	***6919.30***	***6923.51***	***6924.43***	***6932.17***	***6935.95***	***6936.67***	***6935.85***	***6935.58***	***6935.72***	***6935.72***	***6935.74***	***6936.00***
TRACE METALS (mg/L)																											
Aluminum	0.1	5.0	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	ND	ND	0.002	0.011	0.007	0.008	0.013	0.004	0.004	0.003	0.006	ND	ND	ND	ND	0.001	0.009	ND	0.001	0.005	ND	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.13	0.06	0.15	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	0.02	ND	ND	ND	0.01	ND	ND	ND	ND	0.02	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03
Iron	0.03	-	0.14	0.26	0.70	16.30	24.10	19.50	26.70	26.60	16.70	12.90	10.10	12.8	0.07	1.00	0.61	0.93	1.70	7.49	6.00	6.85	6.60	3.82	2.81	2.77	1.56
Lead	0.001	0.1	ND	ND	ND	ND	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.34	0.10	2.56	3.20	4.80	5.60	4.57	5.18	4.07	3.96	3.19	3.89	0.14	0.33	2.07	2.80	3.60	3.80	4.26	3.99	3.95	3.77	3.61	2.83	3.29
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.04	0.04	0.06	0.05	0.07	0.08	0.08	0.10	0.08	0.08	0.07	0.07	0.04	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	**0.082**	0.009	<.001	0.005	ND	ND	ND	ND	0.002	ND	ND	0.002	**0.083**	0.004	0.009	<.005	0.005	ND	ND	ND	ND	0.002	ND	ND	0.002
Uranium	0.0003		0.5600	0.0040	1.3800	1.0600	0.8000	0.8010	0.8310	0.9120	0.9140	0.8720	0.8540	0.7460	0.2100	0.1000	1.2800	1.1400	0.9730	1.0400	0.9620	1.0100	1.2300	1.0400	1.0600	1.0500	0.9470
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.05	ND	0.04	0.04	0.05	0.07	0.05	0.05	0.04	0.03	0.02	0.07	0.04	ND	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.05
TRACE METALS (mg/L) TOTALS																											
Iron	0.03		0.14	0.26	0.70	16.30	24.10	19.50	26.70	26.60	24.20	15.60	13.30	20.1	0.07	1.00	0.61	0.93	1.70	7.49	6.00	6.85	6.60	6.40	4.55	5.41	6.74
Manganese	0.01		ND	ND	ND	ND	0.00	ND	ND	ND	4.17	4.16	3.28	3.76	0.14	0.33	2.07	2.80	3.60	3.80	4.26	3.99	3.95	3.89	3.65	3.01	3.31
RADIONUCLIDES (pCi/L) DISSOLVED																											
Gross Alpha		15	NM	NM	NM	NM	NM	**455.0**	**581.0**	**390.0**	**577.0**	**391.0**	**561.0**	**577.0**	NM	NM	NM	NM	NM	NM	**720.0**	**713.0**	**671.0**	**747.0**	**1250.0**	**584.0**	**715.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	19.1	23.8	18.5	24.0	21.1	113.0	116.0	NM	NM	NM	NM	NM	NM	23.5	24.6	25.3	25.6	104.0	117.0	142.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	89.7	145.0	99.7	65.3	NM	NM	NM	NM	NM	NM	NM	NM	NM	105.0	357.0	136.0	78.9
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	13.2	14.1	13.6	9.3	NM	NM	NM	NM	NM	NM	NM	NM	NM	14.3	37.0	16.6	10.4
Radium 226		5.0*	**10.5**	2.4	3.8	4.3	**6.5**	4.6	**5.6**	**5.6**	4.4	3.6	2.8	3.3	**7.3**	2.3	2.3	1.6	1.9	2.5	2.7	2.1	2.7	2.3	2.6	2.1	2.3
Radium 226 precision (±)			NM	NM	NM	NM	0.5	0.4	0.4	0.6	0.4	0.4	0.6	0.7	NM	NM	NM	NM	NM	0.3	0.3	0.2	0.5	0.3	0.3	0.4	0.5
Radium 228		5.0*	NM	NM	**8.9**	NM	NM	NM	NM	NM	3.7	3.5	3.8	3.4	NM	NM	1.0	**19.2**	NM	NM	NM	NM	NM	3.3	3.7	2.8	4.4
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	0.8	1.2	1.1	0.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.7	0.9	0.9	1.2
Combined Radium 226 & Radium 228		5.0	NA	NA	**12.7**	NA	NA	NA	NA	NA	**8.1**	**7.1**	**6.6**	**6.7**	NA	NA	**3.3**	**20.8**	NA	NA	NA	NA	NA	**5.6**	**6.3**	**4.9**	**6.7**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-LQD Class III Guidelines (Livestock)	#3-NW													#4-SW												
			1989	1990	Spring 1992	Winter 1992	Spring 1998	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Fall 2015	1989	1990	Spring 1992	Winter 1992	Spring 1998	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Fall 2015
Analyte			7/13/1989	11/14/1990	5/26/1992	12/29/1992	5/21/1998	10/12/2011	10/24/2012	5/22/2013	9/16/2013	7/9/2014	10/9/2014	6/23/2015	10/9/2015	7/13/1989	11/14/1990	5/26/1992	12/29/1992	5/21/1998	10/13/2011	10/24/2012	5/22/2013	9/16/2013	7/9/2014	10/9/2014	6/23/2015	10/9/2015
MAJOR IONS (mg/L)																												
Hardness as CaCO3			722	725	844	928	803	640	636	593	598	603	576	572	562	497	426	472	488	519	721	859	842	819	773	743	750	712
Alkalinity, Total as CaCO3			NM	NM	NM	NM	NM	162	186	179	178	NM	NM	NM	NM	NM	NM	NM	NM	NM	162	175	178	188	NM	NM	NM	NM
Carbonate as CO3	5.0		0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		329	200	315	281	256	198	227	219	217	211	211	207	201	188	96	85	148	156	198	213	218	229	225	220	219	208
Calcium	1		210	198	242	270	221	179	179	165	167	161	160	160	156	138	122	147	139	147	203	247	240	234	219	212	213	201
Chloride	1	2,000	42.0	48.9	56.8	56.8	60.0	40.0	37.0	39.0	35.0	38.0	37.0	42.0	37.0	51.0	49.9	52.0	56.8	57.0	51.0	52.0	51.0	50.0	51.0	50.0	53.0	50.0
Fluoride	0.1	-	0.12	0.09	0.14	0.13	0.16	0.20	0.10	0.20	0.10	0.10	0.20	0.20	0.40	0.19	0.59	1.05	0.44	0.34	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Magnesium	1		48.0	56.0	58.2	61.6	61.0	47.0	46.0	44.0	44.0	49.0	43.0	42.0	42.0	37.0	29.4	25.4	34.3	37.0	52.0	59.0	59.0	57.0	55.0	52.0	53.0	51.0
Nitrogen, Ammonia as N	0.05	-	0.64	0.38	0.60	0.17	0.30	0.16	0.18	0.21	0.17	0.14	0.18	0.17	0.18	0.69	0.36	ND	0.23	0.08	0.80	0.51	0.48	0.46	0.42	0.44	0.41	0.4
Nitrite as N		10.0	NM	NM	NM	NM	NM	NM	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	ND	ND	NM	NM	NM	NM
Nitrate as N			0.51	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.16	ND	0.03	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		13.0	14.2	13.2	12.3	12.2	11.0	12.0	11.0	11.0	11.0	10.0	10.0	11.0	9.3	10.7	10.0	9.6	9.5	11.0	12.0	12.0	12.0	11.0	11.0	11.0	12.0
Silica	0.2		NM	NM	NM	NM	NM	6.4	6.6	6.1	6.0	6.3	6.1	6.3	6.0	NM	NM	NM	NM	NM	8.9	9.2	8.5	9.0	9.1	8.9	9.2	8.8
Sodium	1		154	120	137	114	132	141	137	140	133	144	137	141	141	170	156	164	170	153	183	189	194	181	183	171	172	170
Sulfate	2	3,000	753	710	792	776	812	701	696	660	662	668	676	680	678	600	590	696	674	659	951	994	984	953	904	882	867	852
PHYSICAL PROPERITES																												
Lab Conductivity @ 25°C (umho/cm)	5		1818	1716	1555	1669	1900	1630	1660	1630	1620	1580	1640	1630	1600	1488	1573	1295	1492	1610	2030	2150	2170	2120	2050	2030	1990	1930
Lab pH (std units)	0.01	6.5-8.5	6.99	7.84	7.43	7.63	7.78	7.71	7.29	7.30	7.32	7.34	7.38	7.28	7.34	7.52	7.55	7.38	7.43	7.96	7.92	7.57	7.53	7.49	7.60	7.73	7.52	7.52
Total Dissolved Solids @ 180°C	20	5,000	1431	1272	1501	1445	1480	1200	1270	1240	1250	1220	1250	1210	1210	1210	1165	1170	1160	1150	1600	1750	1740	1700	1600	1630	1570	1530
Field pH (std units)		6.5-8.5	6.66	6.54	6.58	7.30	6.73	7.34	7.32	7.62	7.42	7.33	7.26	7.17	7.37	6.75	**6.41**	6.68	7.40	6.82	7.74	7.60	7.76	7.57	7.60	7.63	7.38	7.62
Field Conductivity (uS/cm)			1646	2030	1720	1397	1650	1666	1612	1659	1700	1679	1876	1697	1538	1560	1640	1430	1255	1460	2200	2340	2370	2370	2310	2280	2150	1842
Field Temperature (°C)			NM	NM	NM	NM	NM	9.5	8.9	11.6	9.7	10.5	10.0	11.7	11.2	NM	NM	NM	NM	NM	9.8	9.3	11.8	9.9	11.0	10.0	11.6	11.8
Depth to Water (ft)			36.87	31.21	30.24	30.41	30.06	26.86	26.86	26.72	27.07	26.65	26.75	26.47	26.84	37.03	31.42	30.46	30.60	30.19	26.97	26.92	26.92	27.20	26.81	26.97	26.68	27.02
Total Depth (ft)			62.01	62.01	62.01	62.01	62.01	62.01	62.01	62.01	62.01	61.94	61.90	62.17	61.94	92.51	92.51	92.51	92.51	92.51	92.51	92.51	92.51	92.51	92.55	92.45	92.40	92.40
Casing ID (in. dia.)			5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5.00	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.00	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10	6955.10
WATER ELEVATION			***6918.13***	***6923.79***	***6924.76***	***6924.59***	***6924.94***	***6928.14***	***6928.14***	***6928.28***	***6927.93***	***6928.35***	***6928.25***	***6928.53***	***6928.16***	***6918.07***	***6923.68***	***6924.64***	***6924.50***	***6924.91***	***6928.13***	***6928.18***	***6928.18***	***6927.90***	***6928.29***	***6928.13***	***6928.42***	***6928.08***
TRACE METALS (mg/L)																												
Aluminum	0.1	5.0	ND	**21.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND	ND	0.001	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.12	0.06	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.11	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	0.01	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.17	56.80	0.42	0.59	0.40	0.55	0.41	0.15	0.41	ND	0.26	0.35	0.37	0.22	0.66	ND	0.25	ND	0.95	0.69	0.22	0.90	ND	0.12	0.30	0.33
Lead	0.001	0.1	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.16	4.85	0.33	0.33	0.41	0.26	0.25	0.24	0.21	0.22	0.21	0.22	**0.2**	0.02	0.16	0.01	0.10	0.01	0.17	0.18	0.19	0.18	0.17	0.16	0.17	**0.16**
Mercury	0.001	0.00005	ND	**0.00**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	0.03	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	**0.060**	0.002	0.009	ND	0.002	ND	ND	ND	ND	ND	ND	ND	ND	**0.067**	0.008	0.003	ND	0.003	ND	ND	ND	ND	ND	ND	ND	0.001
Uranium	0.0003		0.1700	0.2810	0.0890	0.0880	0.0930	0.1340	0.1550	0.1400	0.1580	0.1350	0.1450	0.1230	**0.1580**	0.0130	0.0190	0.0070	0.0030	0.0120	0.0400	0.0457	0.0574	0.0562	0.0535	0.0606	0.0557	**0.0624**
Vanadium	0.1	0.1	ND	ND	ND	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.04	0.28	0.03	0.01	0.01	0.01	ND	ND	ND	ND	ND	ND	ND	0.03	ND	0.01	ND	ND	0.02	ND	ND	ND	ND	ND	ND	0.02
TRACE METALS (mg/L) TOTALS																												
Iron	0.03		0.17	56.80	0.42	0.59	0.40	0.55	0.41	0.15	0.41	0.52	0.49	0.48	0.48	0.22	0.66	ND	0.25	ND	0.95	0.69	0.22	0.90	0.98	0.93	1.27	**0.91**
Manganese	0.01		0.16	4.85	0.33	0.33	0.41	0.26	0.25	0.24	0.21	0.23	0.22	0.21	0.21	0.02	0.16	0.01	0.10	0.01	0.17	0.18	0.19	0.18	0.18	0.17	0.17	0.16
RADIONUCLIDES (pCi/L) DISSOLVED																												
Gross Alpha		15	NM	NM	NM	NM	NM	NM	**156.0**	**169.0**	**202.0**	**151.0**	**139.0**	**127.0**	**157.0**	NM	NM	NM	NM	NM	NM	**69.7**	**99.0**	**130.0**	**73.1**	**78.5**	**74.1**	**93.9**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	7.1	8.4	10.6	7.2	7.9	25.7	31.7	NM	NM	NM	NM	NM	NM	6.3	7.7	10.6	7.8	7.1	16.3	20.3
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	22.1	24.7	31.3	30.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	18.7	22.4	19.2	24.5
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	4.2	5.9	4.3	1.2	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.2	6.9	3.9	4.5
Radium 226		5.0*	**9.4**	4.6	4.3	4.5	**6.0**	**7.3**	**6.9**	**8.8**	**8.6**	**7.6**	**9.1**	**9.6**	**8.4**	4.7	3.2	3.9	2.6	3.6	**8.0**	**7.3**	**8.2**	**8.0**	**5.9**	**7.5**	**7.1**	**8.4**
Radium 226 precision (±)			NM	NM	NM	NM	NM	0.5	0.5	0.4	0.8	0.5	0.6	1.9	1.7	NM	NM	NM	NM	NM	0.6	0.5	0.4	0.8	0.5	0.5	1.4	1.6
Radium 228		5.0*	NM	NM	3.5	4.5	NM	NM	NM	NM	NM	1.7	2.6	<1.2	2.2	NM	NM	4.0	**6.3**	NM	NM	NM	NM	NM	**5.4**	**7.6**	3.1	4.1
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	0.9	1.3	0.8	0.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.9	1.5	1.0	1.1
Combined Radium 226 & Radium 228		5.0	NA	NA	**7.8**	**9.0**	NA	NA	NA	NA	NA	**9.3**	**11.7**	NA	**10.6**	NA	NA	**7.9**	**8.9**	NA	NA	NA	NA	NA	**11.3**	**15.1**	**10.2**	**12.5**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-LQD Class III Guidelines (Livestock)	MW-650													
			1986	Winter 1986	Summer 1989	Fall 1990	Spring 1992	Spring 1998	Fall 2011	Fall 2012	Spring 2013	Fall 2103	Summer 2014	Fall 2014	Summer 2015	Fall 2015
Analyte			11/13/1986	12/5/1986	7/12/1989	11/14/1990	5/21/1992	5/28/1998	10/13/2011	10/25/2012	5/23/2013	9/17/2013	7/9/2014	10/8/2014	6/23/2015	10/7/2015
MAJOR IONS (mg/L)																
Hardness as CaCO3			NM	856	1092	3291	1061	1611	1214	1045	1294	1273	1304	1216	1280	1250
Alkalinity, Total as CaCO3			NM	NM	NM	NM	NM	NM	179	181	193	196	NM	NM	NM	NM
Carbonate as CO3	5.0		NM	0	0	0	0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		NM	144	211	0	210	266	218	220	236	239	247	237	260	245
Calcium	1		NM	211	289	324	286	400	305	254	324	319	328	306	325	313
Chloride	1	2,000	NM	10.0	7.6	252.0	8.7	10.2	6.0	7.0	6.0	6.0	6.0	7.0	7.0	7.0
Fluoride	0.1	-	NM	0.29	0.15	0.08	0.19	0.19	0.20	0.20	0.20	0.10	0.10	0.10	0.20	0.10
Magnesium	1		NM	80.0	90.0	605.0	84.4	149.0	110.0	100.0	118.0	116.0	118.0	110.0	114.0	114.0
Nitrogen, Ammonia as N	0.05	-	NM	0.40	1.10	186.00	0.87	0.76	0.70	0.56	0.53	0.52	0.48	0.60	0.54	0.56
Nitrite as N		10.0	NM	NM	NM	NM	NM	ND	NM	NM	ND	ND	NM	NM	NM	NM
Nitrate as N			NM	NM	ND	ND	0.03	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		NM	14.0	11.1	11.2	11.1	13.3	13.0	11.0	14.0	12.0	13.0	13.0	12.0	13.0
Silica	0.2		NM	NM	NM	NM	NM	NM	6.5	5.5	6.4	6.2	6.3	6.1	6.4	6.4
Sodium	1		NM	126	129	285	97	114	106	92	112	116	113	101	106	107
Sulfate	2	3,000	NM	971	1170	**10400**	1147	1470	1280	1270	1240	1210	1260	1250	1290	1270
PHYSICAL PROPERITES																
Lab Conductivity @ 25°C (umho/cm)	5		NM	1790	2003	10010	1519	2520	2310	2280	2310	2280	2370	2380	2450	2360
Lab pH (std units)	0.01	6.5-8.5	NM	7.60	7.38	**2.58**	7.38	8.00	7.71	7.32	7.32	7.38	7.34	7.34	7.19	7.28
Total Dissolved Solids @ 180°C	20	5,000	NM	1640	1852	**15404**	1889	2280	2040	2080	2110	2080	2090	2100	2190	2150
Field pH (std units)		6.5-8.5	7.30	7.39	7.10	**2.38**	6.80	6.86	7.46	7.35	7.60	7.41	7.36	7.35	7.13	7.33
Field Conductivity (uS/cm)			1850	1770	1854	11200	1910	1860	2490	2480	2570	2610	2650	2660	2630	2690
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	8.4	8.2	10.9	8.6	9.1	9.1	10.7	9.9
Depth to Water (ft)			32.57	32.48	28.66	27.83	26.52	17.45	16.90	17.80	17.14	17.66	17.15	17.63	17.10	17.86
Total Depth (ft)			93.30	93.30	93.30	93.30	93.30	93.30	93.30	93.00	93.00	93.30	93.49	93.30	93.60	93.00
Casing ID (in. dia.)			5.00	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54	6935.54
WATER ELEVATION			***6902.97***	***6903.06***	***6906.88***	***6907.71***	***6909.02***	***6918.09***	***6918.64***	***6917.74***	***6918.40***	***6917.88***	***6918.39***	***6917.91***	***6918.44***	***6917.68***
TRACE METALS (mg/L)																
Aluminum	0.1	5.0	NM	2.0	ND	**493.0**	ND	1.3	0.3	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	NM	ND	0.003	0.003	0.001	0.002	0.004	ND	ND	0.002	ND	ND	ND	ND
Barium	0.1	-	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND
Boron	0.1	5.0	NM	0.90	0.12	0.06	0.10	0.10	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	NM	ND	ND	**0.06**	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	NM	**0.06**	ND	**0.38**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	NM	ND	ND	0.49	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	NM	3.10	0.54	1320.00	0.06	19.00	3.31	0.16	0.04	0.40	ND	0.66	0.14	0.09
Lead	0.001	0.1	NM	ND	ND	**0.16**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	NM	0.23	0.08	79.00	0.12	0.62	0.24	0.31	0.15	0.23	0.19	0.15	0.14	0.15
Mercury	0.001	0.00005	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	NM	0.03	0.07	2.65	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	NM	ND	0.048	**0.059**	ND	0.002	ND	ND	ND	ND	ND	ND	ND	0.001
Uranium	0.0003		NM	3.9000	8.3000	3.4400	5.4100	15.2000	8.9100	6.9000	8.7000	8.0000	10.1000	7.4000	8.7100	8.9000
Vanadium	0.1	0.1	NM	ND	ND	**5.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	NM	0.03	0.19	5.90	0.01	0.02	0.01	ND	ND	ND	ND	ND	ND	ND
TRACE METALS (mg/L) TOTALS																
Iron	0.03		NM	3.10	0.54	1320.00	0.06	19.00	3.31	0.16	0.04	0.40	5.29	3.73	18.30	7.82
Manganese	0.01		NM	0.23	0.08	79.00	0.12	0.62	0.24	0.31	0.15	0.23	0.31	0.15	0.20	0.18
RADIONUCLIDES (pCi/L) DISSOLVED																
Gross Alpha		15	NM	NM	NM	NM	NM	NM	NM	**6860.0**	**7570.0**	**7230.0**	**7370.0**	**4220.0**	**5810.0**	**9250.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	51.8	55.4	59.3	61.1	47.1	1130.0	1790.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	580.0	768.0	2640.0	609.0
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	17.9	16.1	268.0	61.9
Radium 226		5.0*	NM	**29.0**	**59.9**	**1.5**	**52.2**	**179.0**	**156.0**	**72.0**	**68.0**	**60.0**	**52.0**	**64.0**	**110.0**	**70.0**
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	2.4	1.6	1.1	2.0	1.3	1.5	21.0	13.0
Radium 228		5.0*	NM	NM	NM	NM	**22.4**	NM	NM	NM	NM	NM	3.6	4.8	**5.6**	4.5
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.8	0.9	1.3	1.1
Combined Radium 226 & Radium 228		5.0	NA	NA	NA	NA	**74.6**	NA	NA	NA	NA	NA	**55.6**	**68.8**	**115.6**	**74.5**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-LQD Class III Guidelines (Livestock)	Jenkins 5					Sullivan 1						Sullivan 2					
			Spring 2013	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Spring 2103	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Fall 2015	Spring 2013	Fall 2013	Summer 2014	Fall 2014	Summer 2015	Fall 2015
Analyte			5/22/2013	9/17/2013	7/7/2014	10/9/2014	6/23/2015	5/22/2013	9/17/2013	7/8/2014	10/7/2014	6/24/2015	10/8/2015	5/22/2013	9/17/2013	7/7/2014	10/7/2014	6/24/2015	10/7/2015
MAJOR IONS (mg/L)																			
Hardness as CaCO3			475	469	478	450	478	557	562	551	529	562	543	649	645	713	734	704	579
Alkalinity, Total as CaCO3			153	171	NM	NM	NM	338	346	NM	NM	NM	NM	360	365	NM	NM	NM	NM
Carbonate as CO3	5.0		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate, as HCO3	5.0		187	208	205	197	200	413	422	427	428	413	395	439	446	452	479	438	393
Calcium	1		136	135	137	129	137	172	174	171	164	174	168	166	166	182	187	180	148
Chloride	1	2,000	6.0	6.0	6.0	6.0	7.0	12.0	11.0	12.0	12.0	13.0	13.0	37.0	34.0	34.0	36.0	35.0	29.0
Fluoride	0.1	-	0.50	0.50	0.50	0.60	0.50	0.10	0.10	0.10	0.10	0.10	0.10	0.10	ND	ND	ND	0.10	0.10
Magnesium	1		33.0	32.0	33.0	31.0	33.0	31.0	31.0	30.0	29.0	31.0	30.0	57.0	56.0	63.0	65.0	62.0	51.0
Nitrogen, Ammonia as N	0.05	-	0.21	0.20	0.16	0.19	0.17	0.14	0.16	0.12	0.16	0.15	0.13	0.38	0.40	0.36	0.40	0.42	0.38
Nitrite as N		10.0	ND	ND	NM	NM	NM	ND	ND	ND	ND	ND	NM	ND	ND	NM	NM	NM	NM
Nitrate as N			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Nitrogen, Nitrate + Nitrite as N	0.1	100.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	1		7.0	8.0	8.0	7.0	9.0	5.0	5.0	5.0	5.0	5.0	5.0	9.0	9.0	10.0	9.0	10.0	9.0
Silica	0.2		16.9	15.2	15.9	15.5	15.7	22.3	23.1	22.9	22.5	23.7	23.8	9.7	9.4	10.2	9.9	10.4	10.4
Sodium	1		43	36	40	35	36	30	32	31	28	31	30	74	68	75	66	76	76
Sulfate	2	3,000	357	376	384	396	393	248	253	264	266	248	265	393	399	461	482	454	395
PHYSICAL PROPERITES																			
Lab Conductivity @ 25°C (umho/cm)	5		1010	1010	1010	1020	1000	1080	1060	1090	1080	1060	1070	1420	1400	1490	1570	1450	1330
Lab pH (std units)	0.01	6.5-8.5	7.35	7.37	7.33	7.44	7.35	7.07	7.11	7.14	7.08	7.05	7.07	7.25	7.27	7.14	7.08	7.17	7.31
Total Dissolved Solids @ 180°C	20	5,000	720	750	758	771	733	763	754	780	768	758	763	1030	1030	1100	1170	1070	983
Field pH (std units)		6.5-8.5	7.54	7.46	7.44	7.31	7.17	7.24	7.06	6.93	7.05	6.89	7.05	7.55	7.26	7.12	7.16	7.02	7.63
Field Conductivity (uS/cm)			1067	1081	1108	1210	1004	1137	1134	1151	1284	1158	1048	1450	1457	1578	1716	1530	1241
Field Temperature (°C)			11.1	10.1	9.5	8.9	9.3	10.8	8.5	8.9	9.3	9.3	9.9	10.9	9.3	9.8	9.7	10.1	10.4
Depth to Water (ft)			93.00	93.05	92.78	92.78	92.58	13.64	14.90	13.97	14.54	14.20	14.95	42.76	43.25	42.56	42.44	42.25	42.67
Total Depth (ft)			205.50	205.50	205.48	205.48	205.80	109.80	109.80	109.88	109.85	110.10	109.85	115.20	115.20	115.24	115.30	115.25	113.00
Casing ID (in. dia.)			5.00	5.00	5.00	5.00	5.00	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc	5" pvc
TOC Elevation			7041.67	7041.67	7041.67	7041.67	7041.67	6935.74	6935.74	6935.74	6935.74	6935.74	6935.74	6976.65	6976.65	6976.65	6976.65	6976.65	6976.65
WATER ELEVATION			***6948.67***	***6948.62***	***6948.89***	***6948.89***	***6949.09***	***6922.10***	***6920.84***	***6921.77***	***6921.20***	***6921.54***	***6920.79***	***6933.89***	***6933.40***	***6934.09***	***6934.21***	***6934.40***	***6933.98***
TRACE METALS (mg/L)																			
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	0.1	0.1	0.2	0.1	0.1	0.1	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	1.48	2.68	0.68	1.02	1.14	1.81	5.55	1.89	3.06	2.59	3.05	0.24	1.04	0.24	1.06	0.39	0.31
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.49	0.52	0.54	0.51	0.43	1.14	1.05	1.02	1.00	1.05	1.01	0.18	0.17	0.20	0.22	0.20	0.13
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.001	ND	ND	ND
Uranium	0.0003		0.0014	0.0015	0.0013	0.0015	0.0017	0.0015	0.0009	0.0005	0.0007	0.0029	0.0004	0.1140	0.1170	0.0965	0.1130	0.0955	0.0654
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
TRACE METALS (mg/L) TOTALS																			
Iron	0.03		1.48	2.68	3.31	3.09	3.17	1.81	5.55	5.75	5.67	5.66	5.28	0.24	1.04	1.48	1.66	1.42	0.95
Manganese	0.01		0.49	0.52	0.54	0.55	0.53	1.14	1.05	1.04	1.09	1.04	0.99	0.18	0.17	0.20	0.22	0.21	0.14
RADIONUCLIDES (pCi/L) DISSOLVED																			
Gross Alpha		15	12.9	**113.0**	9.3	9.6	11.2	ND	**17.0**	ND	5.9	5.5	3.9	**129.0**	**111.0**	**105.0**	**99.9**	**109.0**	**111.0**
Gross Alpha precision (±)			2.1	10.3	2.8	2.7	2.8	2.5	2.5	6.7	2.1	3.2	2.1	6.5	6.4	7.3	6.1	22.6	23.0
Gross Beta			NM	NM	10.2	9.5	10.3	NM	NM	38.3	4.4	6.1	7.0	NM	NM	19.6	32.0	36.7	26.2
Gross Beta precision (±)			NM	NM	2.7	3.1	2.6	NM	NM	8.9	2.5	3.0	3.2	NM	NM	5.7	4.4	5.1	4.1
Radium 226		5.0*	**6.2**	4.5	3.5	4.7	3.6	2.1	2.4	1.9	2.3	2.3	2.1	**23.0**	**21.0**	**23.0**	**20.0**	**22.0**	**43.0**
Radium 226 precision (±)			0.4	0.6	0.3	0.4	0.8	0.2	0.5	0.3	0.3	0.5	0.5	0.7	1.3	0.8	0.9	4.1	8.1
Radium 228		5.0*	NM	NM	3.4	3.9	3.0	NM	NM	1.9	2.7	1.4	1.6	NM	NM	**7.4**	**8.8**	4.4	**6.6**
Radium 228 precision (±)			NM	NM	0.8	1.5	1.2	NM	NM	0.9	1.3	0.8	0.9	NM	NM	0.9	1.5	1.1	1.4
Combined Radium 226 & Radium 228		5.0	NA	NA	**6.9**	**8.6**	**6.6**	NA	NA	3.8	5.0	3.7	3.7	NA	NA	**30.4**	**28.8**	**26.4**	**49.6**

*Guideline level is for Combined Radium 226 and 228

ND = Not Detected or below Minimum Detection Limit

NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline

Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	Walker/Jenkins Pit																							
			1982	Spring 1983	Fall 1983	Spring 1984	Summer 1984	Fall 1984	Winter 1984	Winter 1984	Spring 1985	Summer 1985	Summer 1985	Fall 1985	Winter 1985	1986	1990	1992	1998	2011	2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015
Analyte			10/5/1982	6/29/1983	10/13/1983	5/15/1984	8/8/1984	9/20/1984	10/18/1984	11/14/1984	4/15/1985	5/20/1985	6/19/1985	7/16/1985	10/16/1985	12/5/1986	12/11/1990	2/4/1992	5/26/1998	10/12/2011	10/22/2012	4/30/2013	9/17/2013	4/24/2014	10/9/2014	6/23/2015
MAJOR IONS (mg/L)																										
Hardness as CaCO3			348	241	369	506	642	672	481	580	428	635	657	753	670	#VALUE!	314	1080	1037	1100	1090	1024	1094	1094	1131	1133
Alkalinity as CaCO3			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	68	78	81	65	NM	NM	NM
Carbonate	5		0	0	0	0	0	0	0	3	NM	0	0	0	NM	NM	NM	137	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		126	107	110	107	122	118	161	110	105	113	112	142	114	NM	205	0	119	83	95	99	80	96	85	89
Calcium	1		103	86	73	66	178	259	153	181	63	167	171	198	186	NM	78	320	272	266	262	244	267	257	267	268
Chloride	1	2,000	30	14	12	8	12	20	16	17	8	16	14	14	13	NM	18	26	36	39	41	39	39	40	42	45
Fluoride	0.1	-	0.29	0.16	1.00	0.12	1.05	0.36	0.35	0.31	0.09	0.28	0.23	0.26	0.27	NM	0.18	0.38	0.38	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Magnesium	1		22.0	6.3	45.7	83.1	48.0	6.0	24.0	31.0	66.0	53.0	56.0	63.0	50.0	NM	29.0	68.3	87.0	106.0	106.0	101.0	104.0	110.0	113.0	113.0
Nitrogen, Ammonia as N	0.05	-	0.69	0.07	0.06	0.06	NM	ND	ND	ND	ND	ND	ND	ND	ND	NM	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	0.31	2.29	2.98	1.13	NM	ND	ND	0.06	1.00	ND	ND	ND	ND	NM	0.12	0.22	NM	NM	NM	ND	NM	NM	NM	NM
Potassium	1		13.0	13.0	12.8	2.0	13.0	14.0	12.0	13.0	9.0	13.0	12.0	14.0	9.0	NM	13.0	12.0	9.0	18.0	19.0	17.0	20.0	21.0	19.0	19.0
Silica	0.2		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	0.3	0.4	0.4	0.7	0.3	0.4
Sodium	1		112	659	104	140	104	95	98	102	1	104	135	114	101	NM	58	120	135	182	183	165	192	191	186	185
Sulfate	2	3,000	765	693	780	797	830	716	616	750	640	786	802	828	763	NM	252	1000	1160	1410	1380	1290	1260	1340	1440	1420
PHYSICAL PROPERITES																										
Lab Conductivity (umhos/cm)	5		NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2400	2500	2450	2360	2350	2590	2570
Lab pH	0.01	6.5-8.5	7.20	7.20	7.60	7.40	NM	8.04	8.00	8.21	6.70	7.91	8.10	7.87	8.20	NM	7.44	7.96	8.03	8.13	8.01	7.83	8.10	7.94	8.19	8.23
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	1136	1161	1190	1259	1206	1169	998	1151	896	1195	1246	1301	1231	NM	556	1729	1790	2030	2150	2090	2180	2010	2270	2160
Field Conductivity (µS)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2540	2650	2780	1969	2720	2830	2810
Field pH		6.5-8.5	NM	NM	NM	NM	7.30	NM	NM	NM	NM	NM	NM	NM	NM	6.70	NM	NM	NM	7.68	7.94	7.49	8.10	8.08	8.38	7.84
Field Temperature (°C)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	11.6	10.0	5.9	18.6	6.2	13.1	20.9
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	92.60	NM	NM	NM	NM	NM
Monument Height			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6926.19	6926.19	6926.19	6926.19
Water level (Foresight SWL-backsight monument)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	4.57	3.20	3.78	2.87
WATER SURFACE ELEVATION (MH-WL)			***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***6863.00***	***6909.00***	***6912.00***	***NA***	***NA***	***NA***	***NA***	***6921.62***	***6922.99***	***6922.41***	***6923.32***
TRACE METALS (mg/L)																										
Aluminum	0.1	5.0	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	0.50	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	ND	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	ND	NM	0.002	ND	ND	0.005	ND	0.002	0.002	0.001	ND	0.001
Barium	0.1	-	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	NM	NM	NM	NM	NM	0.7	0.2	ND	ND	ND	0.4	ND	NM	NM	ND	0.1	ND	0.2	0.1	0.1	0.1	0.1	0.1	0.2
Cadmium	0.005	0.05	ND	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	0.02	0.01	0.01	ND	ND	ND	NM	ND	ND	0.03	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.02	ND	0.06	0.08	0.16	0.30	ND	0.13	NM	ND	0.07	0.06	NM	NM	0.05	ND	ND	0.44	ND	ND	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	0.09	ND	ND	0.06	ND	ND	NM	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.03	0.03	0.05	0.12	NM	NM	NM	NM	NM	NM	NM	NM	0.05	NM	ND	0.07	ND	0.02	ND	0.03	ND	0.02	ND	0.01
Mercury	0.001	0.00005	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	0.02	0.04	0.03	0.04	0.10	0.05	0.07	0.05	0.03	0.04	0.04	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	ND	0.020	0.007	ND	ND	0.002	ND	ND	ND	0.002
Uranium	0.0003		0.21	7.45	0.16	0.43	0.21	0.44	0.58	1.02	NM	0.44	0.52	0.56	0.14	NM	0.14	0.11	0.41	0.29	0.27	0.25	0.27	0.24	0.24	0.22
Vanadium	0.1	0.1	NM	NM	NM	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	0.02	0.01	0.03	0.01	0.12	NM	0.01	0.02	ND	ND	NM	ND	0.12	0.01	0.02	ND	0.01	ND	0.01	ND	ND
TOTAL METALS (mg/L)																										
Iron	0.03		0.02	ND	0.06	0.08	0.16	0.30	ND	0.13	NM	ND	0.07	0.06	NM	NM	0.05	ND	ND	0.44	ND	ND	ND	0.79	1.13	0.64
Manganese	0.01		0.03	0.03	0.05	0.12	NM	NM	NM	NM	NM	NM	NM	NM	0.05	NM	ND	0.07	ND	0.02	ND	0.03	ND	0.03	0.03	0.03
RADIONUCLIDES (pCi/L) DISSOLVED																										
Gross Alpha		15	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**295.0**	**197.0**	**234.0**	**221.0**	**148.0**	**167.0**
Gross Alpha precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	12.4	11.0	12.7	12.9	10.9	34.0
Gross Beta			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	52.7	42.8	43.1
Gross Beta precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	7.2	9.9	6.6
Radium 226		5.0*	**7.0**	**5.6**	**5.5**	4.3	2.1	3.3	**5.5**	1.4	NM	NM	NM	NM	3.6	NM	0.5	2.1	0.6	0.4	0.9	1.6	1.6	0.4	0.8	0.6
Radium 226 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.2	0.3	0.2	0.4	0.2	0.2	0.2
Radium 228		5.0*	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND
Radium 228 precision (±)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.6	1.1	0.9
Combined Radium 226 & Radium 228		5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	Sullivan Pit																							
			Fall 2015	Spring 1981	Fall 1981	1982	Sprind 1983	Fall 1983	Spring 1984	Fall 1984	Fall 1984	Winter 1984	Spring 1985	Summer 1985	Summer 1985	Fall 1985	Winter 1985	1986	Spring 1989	Summer 1989	Summer 1989	Summer 1989	1992	1998	2011	2012
Analyte			10/6/2015	4/2/1981	8/7/1981	10/5/1982	5/26/1983	10/13/1983	5/15/1984	8/8/1984	10/17/1984	11/14/1984	4/15/1985	5/20/1985	6/19/1985	7/16/1985	10/16/1985	6/17/1986	5/17/1989	6/1/1989	6/13/1989	6/19/1989	2/6/1992	5/26/1998	10/13/2011	10/25/2012
MAJOR IONS (mg/L)																										
Hardness as CaCO3			1244	627	676	359	461	400	400	697	536	616	598	687	712	701	683	708	512	674	694	734	940	1115	1134	1033
Alkalinity as CaCO3			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	82	93
Carbonate	5		ND	NM	0	0	0	0	0	0	0	0	NM	0	0	0	NM	NM	0	0	0	0	5.8.5	ND	ND	ND
Bicarbonate	5		81	117	115	108	112	110	115	115	107	140	107	81	102	139	105	93	103	112	105	115	8	95	100	113
Calcium	1		261	167	167	107	89	69	55	182	175	176	77	178	178	187	178	180	196	178	189	200	271	295	283	251
Chloride	1	2,000	46	17	15	30	14	12	8	8	13	16	12	16	14	15	13	12	18	19	12	14	14	19	39	20
Fluoride	0.1	-	0.10	NM	0.39	0.24	0.14	1.00	0.10	0.90	0.28	0.27	0.09	0.22	0.19	0.21	0.22	0.22	NM	NM	NM	NM	0.18	0.21	0.40	0.30
Magnesium	1		116.0	51.0	63.0	22.3	58.2	55.8	64.1	59.0	24.0	43.0	99.0	59.0	65.0	57.0	58.0	63.0	5.3	55.8	54.0	57.0	64.1	92.0	104.0	99.0
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	0.43	ND	ND	0.07	NM	ND	ND	0.06	ND	ND	ND	ND	0.11	0.10	ND	1.10	ND	ND	0.07	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.01	NM	NM	NM	NM	NM	NM	ND	ND
Nitrogen, Nitrite as N		10.0	NM	0.22	0.36	0.60	1.94	2.92	1.08	NM	ND	ND	1.70	ND	ND	ND	ND	0.02	0.03	0.02	ND	0.03	0.04	NM	ND	NM
Potassium	1		20.0	14.0	13.0	13.0	14.3	14.9	18.5	14.0	14.0	12.0	10.0	14.0	13.0	14.0	14.0	15.3	13.5	10.5	10.3	10.3	13.6	13.4	16.0	14.0
Silica	0.2		0.3	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND
Sodium	1		191	113	122	112	107	115	164	119	115	99	105	121	121	107	119	114	112	111	129	139	125	138	168	151
Sulfate	2	3,000	1510	748	728	850	783	843	727	925	815	750	850	878	848	904	837	846	820	820	880	920	1000	1290	1450	1500
PHYSICAL PROPERITES																										
Lab Conductivity (umhos/cm)	5		2590	1550	1620	NM	NM	NM	NM	NM	1426	1310	NM	1480	1530	1560	1400	1585	1450	1595	1705	1818	1823	2210	2530	2620
Lab pH	0.01	6.5-8.5	8.02	7.60	7.90	7.20	6.80	7.70	7.30	NM	7.90	8.09	6.80	7.38	8.09	7.85	8.10	8.00	7.94	8.14	7.88	8.15	**8.88**	7.87	8.18	8.10
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	2260	1196	1164	1200	1278	1259	1138	1301	1208	1164	1188	1306	1290	1352	1341	1354	1433	1632	1530	1635	1596	1900	2250	2330
Field Conductivity (µS)			2710	1580	1620	NM	NM	NM	NM	1534	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2650	2820
Field pH		6.5-8.5	8.25	7.70	8.00	NM	NM	NM	NM	7.60	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	8.07	7.99
Field Temperature (°C)			15.2	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	11.4	7.5
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Monument Height			6926.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Water level (Foresight SWL-backsight monument)			3.70	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
WATER SURFACE ELEVATION (MH-WL)			***6922.49***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***6900.50***	***6905.00***	***NA***	***NA***	***6904.00***	***6906.00***	***NA***	***NA***	***NA***
TRACE METALS (mg/L)																										
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	ND	ND	0.70	ND
Arsenic	0.001	0.2	0.001	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	0.001	0.002	ND
Barium	0.1	-	ND	NM	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.1	NM	ND	0.2	NM	NM	NM	0.2	0.3	ND	0.9	0.2	0.7	0.2	NM	0.1	NM	NM	NM	NM	0.2	0.1	0.2	0.2
Cadmium	0.005	0.05	ND	0.01	0.01	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	0.02	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	ND	ND	ND	ND
Copper	0.01	0.5	ND	NM	ND	ND	ND	0.01	ND	0.02	ND	ND	NM	ND	ND	ND	ND	ND	NM	NM	NM	NM	ND	ND	ND	ND
Iron	0.03	-	ND	ND	ND	0.01	0.03	0.06	0.06	NM	ND	0.13	NM	0.26	ND	0.07	NM	ND	0.13	0.21	0.15	0.13	ND	0.43	0.51	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	NM	ND	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND
Manganese	0.01	-	ND	0.03	0.02	0.02	0.03	0.03	0.05	NM	NM	NM	NM	NM	NM	NM	0.03	0.07	NM	NM	NM	NM	0.03	0.03	0.01	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	NM	NM	NM	NM	ND	ND	ND	ND
Molybdenum	0.1		ND	NM	NM	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	NM	0.02	ND	ND	0.04	0.02	0.04	0.04	0.02	0.04	0.02	0.02	0.03	ND	NM	NM	NM	NM	NM	ND	ND	ND	ND
Selenium	0.001	0.05	0.002	ND	ND	ND	NM	NM	NM	NM	NM	NM	NM	NM	NM	ND	ND	0.026	0.024	0.039	0.045	0.049	0.025	0.020	0.003	0.003
Uranium	0.0003		0.26	0.33	NM	0.63	0.54	0.36	14.20	0.35	0.43	0.33	NM	0.66	0.43	0.57	0.72	0.61	0.14	NM	NM	0.80	0.03	0.24	0.14	0.15
Vanadium	0.1	0.1	ND	NM	ND	NM	NM	NM	ND	NM	ND	ND	ND	ND	ND	NM	ND	NM	NM	NM	NM	NM	ND	ND	ND	ND
Zinc	0.01	25.0	ND	NM	NM	NM	ND	ND	ND	ND	0.01	0.01	NM	0.03	ND	0.02	ND	ND	ND	NM	NM	NM	ND	ND	ND	ND
TOTAL METALS (mg/L)																										
Iron	0.03		0.12	ND	ND	0.01	0.03	0.06	0.06	NM	ND	0.13	NM	0.26	ND	0.07	NM	ND	0.13	0.21	0.15	0.13	ND	0.43	0.51	ND
Manganese	0.01		0.03	0.03	0.02	0.02	0.03	0.03	0.05	NM	NM	NM	NM	NM	NM	NM	0.03	0.07	NM	NM	NM	NM	0.03	0.03	0.01	ND
RADIONUCLIDES (pCi/L) DISSOLVED																										
Gross Alpha		15	**190.0**	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	**111.0**
Gross Alpha precision (±)			39.4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	8.7
Gross Beta			47.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Gross Beta precision (±)			7.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Radium 226		5.0*	1.7	**19.0**	**5.9**	3.2	3.4	2.9	2.5	2.5	3.0	**5.1**	3.1	2.1	2.0	NM	NM	NM	2.1	2.2	2.1	2.0	0.5	**6.2**	2.1	2.0
Radium 226 precision (±)			0.4	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	0.3	0.3
Radium 228		5.0*	1.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Radium 228 precision (±)			0.9	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Combined Radium 226 & Radium 228		5.0	3.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			4/30/2013	9/17/2013	4/24/2014	10/8/2014	6/23/2015	10/9/2015
MAJOR IONS (mg/L)								
Hardness as CaCO3			1107	1265	1183	1219	1240	1128
Alkalinity as CaCO3			88	85	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	ND	ND
Bicarbonate	5		107	103	111	106	109	98
Calcium	1		277	314	291	304	309	304
Chloride	1	2,000	18	19	19	19	22	21
Fluoride	0.1	-	0.20	0.20	0.30	0.30	0.30	0.20
Magnesium	1		101.0	117.0	111.0	112.0	114.0	118.0
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	ND	ND	NM	NM	NM	NM
Potassium	1		16.0	18.0	17.0	18.0	17.0	18.0
Silica	0.2		1.0	ND	0.4	ND	0.3	ND
Sodium	1		167	191	182	177	177	189
Sulfate	2	3,000	1370	1490	1460	1520	1530	1570
PHYSICAL PROPERITES								
Lab Conductivity (umhos/cm)	5		2450	2590	2500	2660	2680	2670
Lab pH	0.01	6.5-8.5	7.87	8.24	7.98	8.17	8.18	8.08
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	2140	2340	2250	2400	2360	2400
Field Conductivity (µS)			2790	2760	2870	2920	2790	2950
Field pH		6.5-8.5	7.26	8.18	8.02	8.32	8.15	8.29
Field Temperature (°C)			6.0	15.7	6.4	14.9	22.7	15.5
Field Turbidity (NTU)			NM	NM	NM	NM	NM	NM
Monument Height			NA	6920.95	6920.95	6920.95	6920.95	6920.95
Water level (Foresight SWL-backsight monument)			NM	NM	5.32	5.95	4.91	5.80
WATER SURFACE ELEVATION (MH-WL)			***NA***	***NA***	***6915.63***	***6915.00***	***6916.04***	***6915.15***
TRACE METALS (mg/L)								
Aluminum	0.1	5.0	ND	ND	ND	ND	ND	ND
Arsenic	0.001	0.2	0.001	0.002	0.001	ND	ND	ND
Barium	0.1	-	ND	ND	ND	ND	ND	ND
Boron	0.1	5.0	0.2	0.2	0.1	0.2	0.2	0.2
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND
Iron	0.03	-	ND	ND	ND	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.01	ND	0.01	ND	ND	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.005	0.003	0.002	0.002	0.002	0.003
Uranium	0.0003		0.13	0.14	0.13	0.14	0.14	0.13
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	0.01	ND	ND	ND
TOTAL METALS (mg/L)								
Iron	0.03		ND	ND	0.48	0.24	0.95	0.11
Manganese	0.01		0.01	ND	0.02	0.01	0.02	ND
RADIONUCLIDES (pCi/L) DISSOLVED								
Gross Alpha		15	**86.8**	**112.0**	**149.0**	**120.0**	**115.0**	**116.0**
Gross Alpha precision (±)			8.4	9.3	10.8	20.1	24.1	25.3
Gross Beta			NM	NM	41.9	27.9	39.1	31.3
Gross Beta precision (±)			NM	NM	6.3	10.3	6.7	5.8
Radium 226		5.0*	1.9	2.7	1.8	2.6	1.7	2.4
Radium 226 precision (±)			0.2	0.5	0.3	0.3	0.4	0.5
Radium 228		5.0*	NM	NM	1.1	3.1	1.1	1.5
Radium 228 precision (±)			NM	NM	0.7	0.9	0.7	0.7
Combined Radium 226 & Radium 228		5.0	NA	NA	2.9	**5.7**	2.8	3.9

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available

Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	SW-1								SW-2						
			Fall 2011	Fall 2012	Spring 2013	Fall 2103	Spring 2014	Fall 2014	Summer 2015	Fall 2015	Fall 2011	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Summer 2015	Fall 2015
Analyte			10/13/2011	10/22/2012	4/30/2013	9/17/2013	4/24/2014	10/7/2014	6/24/2015	10/8/2015	10/12/2011	4/30/2013	9/17/2013	4/24/2014	10/7/2014	6/24/2015	10/8/2015
MAJOR IONS (mg/L)																	
Hardness as CaCO3			124	188	76	141	41	185	117	192	143	79	140	41	185	110	186
Alkalinity as CaCO3			134	183	90	151	NM	NM	NM	NM	145	89	137	NM	NM	NM	NM
Carbonate	5		4	ND	ND	ND	ND	ND	ND	ND	5	ND	7	ND	ND	10	ND
Bicarbonate	5		155	214	110	177	54	267	166	187	167	109	153	54	246	163	176
Calcium	1		38	57	24	40	13	56	32	57	44	25	38	13	56	31	53
Chloride	1	2,000	6	9	3	9	1	7	5	11	6	3	9	1	7	5	11
Fluoride	0.1	-	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.3	0.2	0.2
Magnesium	1		7	11	4	10	2	11	9	12	8	4	11	2	11	8	13
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	NM	ND	ND	ND	NM	NM	NM	NM	ND	ND	NM	NM	NM	NM
Potassium	1		3	5	2	5	2	5	3	6	4	2	6	2	5	3	6
Silica	0.2		25.3	31.0	14.0	11.2	12.6	25.6	2.7	19.1	26.3	14.2	10.8	13.2	24.4	1.6	15.4
Sodium	1		16	36	10	37	4	29	30	40	19	11	39	4	30	30	40
Sulfate	2	3,000	26	64	14	62	6	45	33	93	27	15	71	6	46	33	91
PHYSICAL PROPERITES																	
Lab Conductivity (umhos/cm)	5		326	486	209	424	96	486	331	521	340	211	423	98	482	316	510
Lab pH	0.01	6.5-8.5	8.04	8.27	8.22	**8.55**	7.73	8.24	8.37	8.29	8.49	8.20	**8.78**	7.76	8.42	**9.09**	8.42
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	227	311	148	264	80	312	215	346	218	146	262	81	312	191	337
Total Suspended Solids, TSS @ 105C (mg/L)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Field Conductivity (µS)			349	510	229	351	116	612	366	522	359	225	350	115	582	345	505
Field pH		6.5-8.5	**8.68**	**8.76**	7.97	**8.62**	7.96	7.36	7.78	8.40	7.83	7.30	**8.72**	7.80	8.10	8.39	**8.53**
Field Temperature (°C)			10.5	7.9	7.4	18.0	5.0	7.5	18.1	11.8	8.6	7.3	21.8	6.8	9.2	24.0	17.1
Field Turbidity (NTU)			NM	47.20	NM	NM	46.50	5.30	3.95	5.32	NM	NM	NM	35.80	4.50	3.18	11.90
TRACE METALS (mg/L)																	
Aluminum	0.1	5.0	0.7	ND	ND	ND	0.3	ND	ND	ND	0.9	ND	ND	0.3	ND	ND	ND
Arsenic	0.001	0.2	0.005	0.003	0.003	0.004	0.001	0.003	0.004	0.004	0.005	0.003	0.004	0.001	0.003	0.004	0.003
Barium	0.1	-	0.1	0.1	ND	ND	ND	0.2	0.1	0.1	0.1	ND	ND	ND	0.2	ND	0.1
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.60	ND	0.15	ND	0.25	ND	ND	ND	0.78	0.16	ND	0.27	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.04	0.03	0.01	0.02	0.01	0.02	ND	0.02	0.05	0.01	ND	ND	0.01	ND	0.03
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	ND	ND	ND	ND	ND	ND	0.001	ND	ND	0.002	ND	ND	ND	0.001	ND
Uranium	0.0003		0.0138	0.0261	0.0108	0.0204	0.0033	0.0232	0.0106	0.0191	0.0144	0.0128	0.0285	0.0032	0.0248	0.0125	0.0217
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	ND	0.02	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																	
Iron	0.03		ND	ND	ND	ND	2.08	0.21	0.09	0.24	0.00	ND	ND	2.58	0.20	0.14	0.62
Manganese	0.01		0.04	0.03	0.01	0.02	0.04	0.03	0.01	0.05	0.05	0.01	ND	0.04	0.02	ND	0.06
RADIONUCLIDES (pCi/L) DISSOLVED																	
Gross Alpha		15	NM	**22.8**	**16.9**	**19.7**	8.0	**20.1**	**15.1**	**20.4**	NM	14.0	**20.2**	8.6	**17.3**	14.0	**18.8**
Gross Alpha precision (±)			NM	1.9	1.5	1.9	1.2	2.0	3.7	4.4	NM	1.4	1.8	1.2	1.7	3.4	4.1
Gross Beta			NM	NM	NM	NM	3.8	6.5	<2.9	8.2	NM	NM	NM	4.5	7.7	3.9	6.4
Gross Beta precision (±)			NM	NM	NM	NM	1.5	1.9	1.2	1.8	NM	NM	NM	1.6	2.0	1.2	1.8
Radium 226		5.0*	0.1	1.1	**6.7**	1.7	0.4	0.7	0.4	0.7	0.5	3.3	0.8	0.6	1.0	1.1	0.9
Radium 226 precision (±)			0.1	0.3	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2
Radium 228		5.0*	NM	NM	NM	NM	ND	<1.8	<1.3	<1.6	NM	NM	NM	ND	ND	ND	<1.6
Radium 228 precision (±)			NM	NM	NM	NM	0.7	1.1	0.8	1.0	NM	NM	NM	0.7	1.2	0.8	0.9
Combined Radium 226 & Radium 228		5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

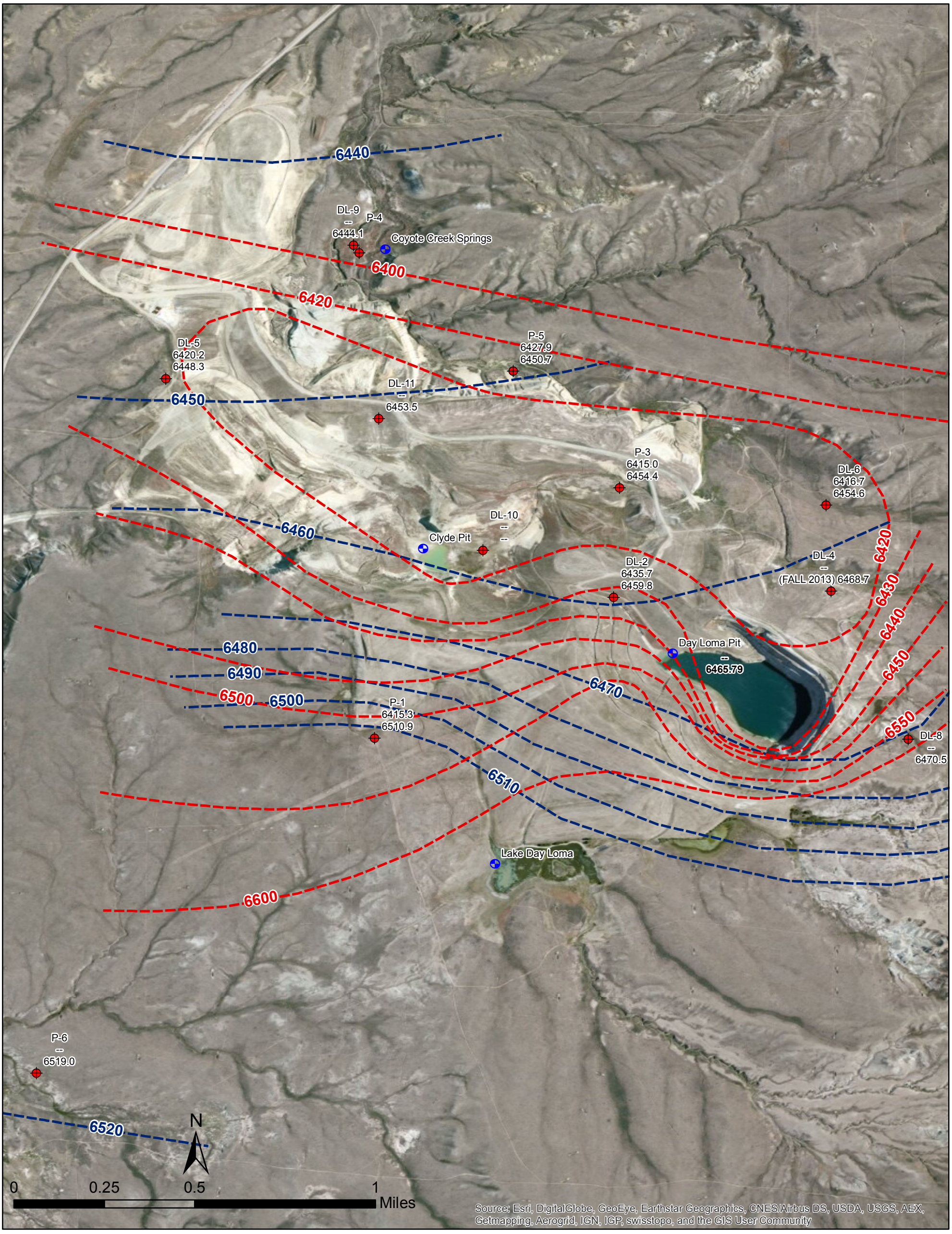
	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	SW-3						SW-4 (Groundwater Seep)						
			Fall 2011	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Fall 2015	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Fall 2015
Analyte			10/12/2011	4/30/2013	9/17/2013	4/24/2014	10/7/2014	10/8/2015	10/12/2011	10/22/2012	4/30/2013	9/17/2013	4/24/2014	10/7/2014	10/8/2015
MAJOR IONS (mg/L)															
Hardness as CaCO3			140	76	136	41	185	178	1729	2789	2781	10332	2695	5631	3723
Alkalinity as CaCO3			138	96	134	NM	NM	NM	ND	ND	ND	ND	NM	NM	NM
Carbonate	5		5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bicarbonate	5		158	118	154	54	243	173	ND	ND	ND	ND	ND	ND	ND
Calcium	1		43	24	38	13	56	50	334	466	412	459	371	432	428
Chloride	1	2,000	6	3	9	1	7	11	55	89	83	382	75	166	154
Fluoride	0.1	-	0.2	0.2	0.2	0.1	0.2	0.1	0.5	0.1	0.1	0.2	ND	ND	11.0
Magnesium	1		8	4	10	2	11	13	218	396	427	2240	431	1110	647
Nitrogen, Ammonia as N	0.05	-	ND	ND	ND	ND	ND	ND	ND	3.06	2.13	13.90	3.79	4.98	6.20
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND
Nitrogen, Nitrite as N		10.0	NM	ND	ND	NM	NM	NM	NM	NM	ND	ND	NM	NM	NM
Potassium	1		4	2	6	2	6	6	10	14	14	16	10	13	14
Silica	0.2		26.6	13.8	10.4	12.6	23.9	13.9	50.2	47.4	31.5	36.8	61.7	23.8	52.0
Sodium	1		19	10	38	4	30	41	86	156	141	582	119	259	178
Sulfate	2	3,000	27	15	73	6	47	96	2620	**4170**	**4280**	**17000**	**4630**	**9560**	**8480**
PHYSICAL PROPERITES															
Lab Conductivity (umhos/cm)	5		339	208	422	98	483	507	3270	4870	5170	14200	5030	9020	8820
Lab pH	0.01	6.5-8.5	**8.52**	8.18	**8.62**	7.75	8.44	**8.51**	**3.65**	**3.45**	**3.81**	**3.54**	**3.63**	**3.51**	**3.43**
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	210	154	254	84	315	331	3380	**5710**	**5850**	**22700**	**6300**	**12500**	**11300**
Total Suspended Solids, TSS @ 105C (mg/L)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Field Conductivity (µS)			363	223	348	115	574	493	3560	5030	5490	6740	5530	7280	9250
Field pH		6.5-8.5	**8.73**	7.86	**8.74**	7.83	8.27	**8.73**	**3.51**	**3.38**	**3.75**	**3.25**	**3.70**	**3.47**	**3.55**
Field Temperature (°C)			9.3	7.4	21.2	7.1	10.8	20.1	8.0	11.3	7.9	23.2	8.3	13.7	16.0
Field Turbidity (NTU)			NM	NM	NM	37.80	6.30	8.23	NM	10.80	NM	NM	NM	NM	NM
TRACE METALS (mg/L)															
Aluminum	0.1	5.0	1.0	0.1	ND	0.3	ND	ND	**89.8**	**183.0**	**157.0**	**745.0**	**296.0**	**737.0**	**416.0**
Arsenic	0.001	0.2	0.005	0.003	0.004	0.001	0.003	0.003	0.007	0.008	0.009	**0.230**	0.007	0.016	0.018
Barium	0.1	-	0.1	ND	ND	ND	0.2	0.1	ND	ND	ND	ND	ND	0.2	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	0.2	0.2	0.3	1.2	0.2	ND	0.4
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	0.03	0.04	0.03	**0.11**	**0.11**	**0.18**	**0.13**
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	0.03	0.04	0.11	0.02	0.07	0.01
Iron	0.03	-	0.80	0.18	ND	0.25	ND	0.09	7.79	15.70	40.80	33.00	10.20	17.00	17.50
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	0.002	ND	0.003	ND	0.003	ND
Manganese	0.01	-	0.04	ND	ND	ND	ND	0.01	6.45	11.90	13.80	58.00	15.10	42.40	23.70
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	ND	ND	ND	ND	ND	ND	0.69	1.29	1.18	8.93	1.65	4.87	2.68
Selenium	0.001	0.05	ND	0.001	ND	ND	ND	ND	0.005	0.005	0.019	**0.068**	0.018	0.042	0.009
Uranium	0.0003		0.0146	0.0103	0.0284	0.0032	0.0246	0.0219	0.0014	0.0039	0.0046	0.2460	0.0026	0.0210	0.0037
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	ND	ND	ND	ND	ND	ND	0.97	1.55	1.41	8.46	2.84	7.83	4.26
TOTAL METALS (mg/L)															
Iron	0.03		ND	ND	ND	2.73	0.26	0.36	ND	0.00	ND	0.00	42.80	28.60	16.60
Manganese	0.01		0.04	ND	ND	0.04	0.02	0.03	6.45	11.90	13.80	58.00	15.60	25.00	24.30
RADIONUCLIDES (pCi/L) DISSOLVED															
Gross Alpha		15	NM	12.2	**19.5**	8.7	**19.3**	**18.6**	NM	**32.7**	**20.4**	**65.3**	**136.0**	10.0	**162.0**
Gross Alpha precision (±)			NM	1.4	1.7	1.2	2.1	4.1	NM	12.3	12.3	39.1	19.5	3.4	39.4
Gross Beta			NM	NM	NM	4.1	6.6	8.7	NM	NM	NM	NM	65.8	ND	35.4
Gross Beta precision (±)			NM	NM	NM	1.5	1.9	1.8	NM	NM	NM	NM	16.8	3.2	17.5
Radium 226		5.0*	0.4	3.4	0.8	0.5	1.1	0.8	**6.9**	**12.0**	**6.5**	**7.3**	**22.0**	**7.9**	**9.9**
Radium 226 precision (±)			0.1	0.2	0.3	0.2	0.3	0.2	0.5	0.8	0.4	0.8	0.9	0.6	2.0
Radium 228		5.0*	NM	NM	NM	<1.1	<1.9	<1.6	NM	NM	NM	NM	**22.9**	**7.4**	**13.9**
Radium 228 precision (±)			NM	NM	NM	0.7	1.2	0.9	NM	NM	NM	NM	1.5	1.6	2.9
Combined Radium 226 & Radium 228		5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**44.9**	**15.3**	**23.8**

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

	2015 Minimum Detection Limit	DEQ-WQD Class III Guideline (Livestock)	SW-5						SW-6							
			Fall 2011	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Fall 2015	Fall 2011	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015
Analyte			10/12/2011	4/30/2013	9/17/2013	4/24/2014	10/7/2014	10/8/2015	10/13/2011	10/22/2012	4/30/2013	9/17/2013	4/24/2014	10/7/2014	6/24/2015	10/9/2015
MAJOR IONS (mg/L)																
Hardness as CaCO3			143	76	140	45	183	181	124	189	86	150	41	183	110	171
Alkalinity as CaCO3			135	84	131	NM	NM	NM	132	181	86	145	NM	NM	NM	NM
Carbonate	5		ND	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	5	10	5
Bicarbonate	5		164	102	159	51	248	171	147	220	104	171	52	241	144	160
Calcium	1		44	24	38	13	55	51	38	56	26	42	13	55	31	47
Chloride	1	2,000	6	3	9	1	7	11	6	10	3	9	1	7	5	12
Fluoride	0.1	-	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Magnesium	1		8	4	11	3	11	13	7	12	5	11	2	11	8	13
Nitrogen, Ammonia as N	0.05	-	1.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrate + Nitrite as N	0.1	100.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite as N		10.0	NM	ND	ND	NM	NM	NM	NM	NM	ND	ND	NM	NM	NM	NM
Potassium	1		4	2	6	2	5	6	3	6	3	6	2	5	3	6
Silica	0.2		26.5	14.2	10.4	12.5	23.8	14.1	24.1	27.0	13.8	9.9	12.8	23.3	1.4	11.8
Sodium	1		19	10	38	4	29	41	16	37	10	39	4	30	30	42
Sulfate	2	3,000	28	15	76	9	47	94	27	70	17	87	6	47	34	99
PHYSICAL PROPERITES									**1**	**6**	**3**	**25**	**0**	**2**	**1**	**6**
Lab Conductivity (umhos/cm)	5		341	209	434	105	485	508	324	487	209	456	100	483	317	501
Lab pH	0.01	6.5-8.5	8.44	7.90	8.45	7.62	8.39	**8.52**	**8.58**	8.50	7.99	**8.56**	7.71	8.45	**9.03**	**8.61**
Total Dissolved Solids, TDS @ 180 C (m	20	5,000	218	154	263	85	311	332	223	311	152	286	79	312	201	327
Total Suspended Solids, TSS @ 105C (mg/L)			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Field Conductivity (µS)			383	223	353	118	577	492	345	485	225	353	114	582	344	484
Field pH		6.5-8.5	**6.30**	7.58	**8.67**	7.87	8.32	8.46	**8.97**	7.32	7.21	**8.67**	**6.41**	8.35	**8.58**	8.39
Field Temperature (°C)			9.1	7.1	21.8	7.3	11.3	18.7	11.5	10.3	7.2	21.8	7.2	11.4	25.8	18.8
Field Turbidity (NTU)			NM	NM	NM	46.60	5.00	8.24	NM	17.70	NM	NM	49.20	4.00	2.62	6.52
TRACE METALS (mg/L)																
Aluminum	0.1	5.0	0.9	0.1	ND	0.2	ND	ND	0.8	ND	0.1	ND	0.3	ND	ND	ND
Arsenic	0.001	0.2	0.005	0.003	0.004	ND	0.003	0.003	0.004	0.003	0.003	0.003	ND	0.003	0.004	0.003
Barium	0.1	-	0.1	ND	ND	ND	0.2	0.1	0.1	0.1	ND	ND	ND	0.2	ND	ND
Boron	0.1	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	0.005	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	0.01	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	0.03	-	0.72	0.21	ND	0.28	ND	ND	0.58	ND	0.19	ND	0.27	ND	ND	ND
Lead	0.001	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Manganese	0.01	-	0.04	0.01	ND	ND	0.01	ND	0.03	ND	0.01	ND	ND	ND	ND	ND
Mercury	0.001	0.00005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum	0.1		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	0.05	-	0.69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	0.001	0.05	0.005	0.002	ND	ND	ND	ND	ND	ND	0.002	ND	ND	ND	ND	ND
Uranium	0.0003		0.0145	0.0096	0.0291	0.0016	0.0247	0.0213	0.0138	0.0299	0.0096	0.0305	0.0030	0.0250	0.0165	0.0217
Vanadium	0.1	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	0.01	25.0	0.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS (mg/L)																
Iron	0.03		ND	ND	ND	3.11	0.45	0.25	ND	ND	ND	ND	3.36	0.18	0.57	0.29
Manganese	0.01		0.04	0.01	ND	0.06	0.03	0.02	0.03	ND	0.01	ND	0.05	0.01	0.02	0.03
RADIONUCLIDES (pCi/L) DISSOLVED																
Gross Alpha		15	NM	9.9	**22.1**	7.7	**19.1**	**20.7**	NM	**27.4**	12.3	**25.3**	7.6	**18.8**	13.7	**19.0**
Gross Alpha precision (±)			NM	1.2	1.7	1.3	1.9	4.5	NM	2.0	1.4	1.8	1.1	2.1	3.4	4.2
Gross Beta			NM	NM	NM	5.1	7.7	7.7	NM	NM	NM	NM	3.7	7.7	3.9	8.5
Gross Beta precision (±)			NM	NM	NM	1.8	1.8	1.7	NM	NM	NM	NM	1.7	1.9	1.3	1.7
Radium 226		5.0*	0.4	1.1	1.1	0.5	0.8	0.6	0.4	1.0	1.8	0.7	0.4	0.8	0.7	0.6
Radium 226 precision (±)			0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2
Radium 228		5.0*	NM	NM	NM	<1.2	<1.8	<1.5	NM	NM	NM	NM	<1.2	<1.9	1.3	2.0
Radium 228 precision (±)			NM	NM	NM	0.7	1.1	0.9	NM	NM	NM	NM	0.7	1.2	0.7	0.9
Combined Radium 226 & Radium 228		5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0	2.6

*Guideline level is for Combined Radium 226 and 228
ND = Not Detected or below Minimum Detection Limit
NM = Not Measured; NA = Not Available
Bold Cells = Above DEQ-WQD Class III Guideline
Shaded Cells = Outliers, 2 Standard Deviations Above or Below the Mean

Figures



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DATE:	4/4/2016
DESIGN:	GHS
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APPROVED:	CDL

FIGURE 4.2-1
Day Loma Area -
Wind River Aquifer
Potentiometric Surface Map
1991 and Fall 2015

Legend

- 2015 POTENTIOMETRIC SURFACE
- 1991 POTENTIOMETRIC SURFACE
- Groundwater Sampling Location
- Surface Water Sampling Location

Top El. 6438.4 (1991 SWL)
Bottom El. 6444.2 (Fall 2015 SWL)
(-) No Data

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_DAY-LOMA_GW POTENTIOMETRIC SURFACE.mxd

Figure 4.2-2: Day Loma Water Levels Over Time

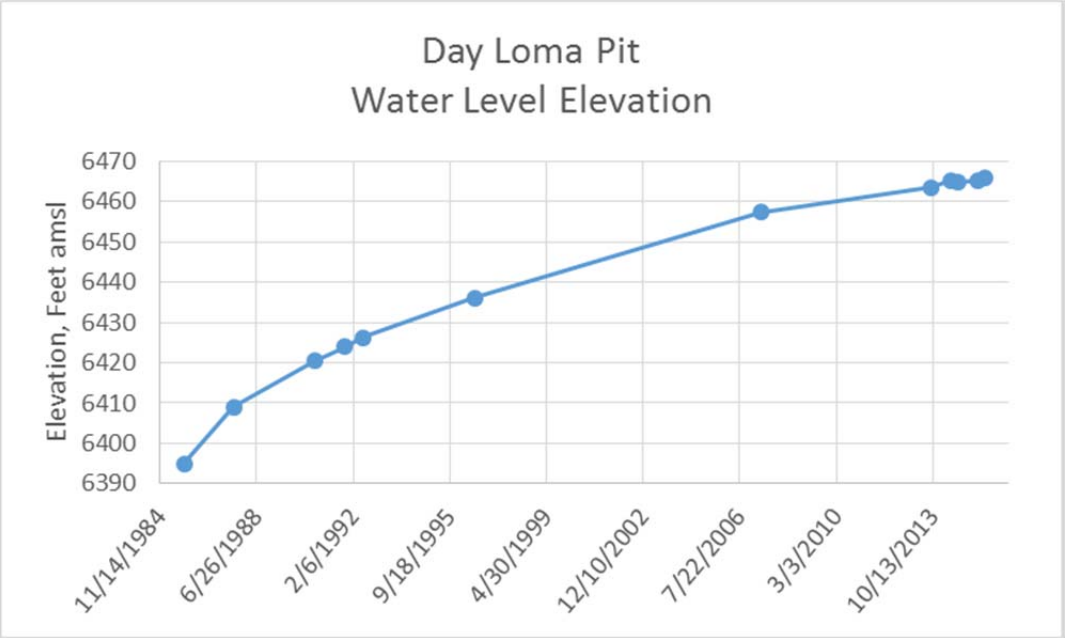


Figure 4.2-3 Day Loma Monitoring Well Water Quality - Total Dissolved Solids vs. Time

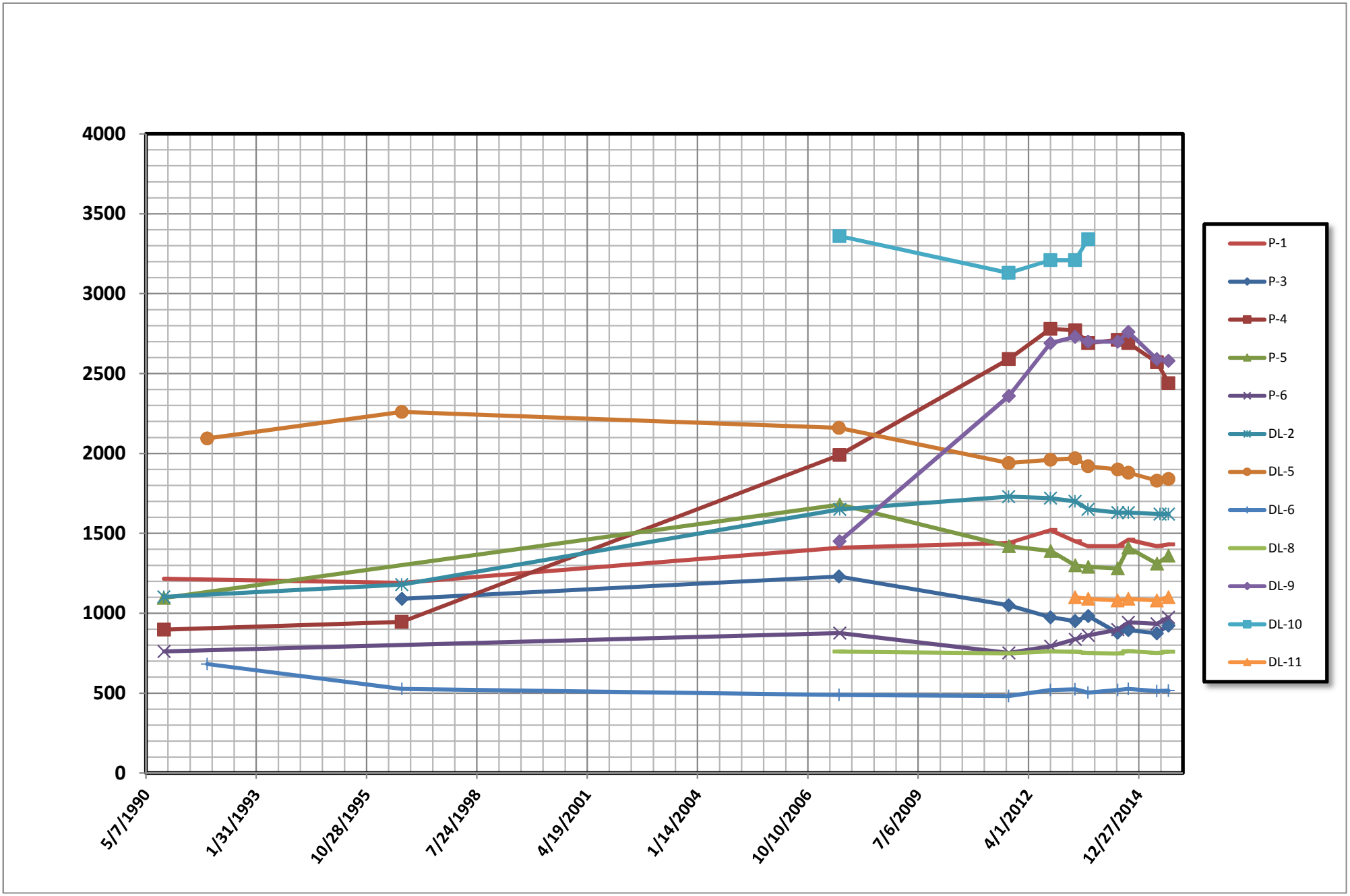


Figure 4.2-4 Day Loma Monitoring Well Water Quality - Sulfate vs. Time

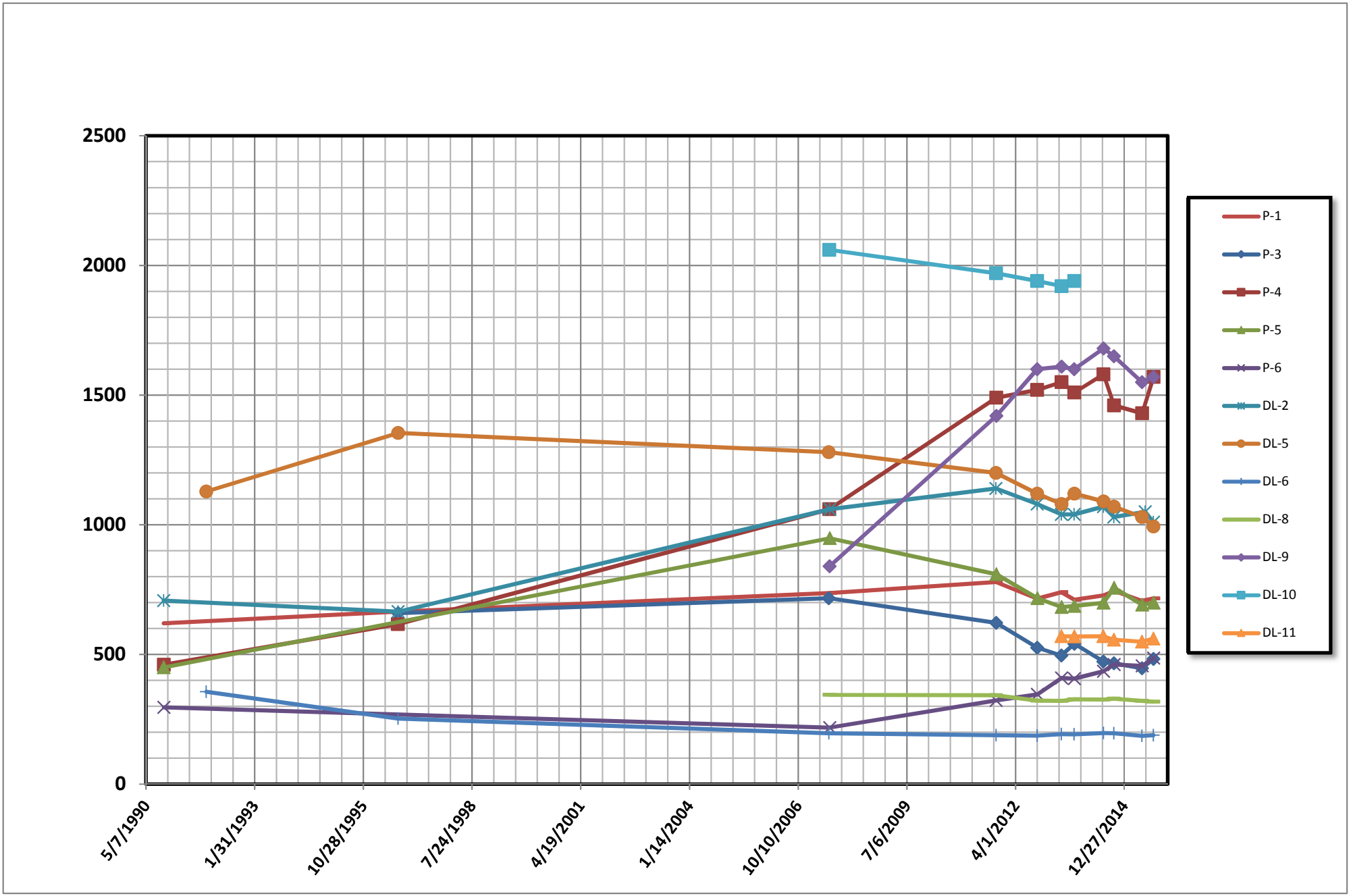


Figure 4.2-5 Day Loma Monitoring Well Water Quality - Radium 226 vs. Time

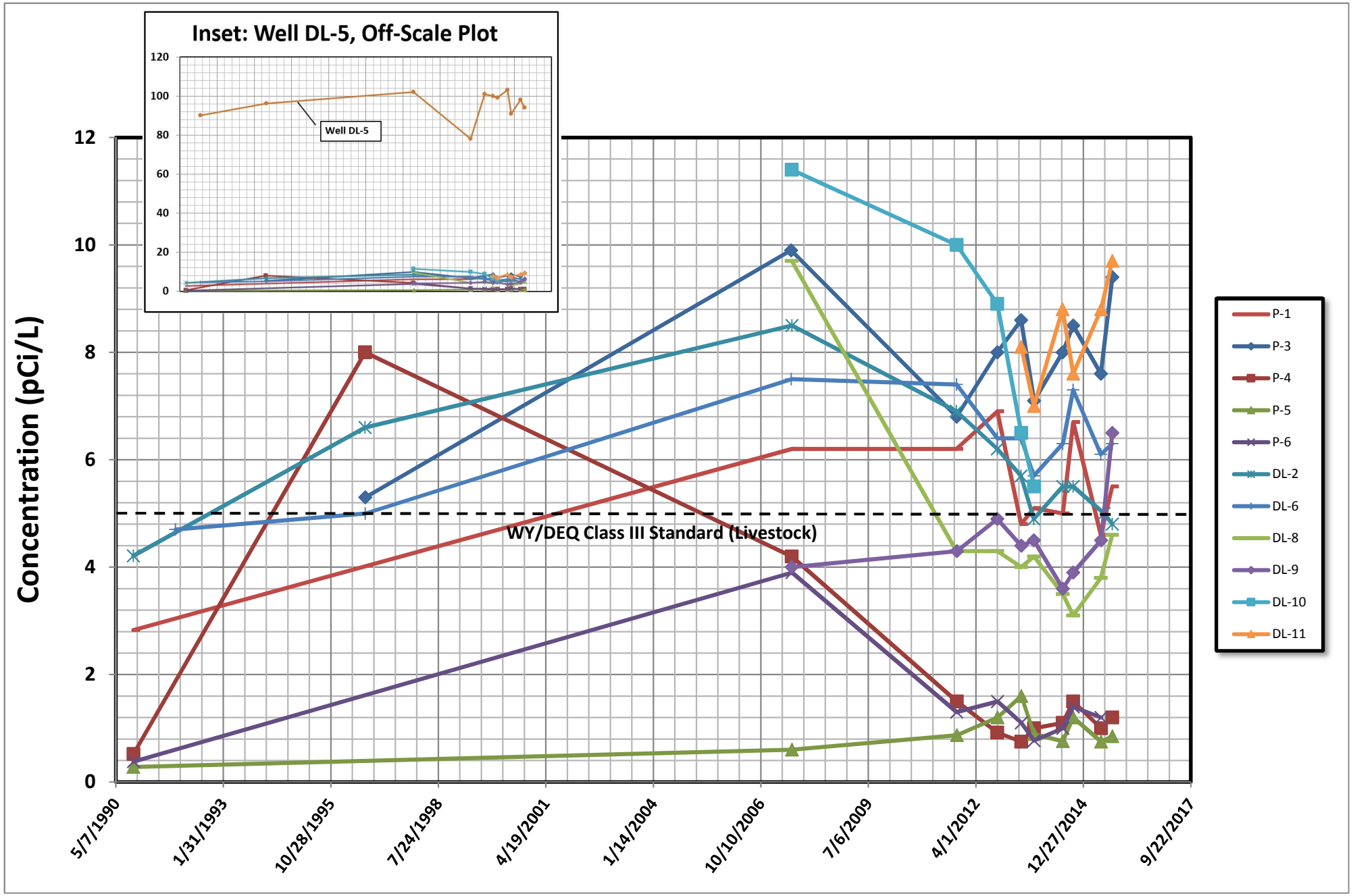


Figure 4.2-6 Day Loma Monitoring Well Water Quality - Uranium vs. Time

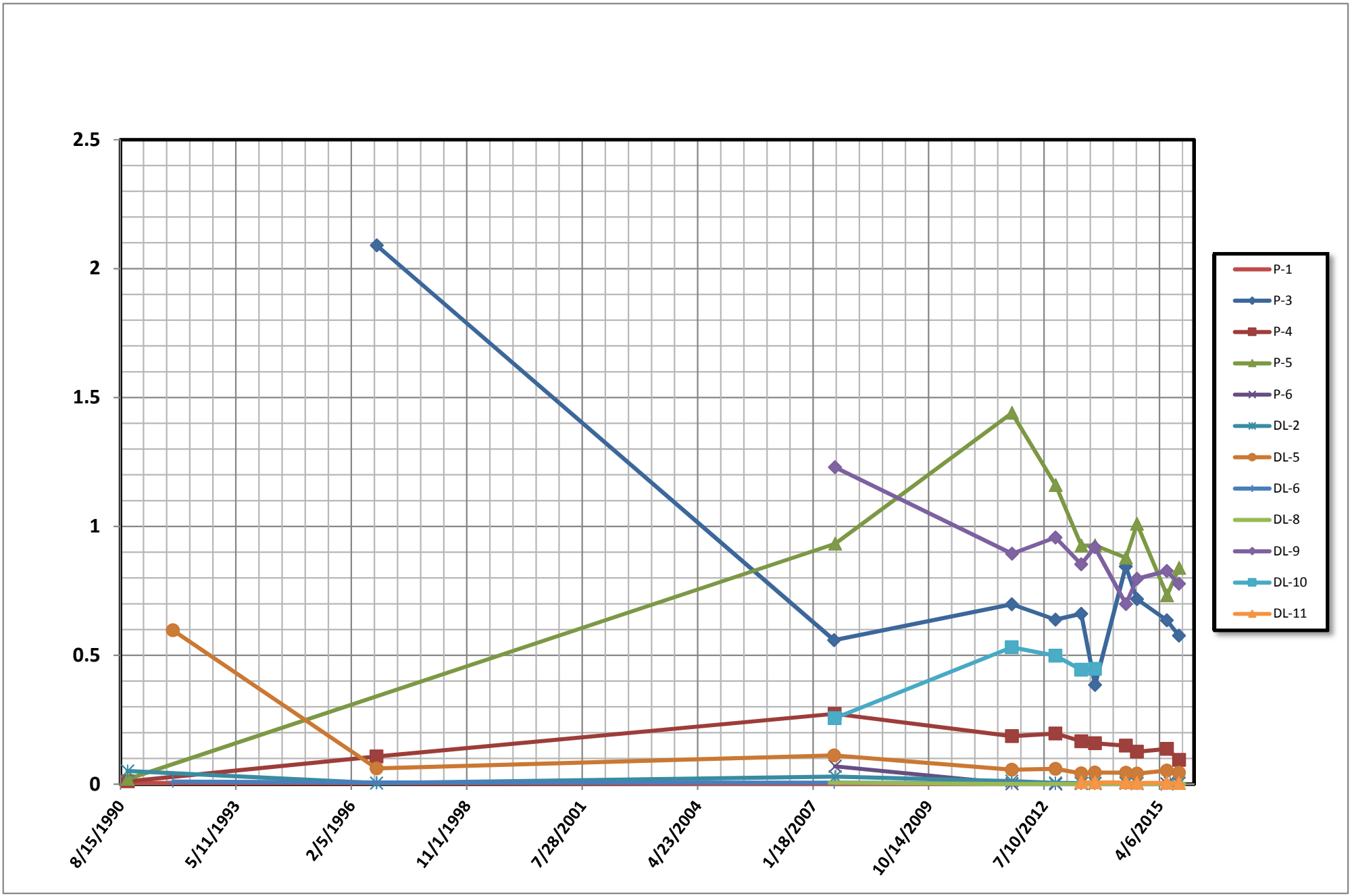


Figure 4.2-7 Day Loma Surface Water Quality - Total Dissolved Solids vs. Time

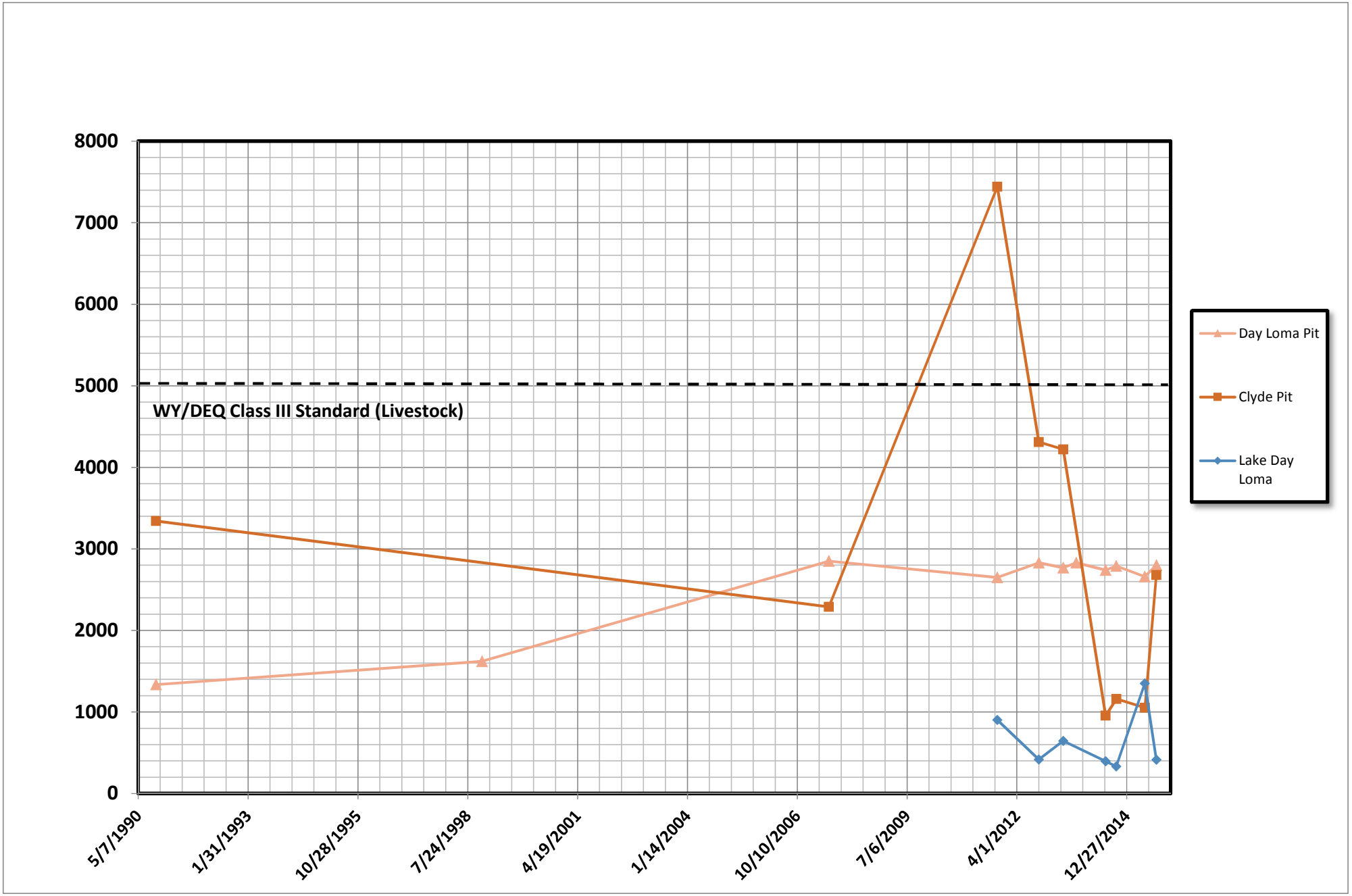


Figure 4.2-8 Day Loma Surface Water Quality - Sulfate vs. Time

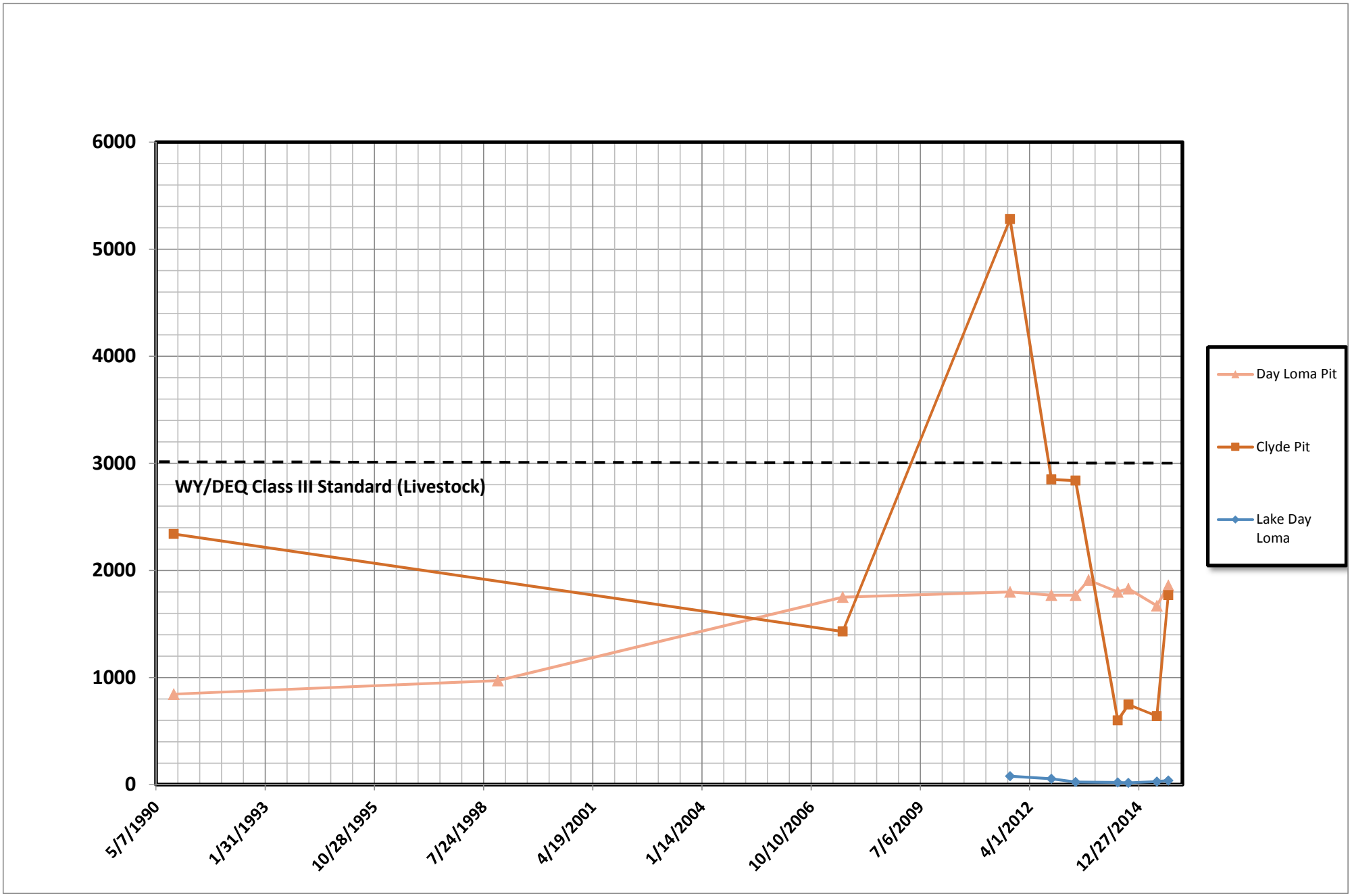


Figure 4.2-9 Day Loma Surface Water Quality - Radium 226 vs. Time

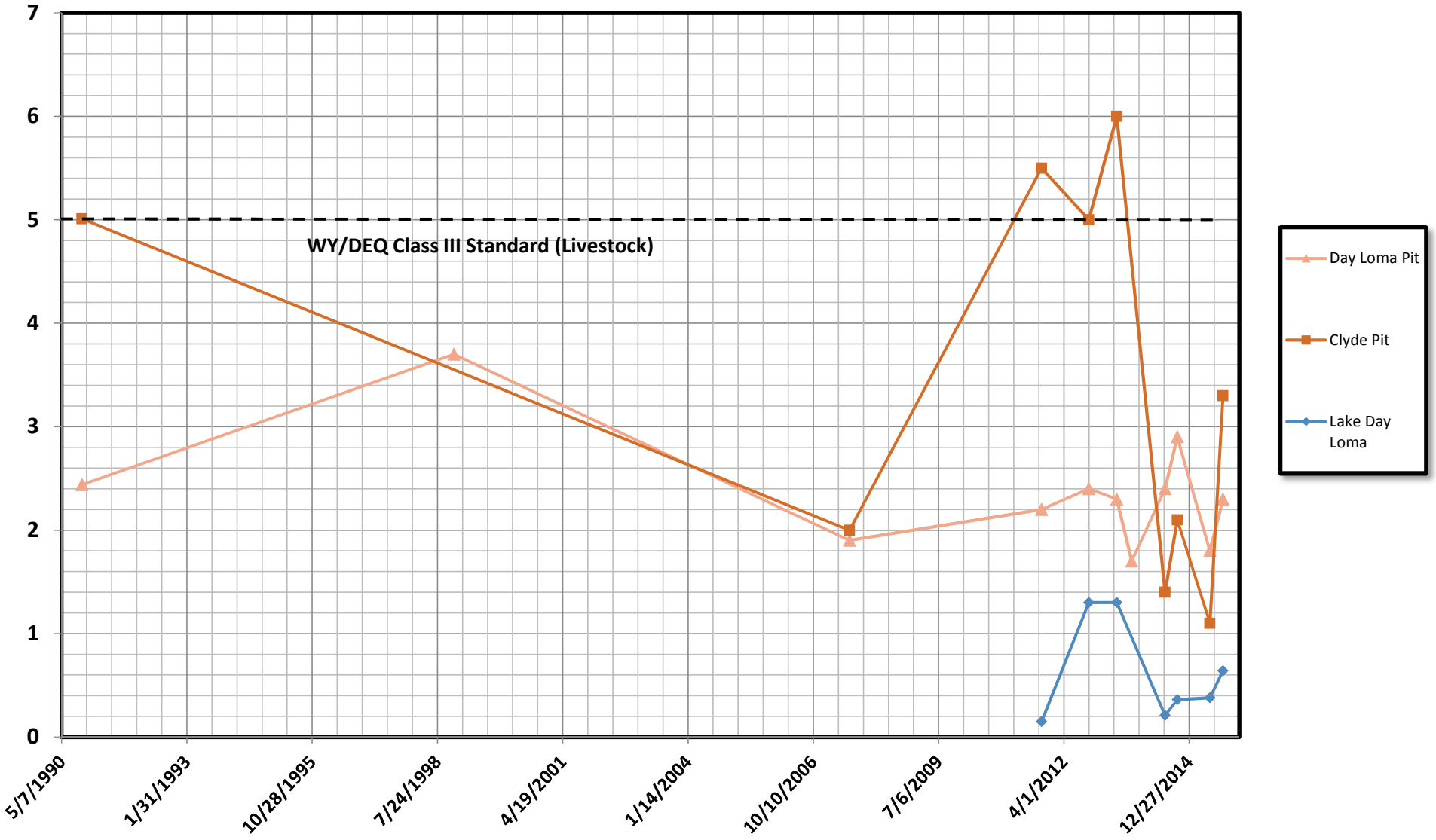
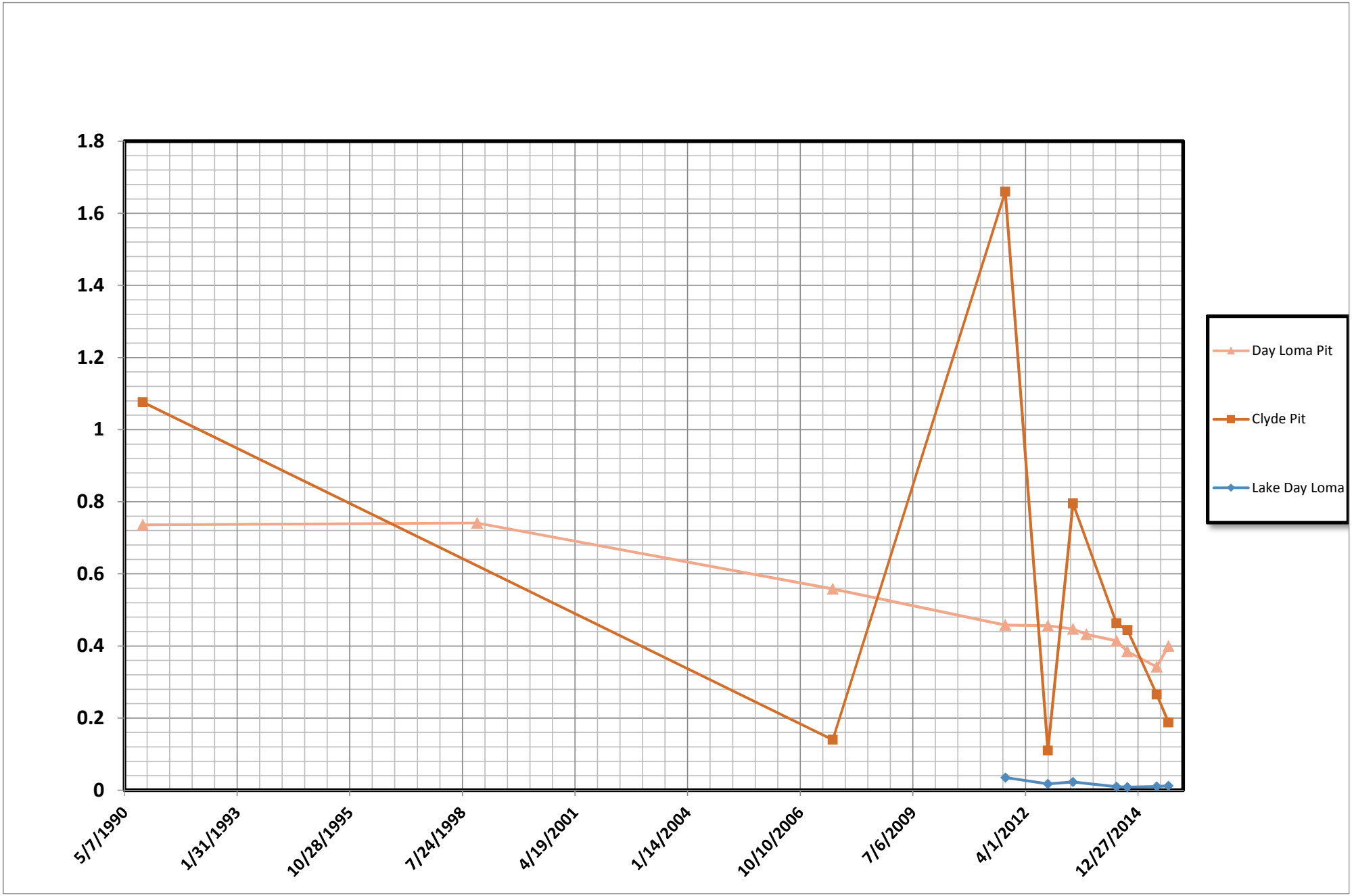
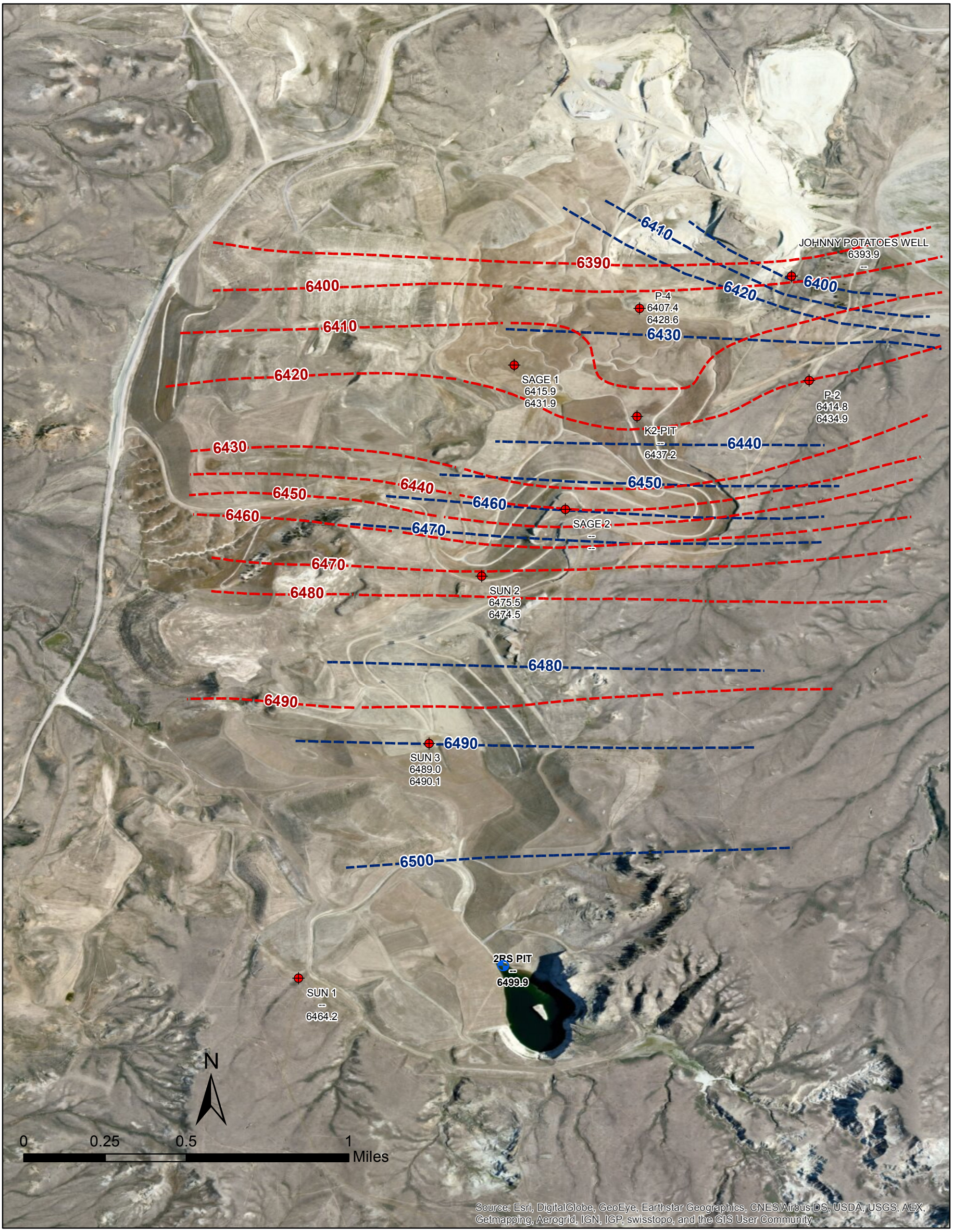


Figure 4.2-10 Day Loma Surface Water Quality - Uranium vs. Time





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DATE:	4/4/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 4.3-1
West Gas Hills Area - Wind River Aquifer Potentiometric Surface Map Fall 2001 and Fall 2015

Legend

- FALL 2015 POTENTIOMETRIC SURFACE
- FALL 2001 POTENTIOMETRIC SURFACE
- Groundwater Sampling Location
- Surface Water Sampling Location

Top El. 6438.4 (Fall 2001 SWL)
Bottom El. 6444.2 (Fall 2015 SWL)
(--) No Data

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_WEST GAS HILLS_GW POTENTIOMETRIC SURFACE.mxd

Figure 4.3-2 West Gas Hills Monitoring Well Water Quality - Total Dissolved Solids vs. Time

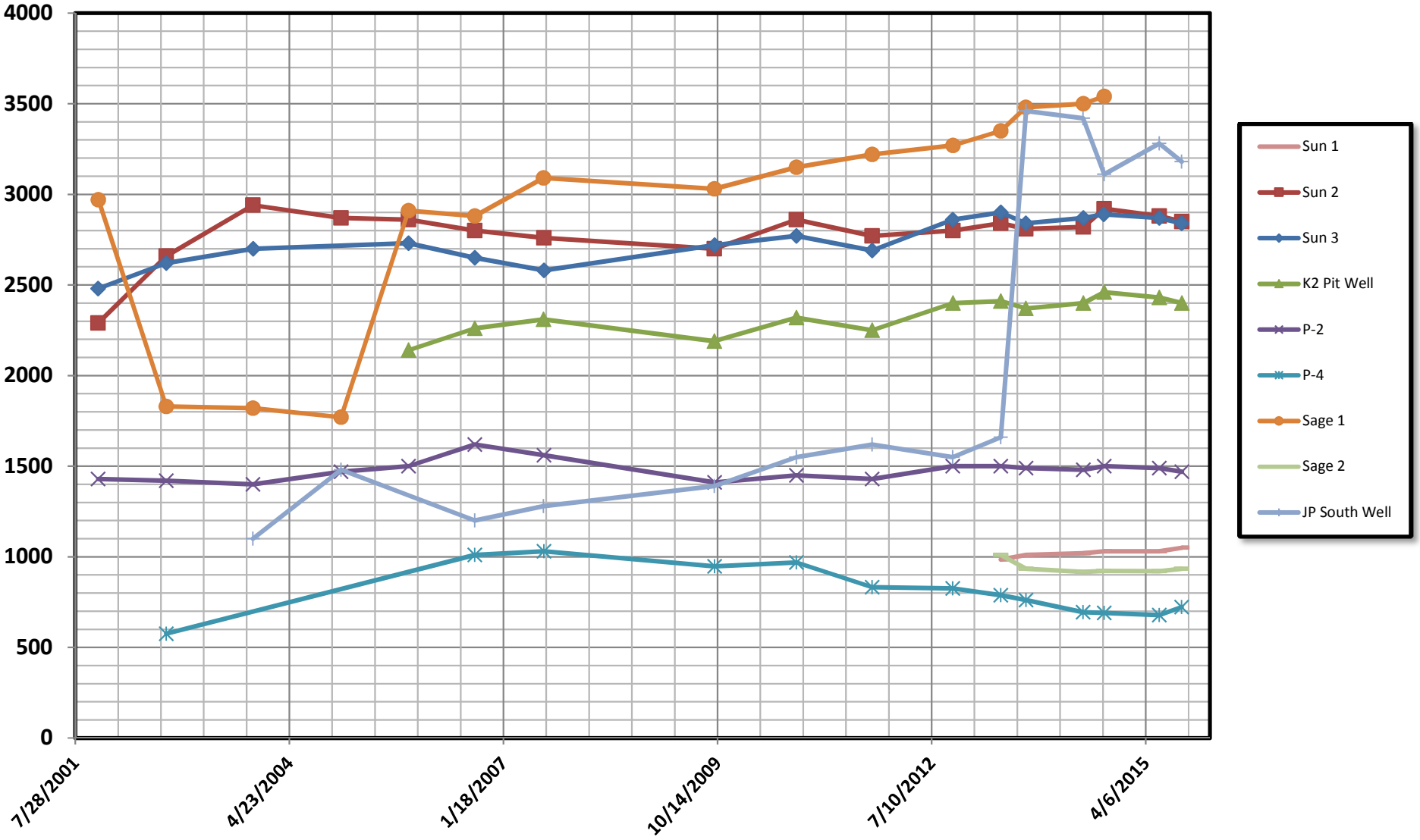


Figure 4.3-3 West Gas Hills Monitoring Well Water Quality - Sulfate vs. Time

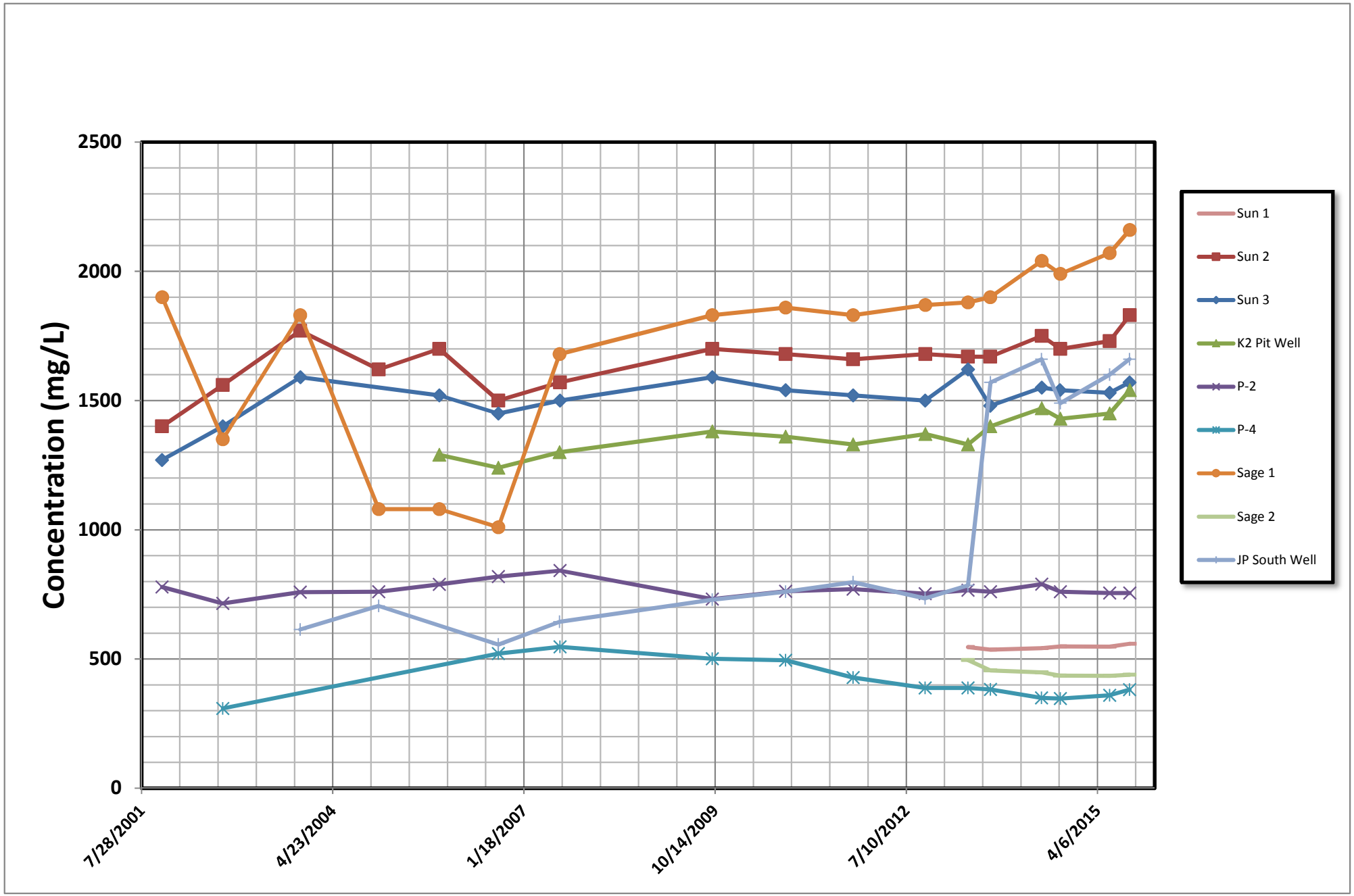


Figure 4.3-4 West Gas Hills Monitoring Well Water Quality - Radium 226 vs. Time

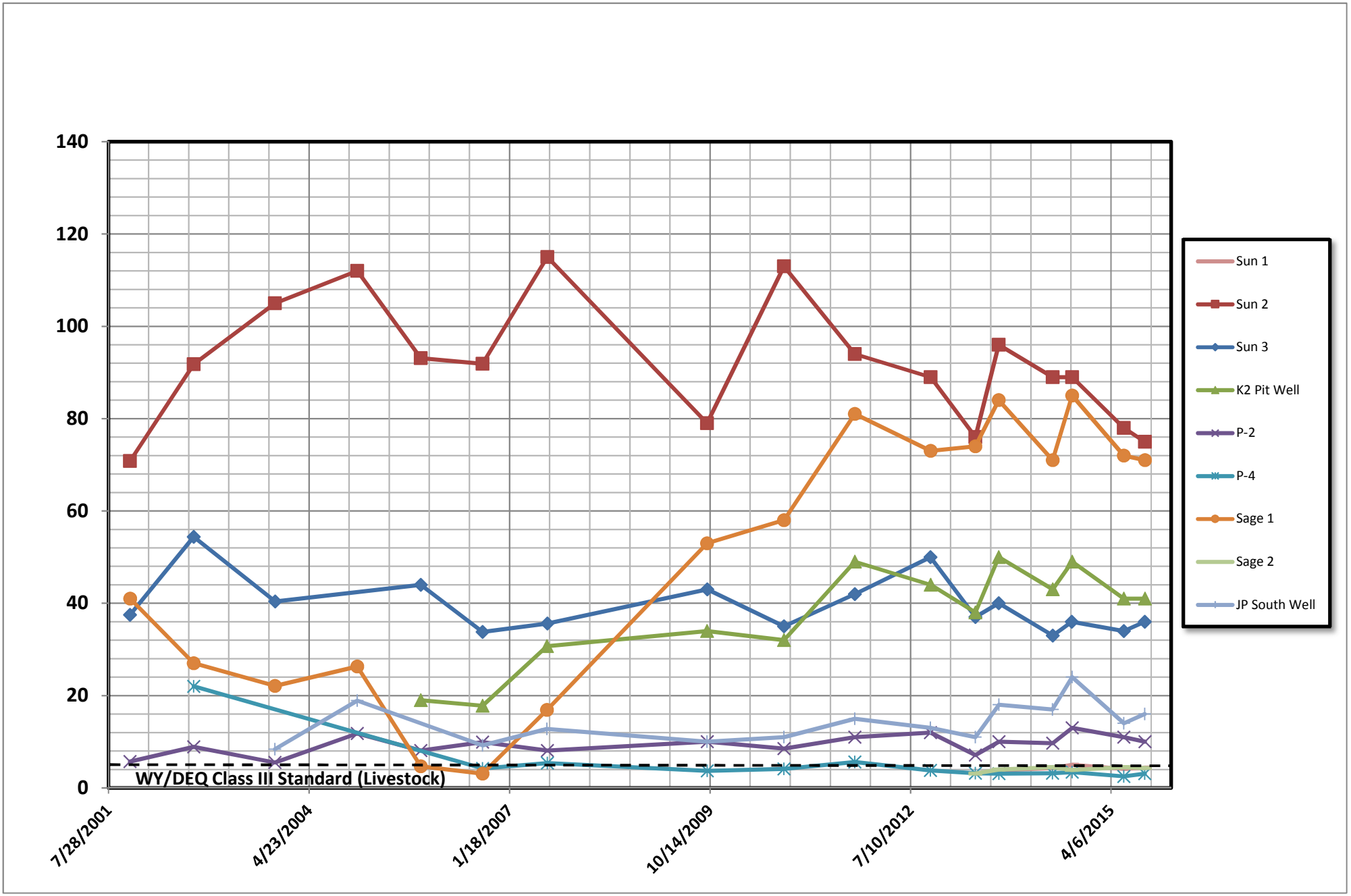


Figure 4.3-5 West Gas Hills Monitoring Well Water Quality - Uranium vs. Time

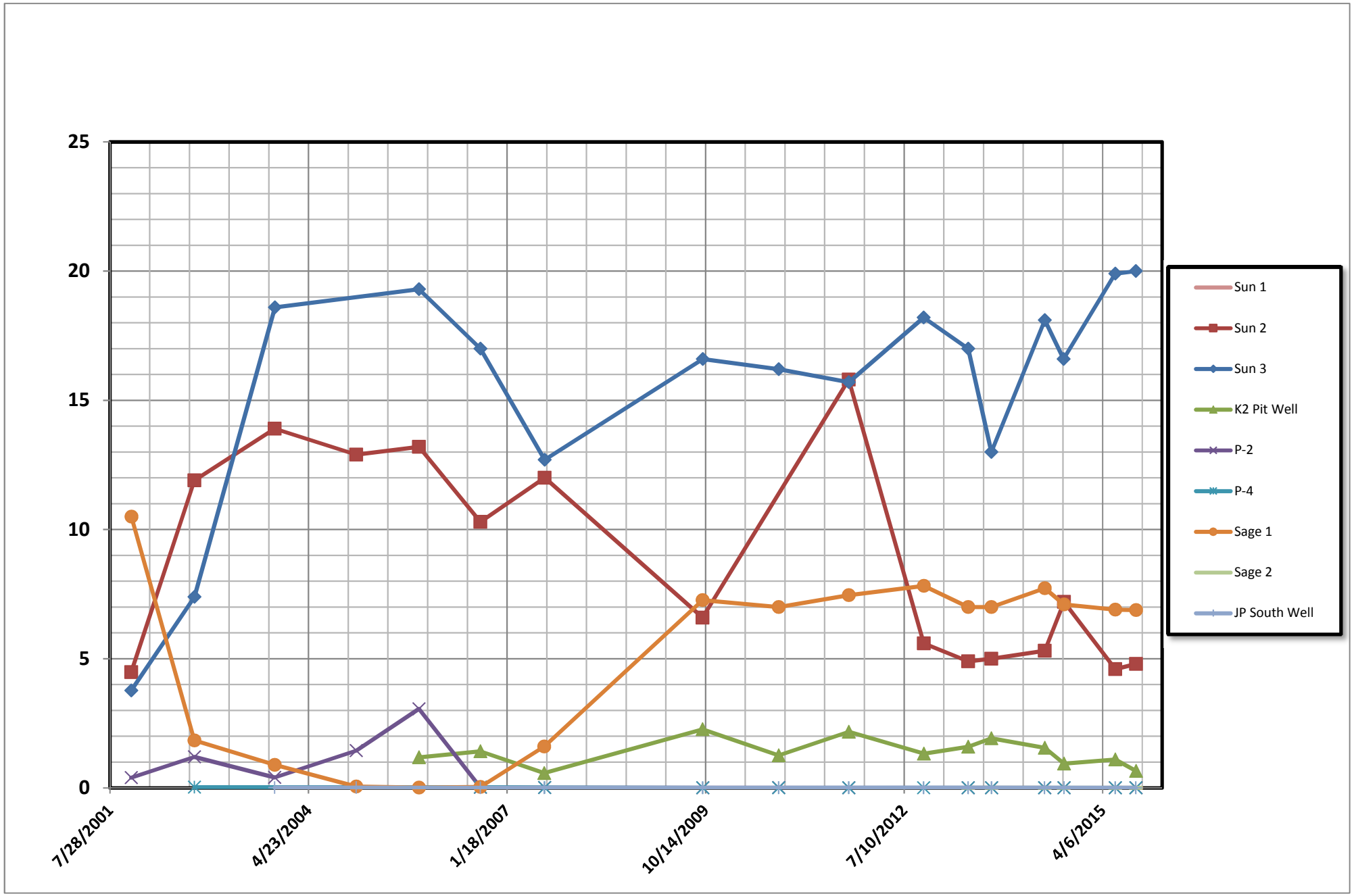


Figure 4.3-6 Johnny Potatoes South Well Water Quality Trends

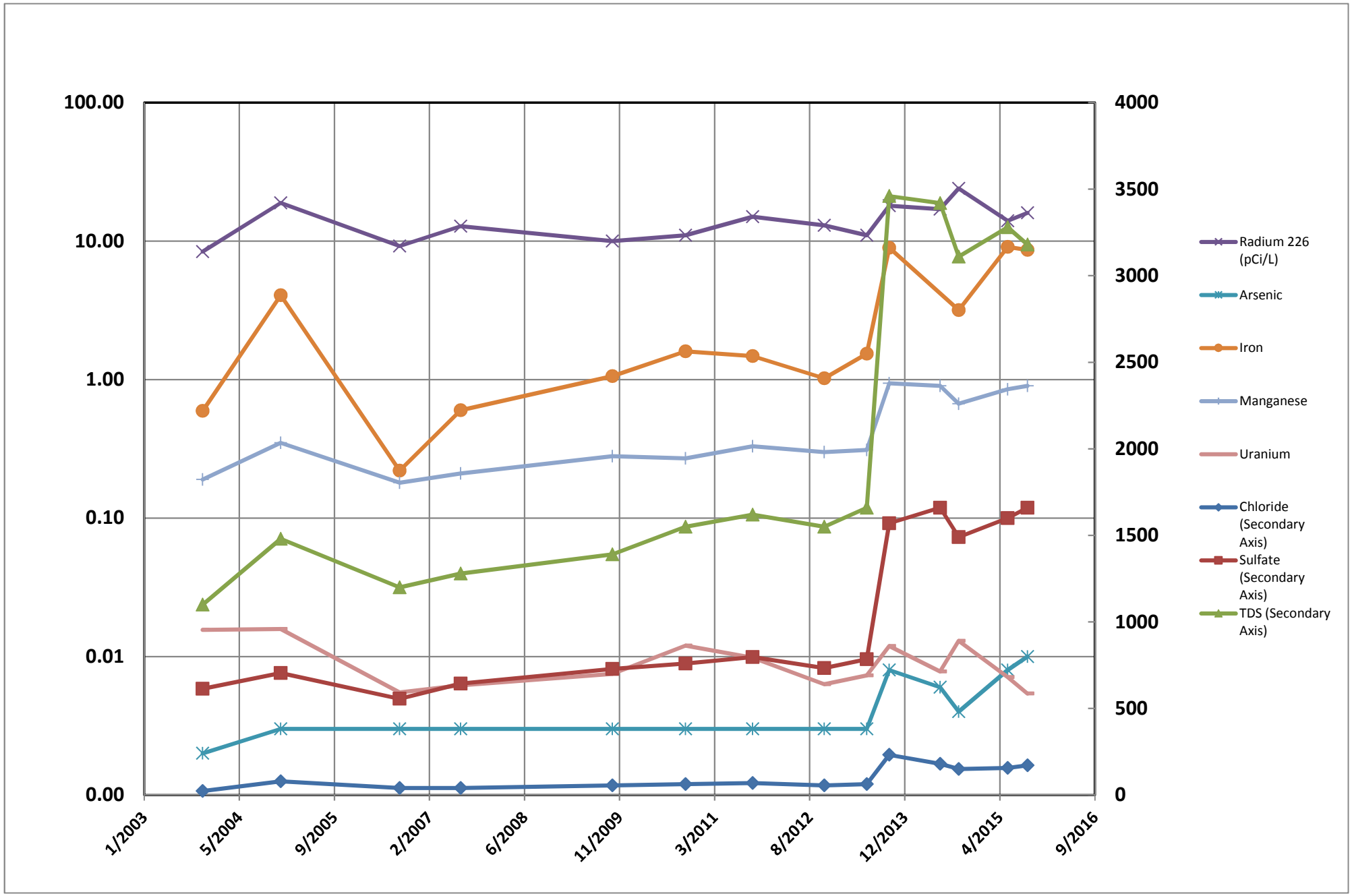


Figure 4.3-7 West Gas Hills Surface Water Quality - Total Dissolved Solids vs. Time

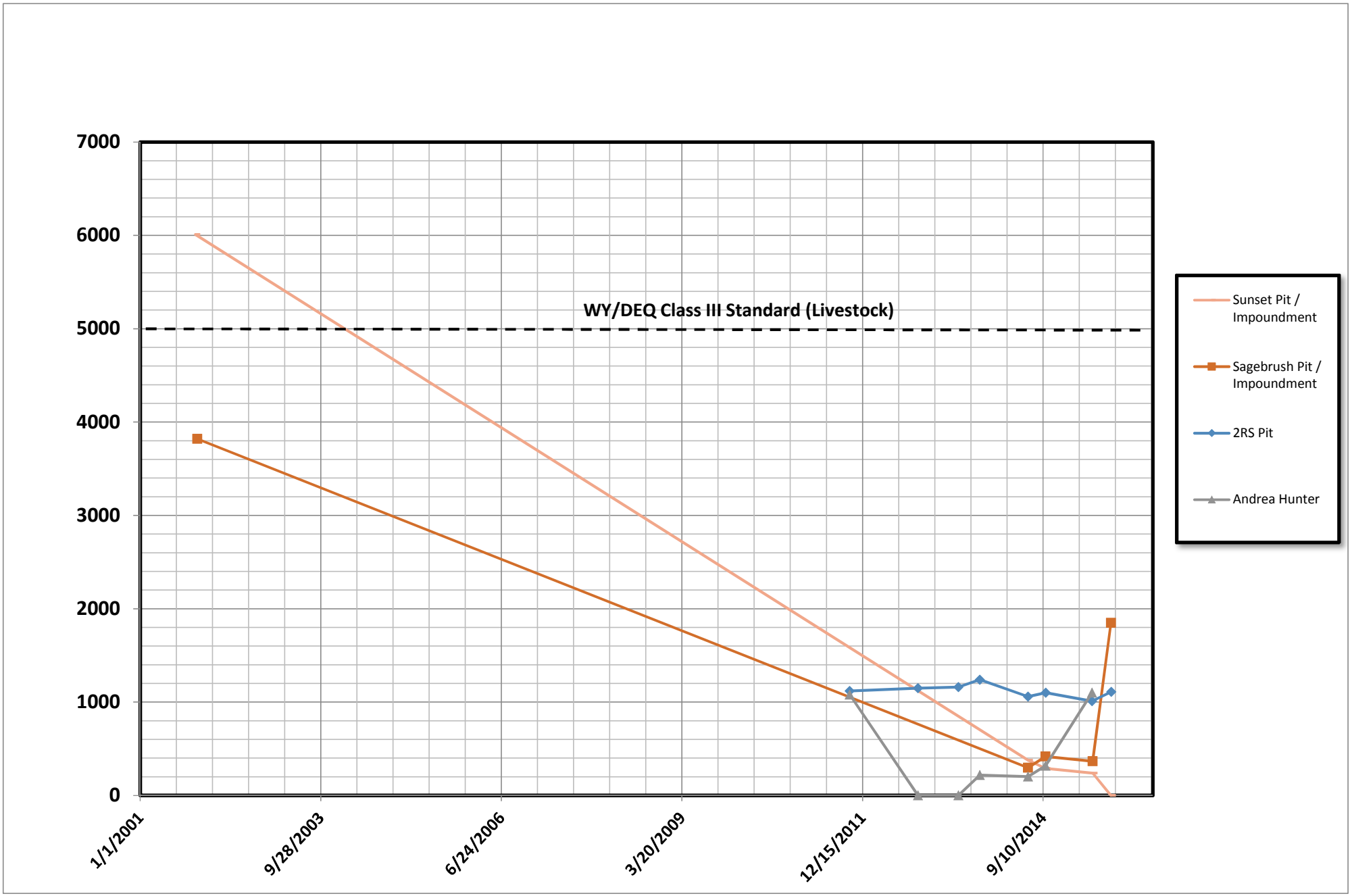


Figure 4.3-8 West Gas Hills Surface Water Quality - Sulfate vs. Time

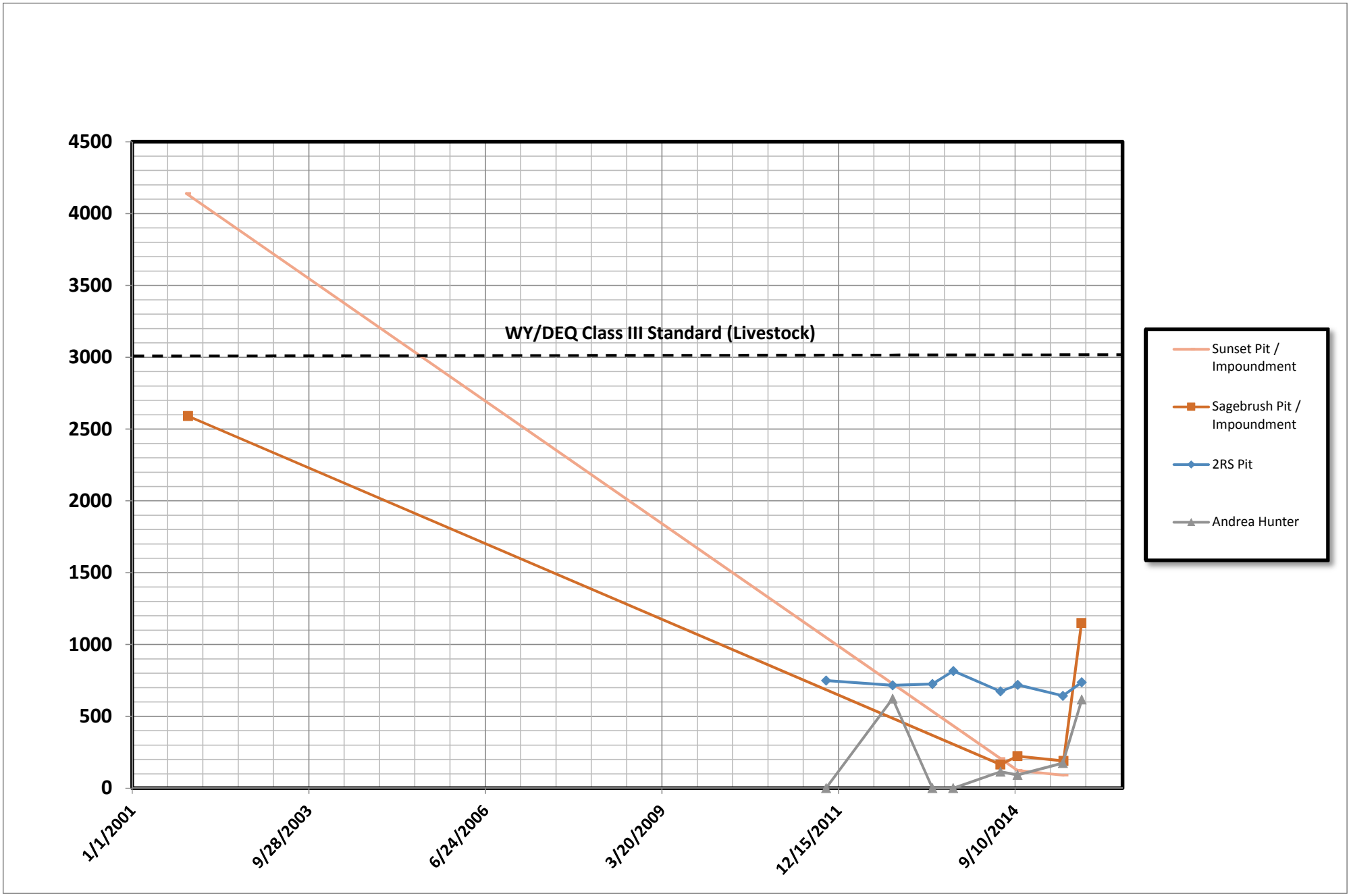


Figure 4.3-9 West Gas Hills Surface Water Quality - Radium 226 vs. Time

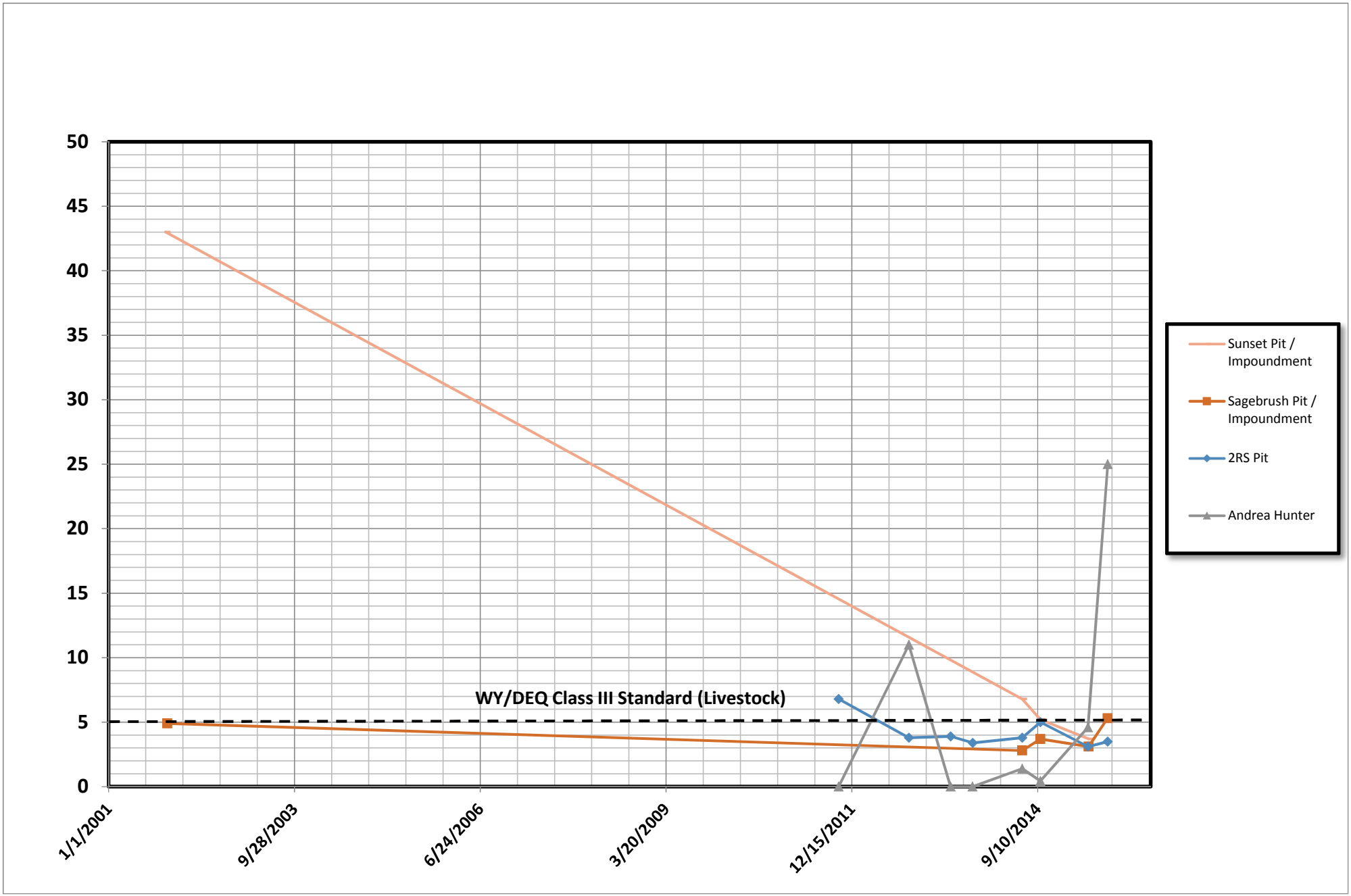


Figure 4.3-10 West Gas Hills Surface Water Quality - Uranium vs. Time

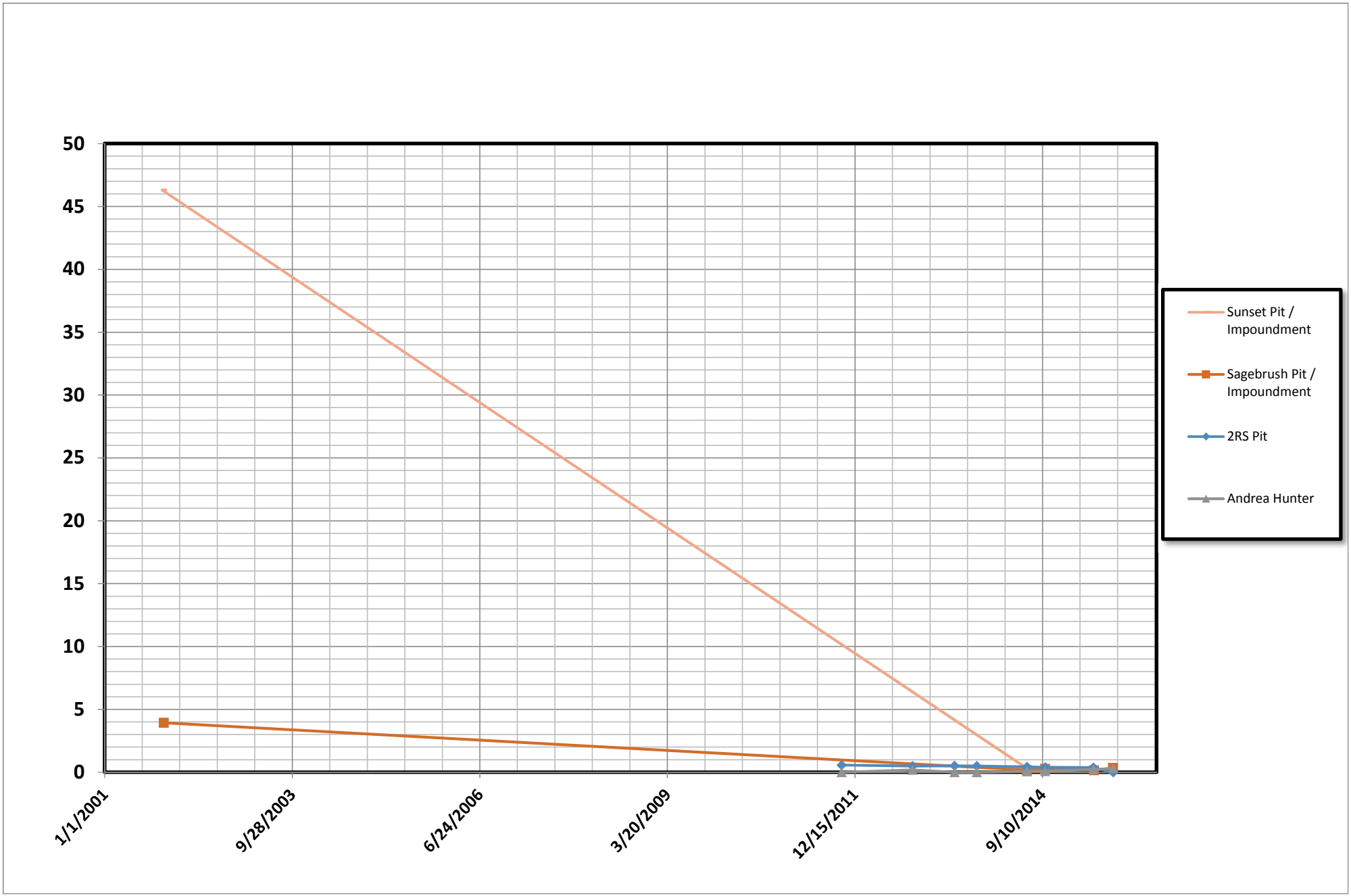


Figure 4.4-1 Central Gas Hills Water Surface Elevations Over Time

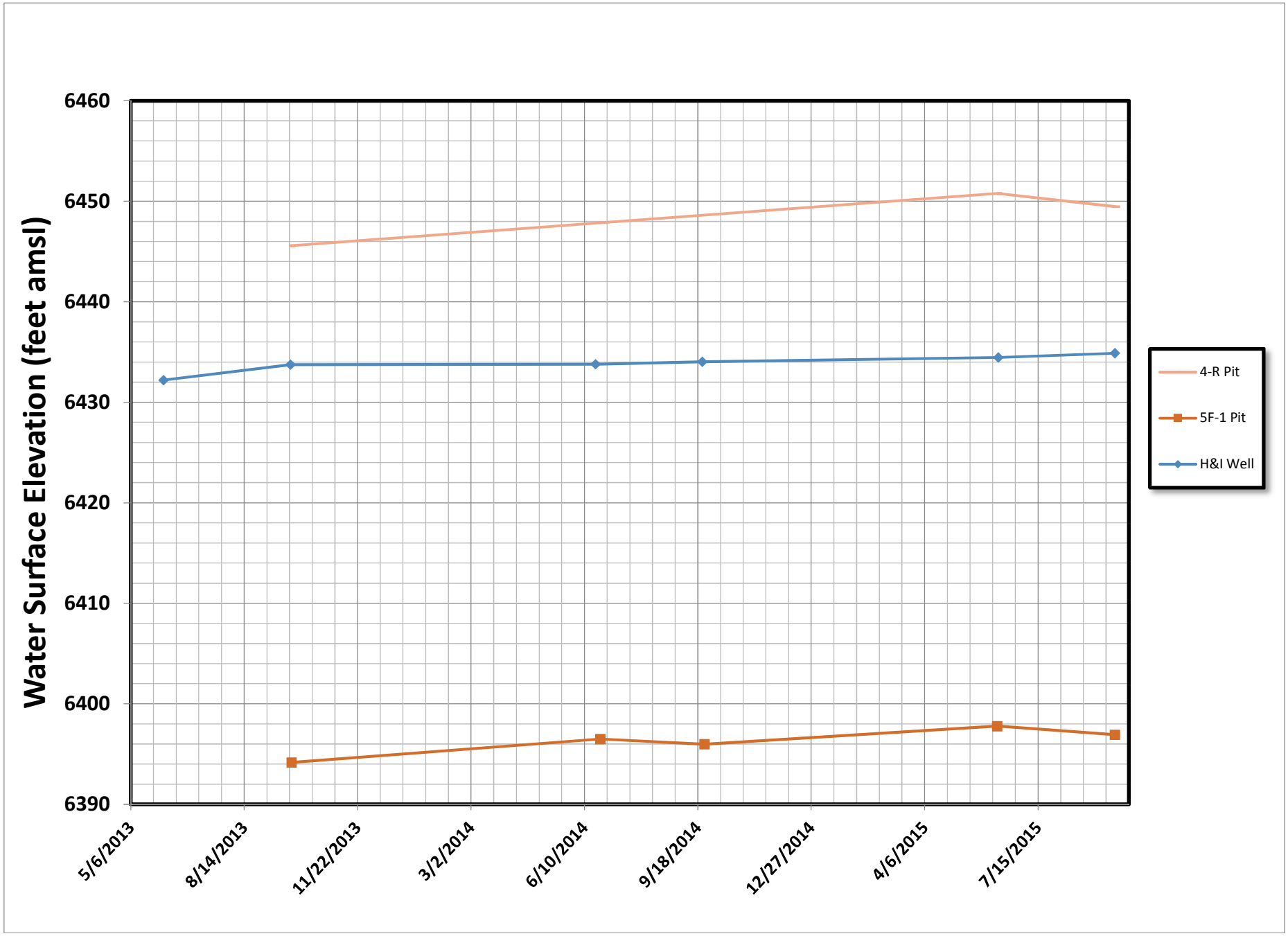


Figure 4.4-2 Central Gas Hills Well Water Quality Trends

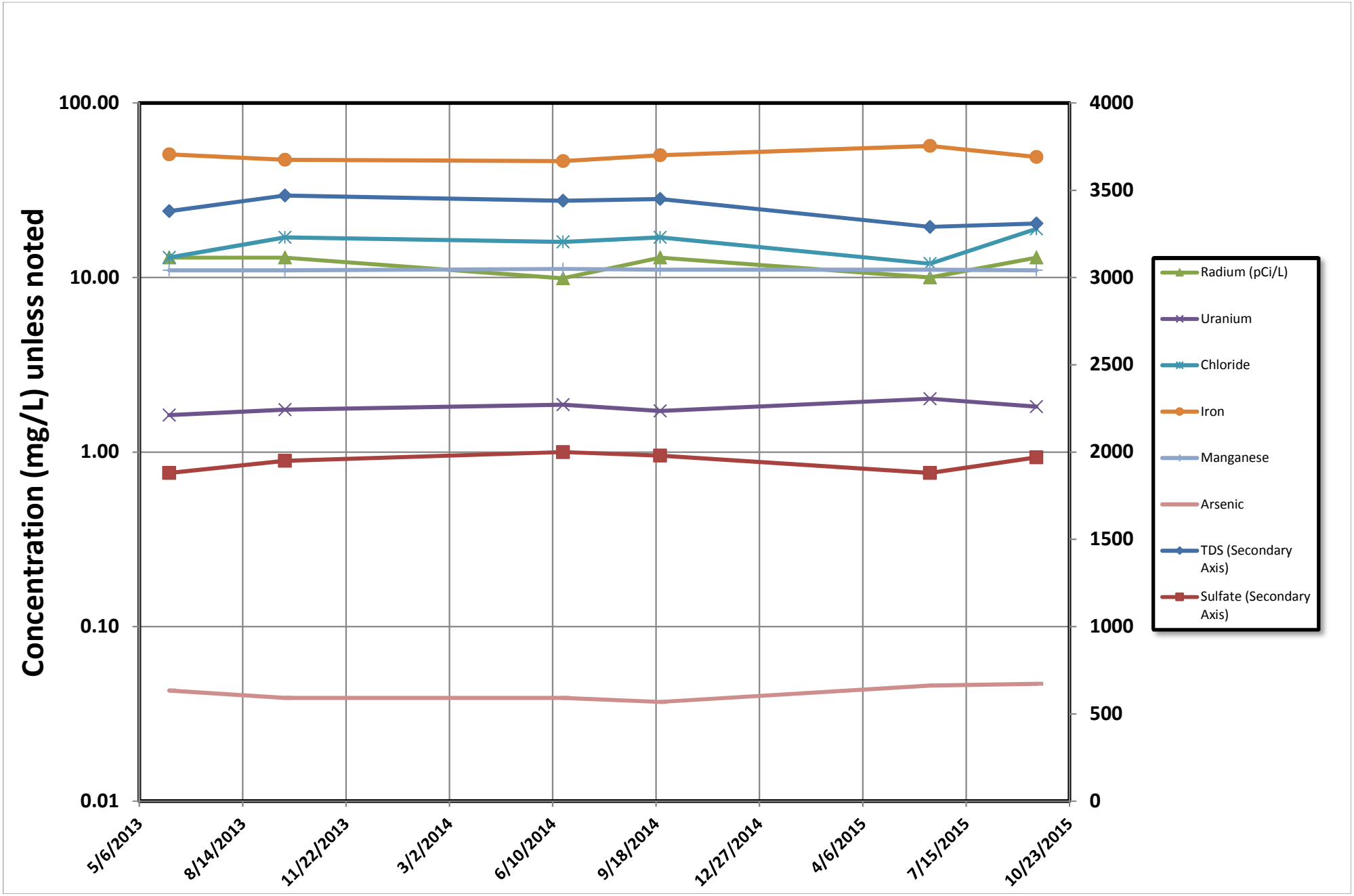


Figure 4.4-3 Central Gas Hills Surface and Groundwater Quality - Total Dissolved Solids vs. Time

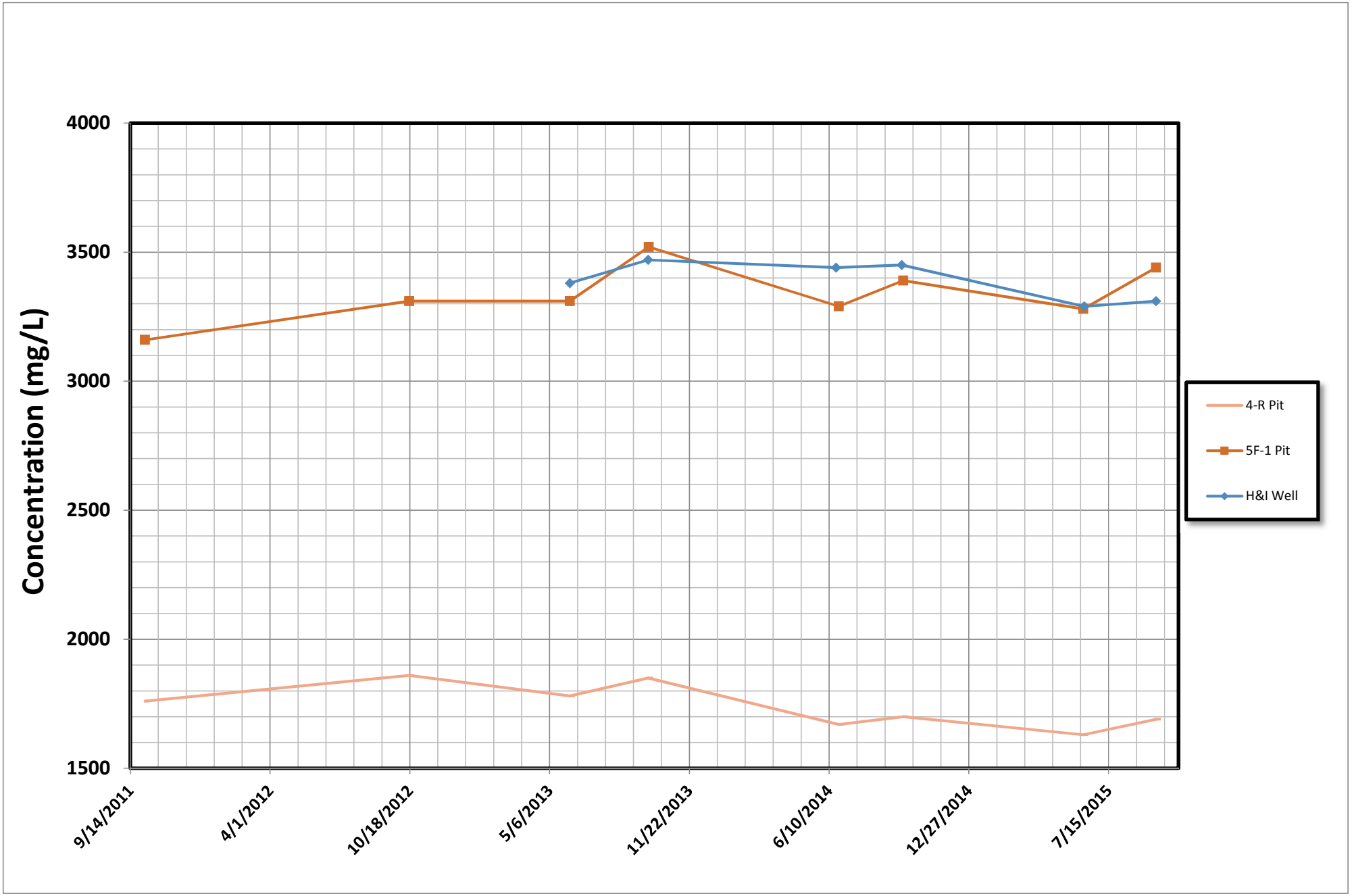


Figure 4.4-4 Central Gas Hills Surface and Ground Water Quality - Sulfate vs. Time

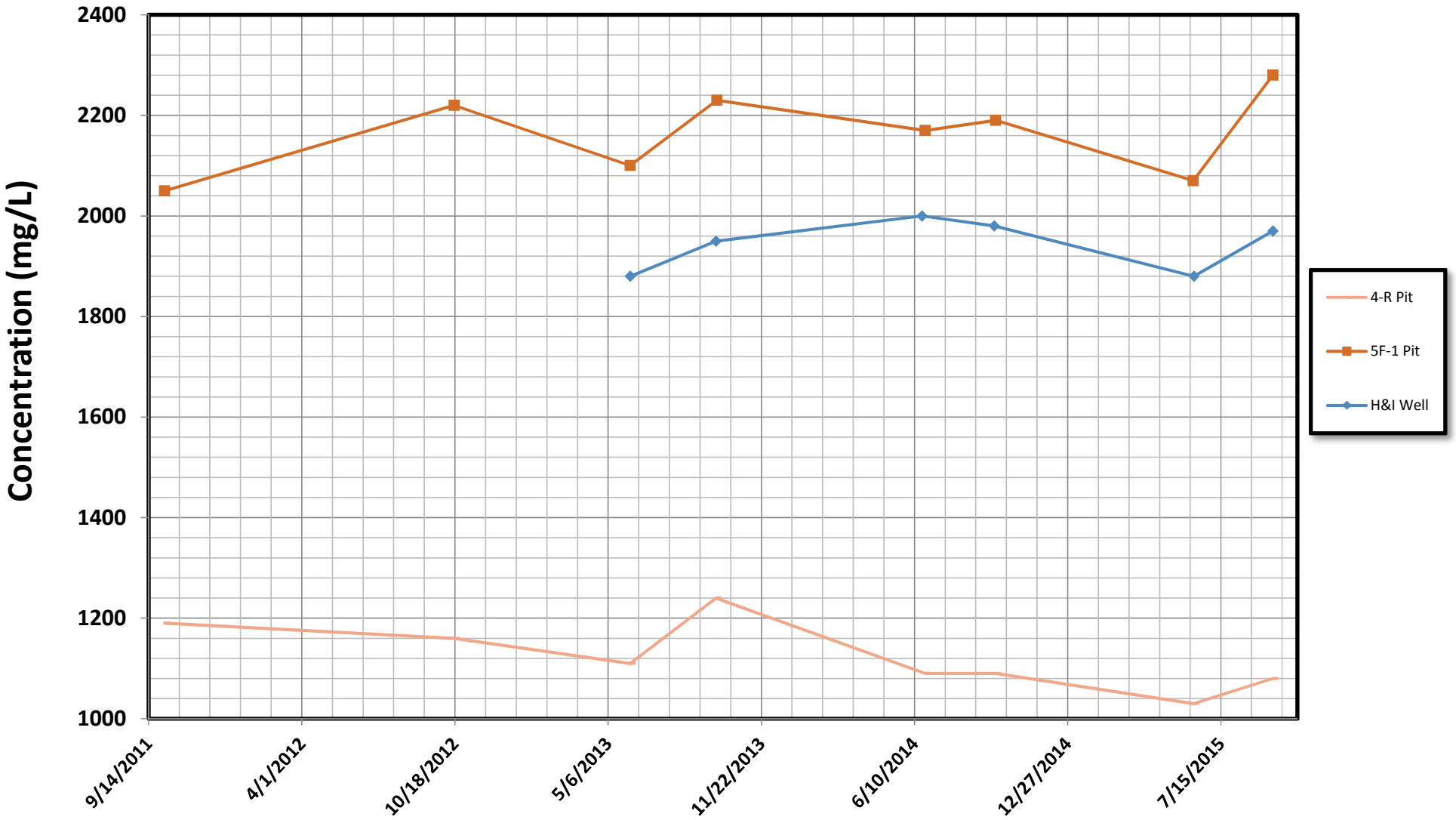


Figure 4.4-5 Central Gas Hills Surface andGroundwater Quality - Radium 226 vs. Time

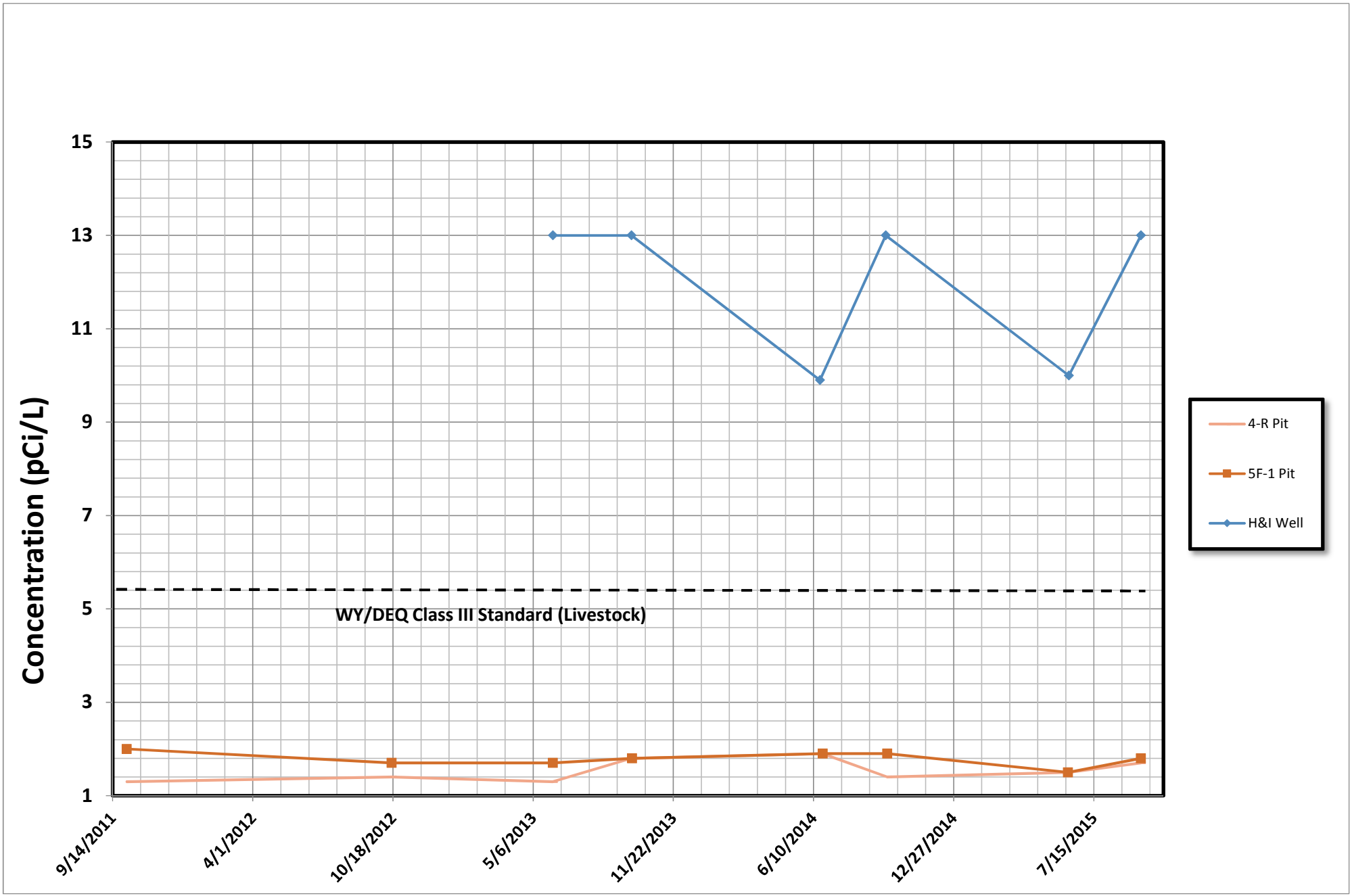
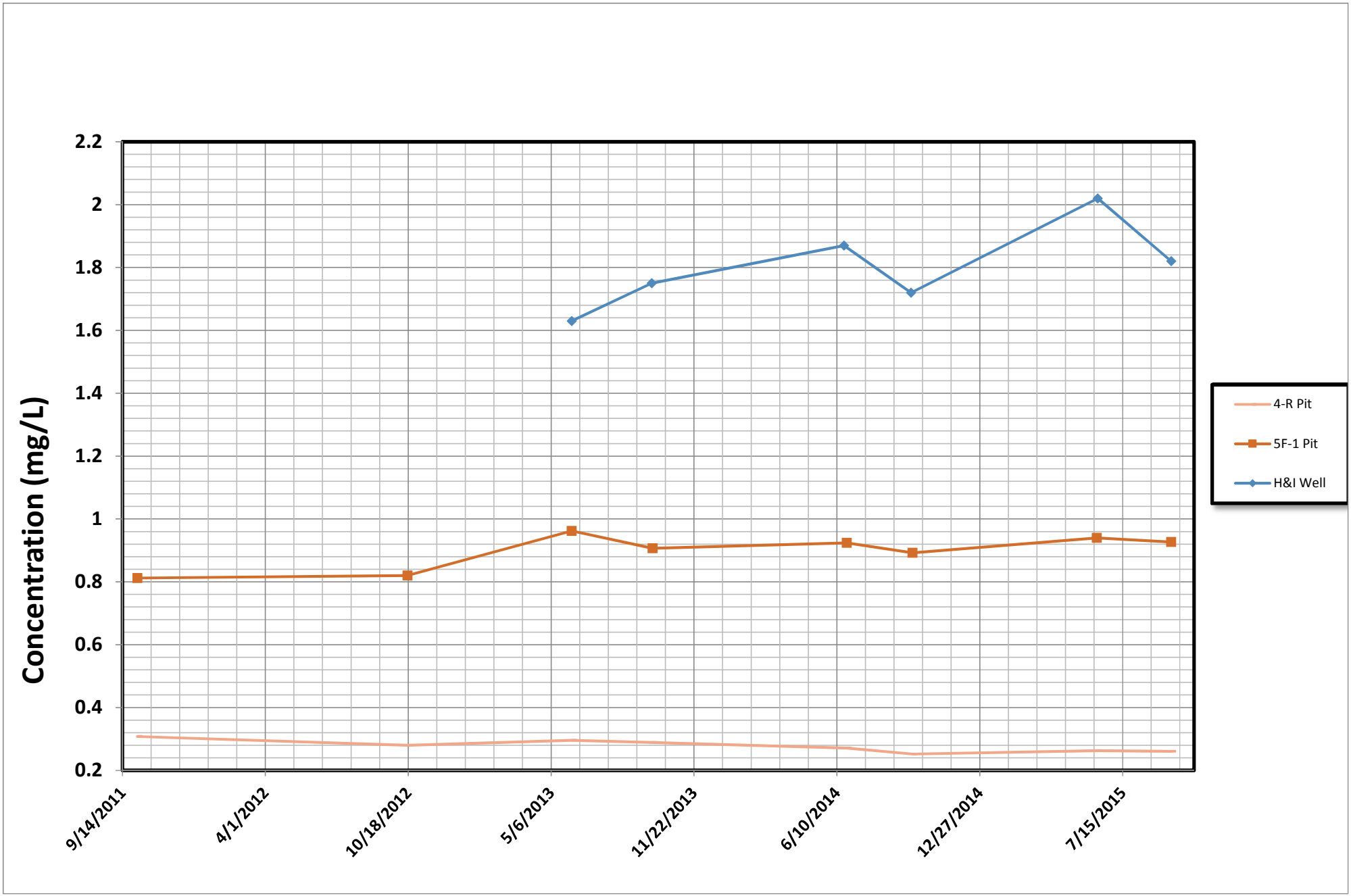


Figure 4.4-6 Central Gas Hills Surface and Groundwater Quality - Uranium vs. Time



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CHECKED:	KJL
APPROVED:	CDL

FIGURE 4.5-1
East Gas Hills Area
Windriver Aquifer
Potentiometric Surface Map
Fall 1993 and Fall 2015

Legend

- 1993 POTENTIOMETRIC SURFACE
- 2015 POTENTIOMETRIC SURFACE
- Groundwater Sampling Location
- Surface Water Sampling Location

Top El. 6438.4 (1993 SWL)
Bottom El. 6444.2 (Fall 2015 SWL)
(--) No Data

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Figure 4.5-2 East Gas Hills Monitoring Well Water Quality - Total Dissolved Solids vs. Time

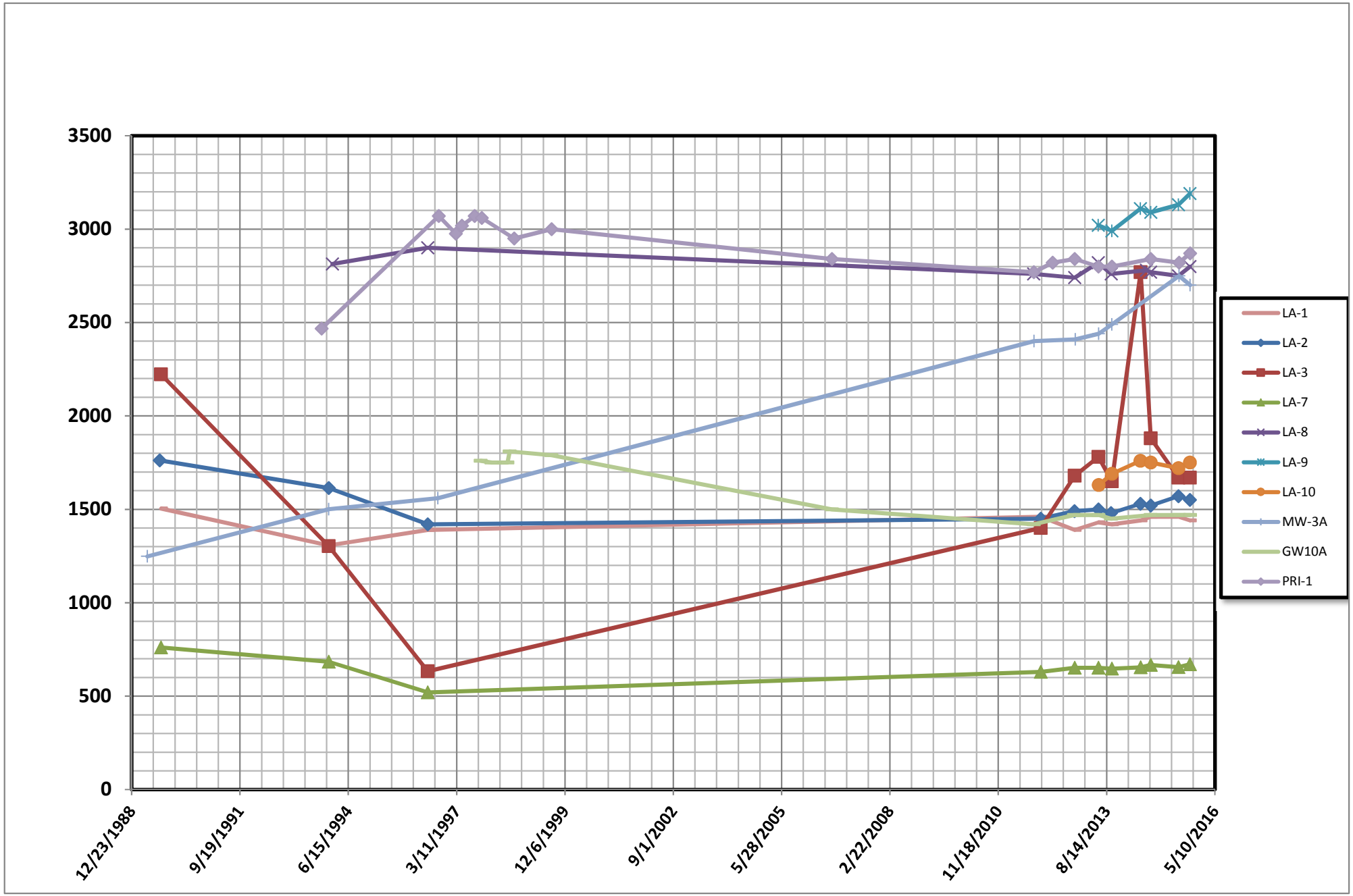


Figure 4.5-3 East Gas Hills Monitoring Well Water Quality - Sulfate vs. Time

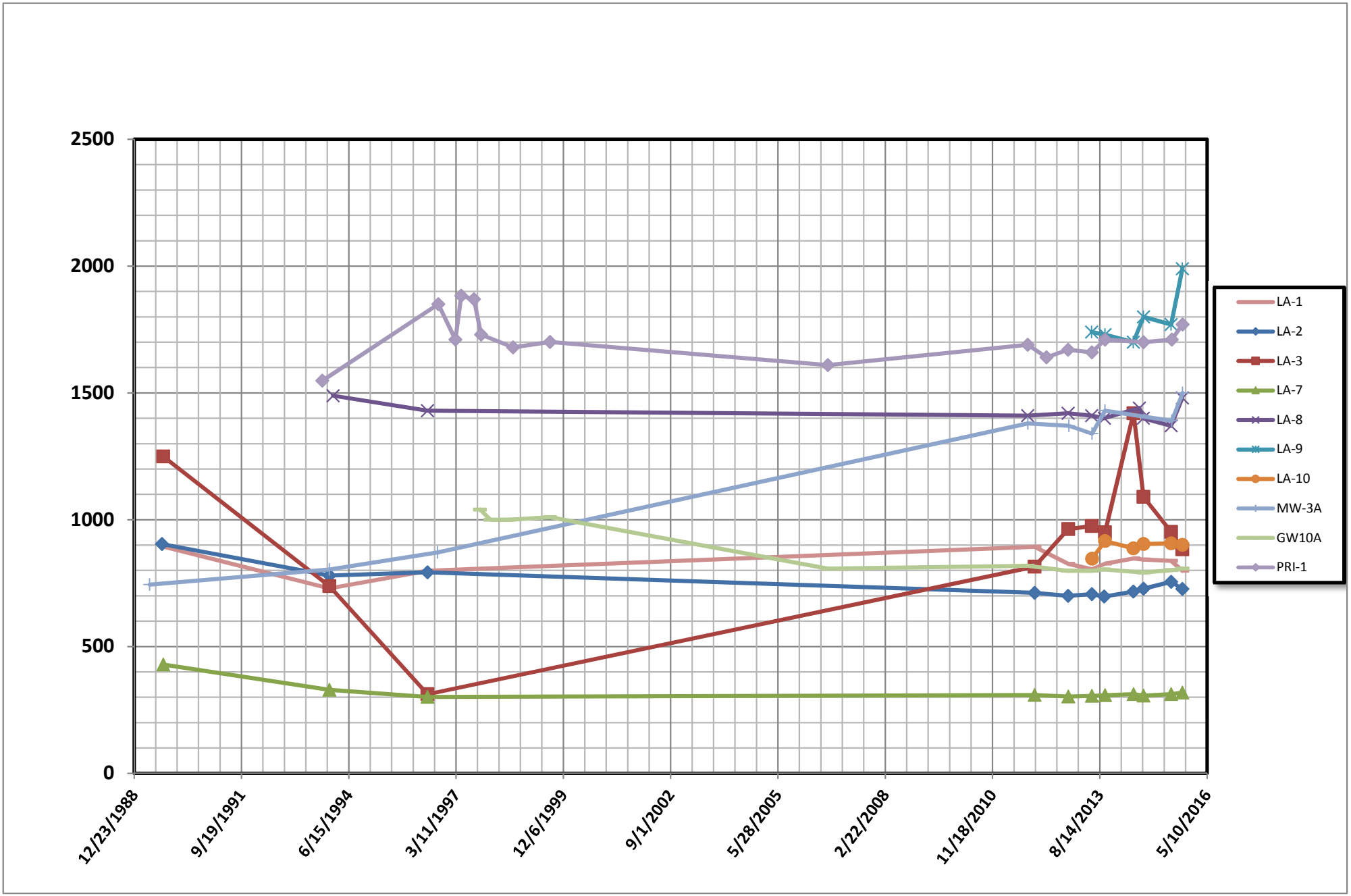


Figure 4.5-4 East Gas Hills Monitoring Well Water Quality - Radium 226 vs. Time

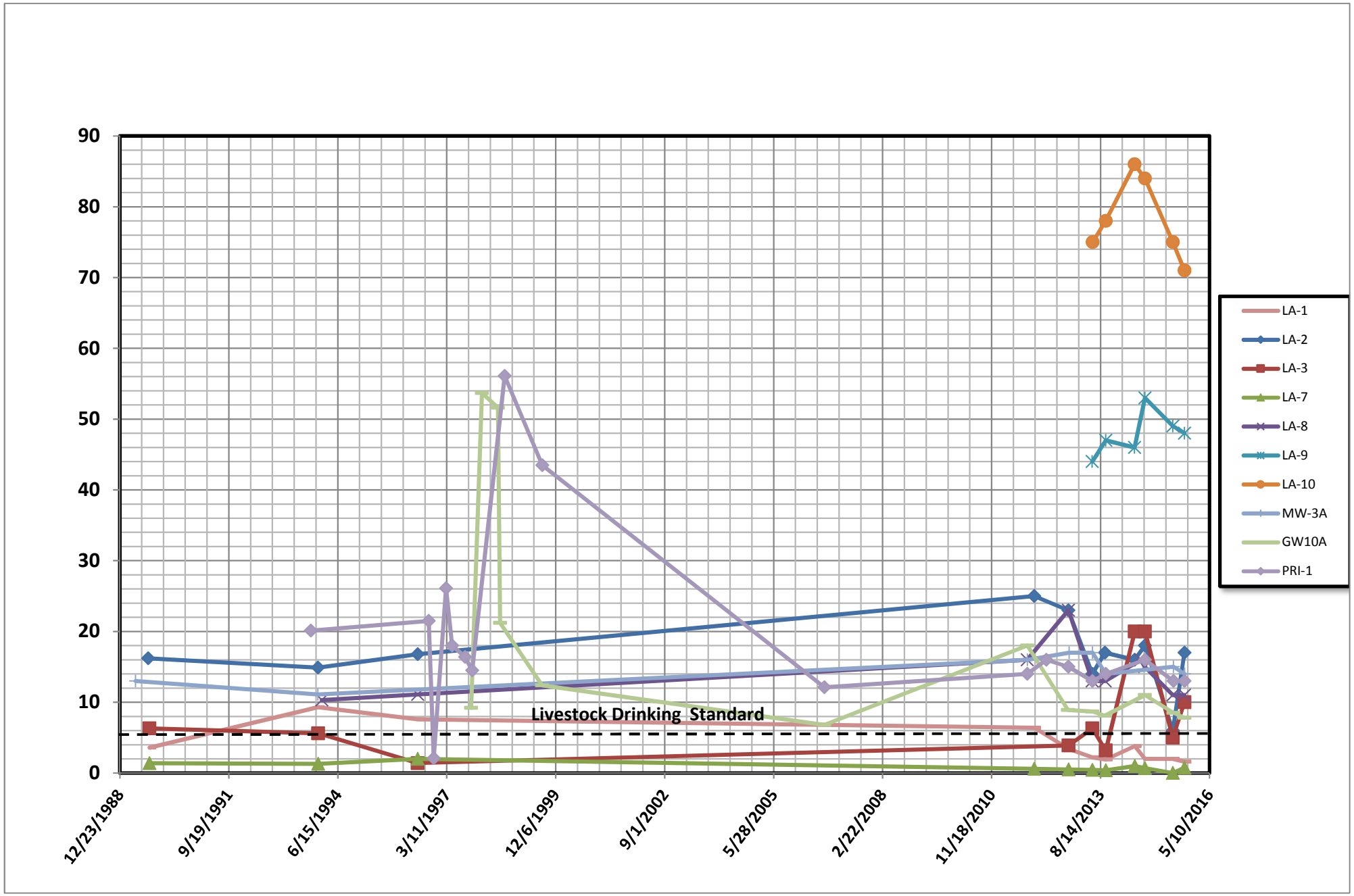


Figure 4.5-5 East Gas Hills Monitoring Well Water Quality - Uranium vs. Time

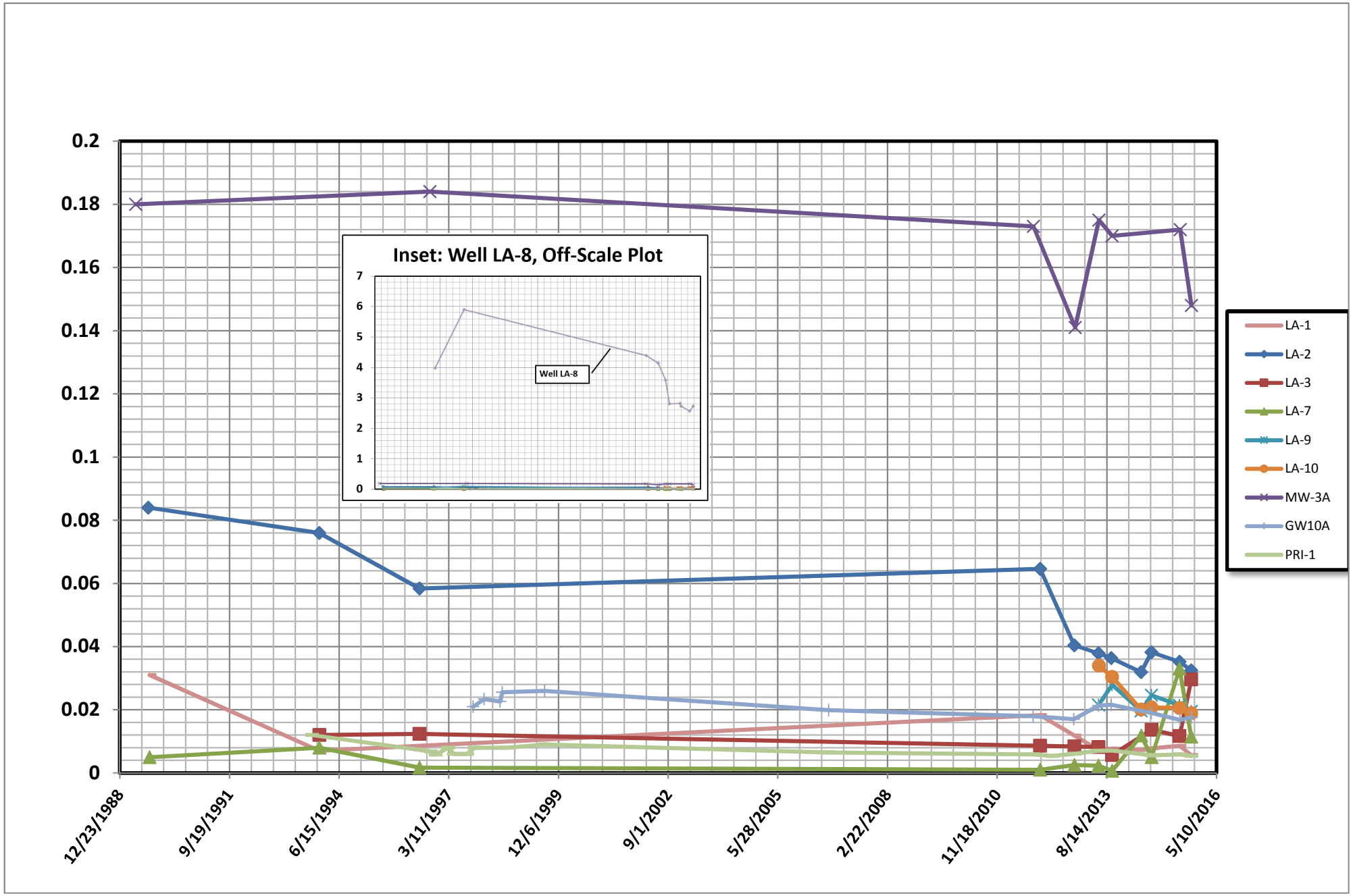


Figure 4.5-6 East Gas Hills Surface Water Quality - Total Dissolved Solids vs. Time

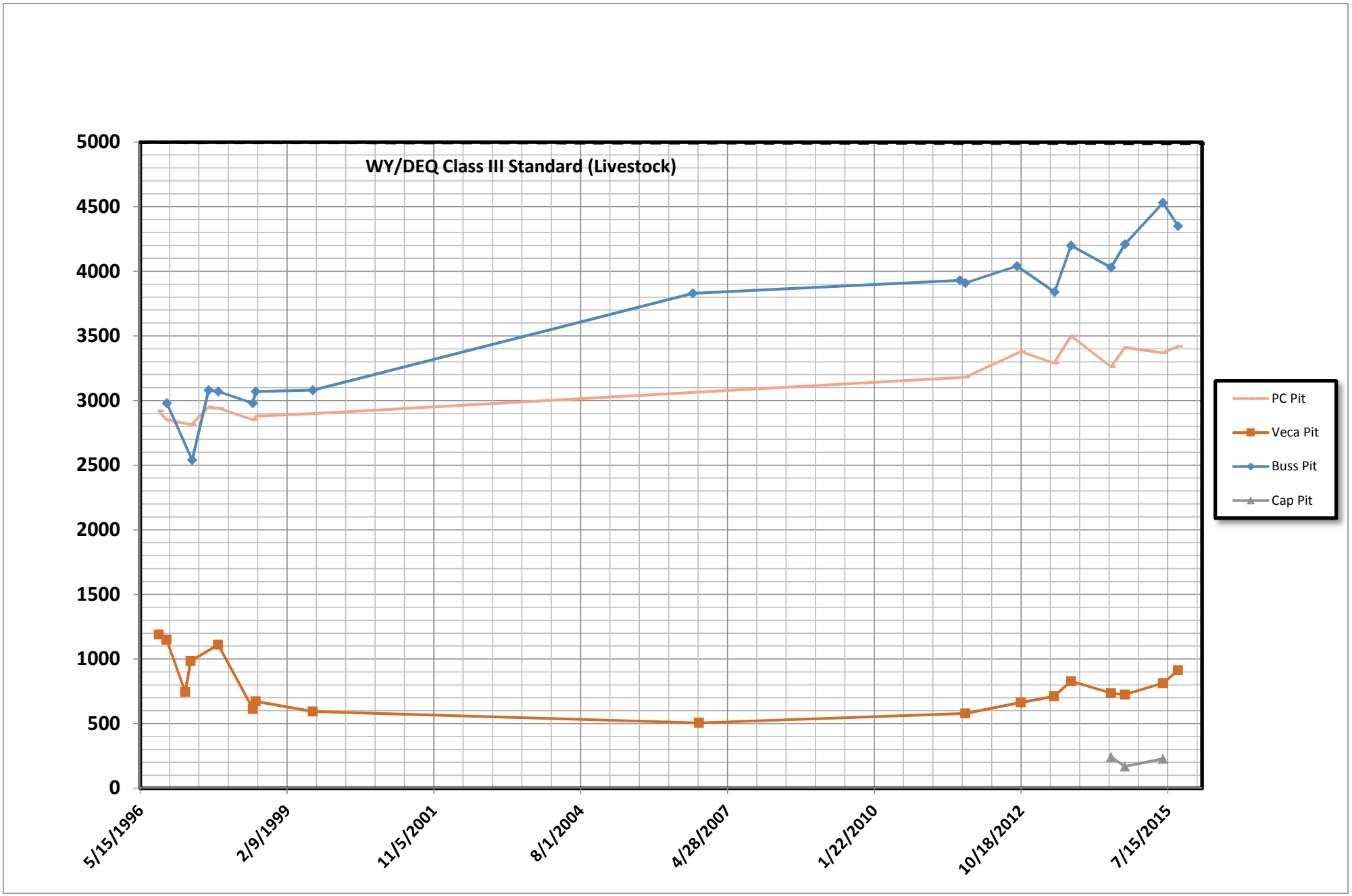


Figure 4.5-7 East Gas Hills Surface Water Quality - Sulfate vs. Time

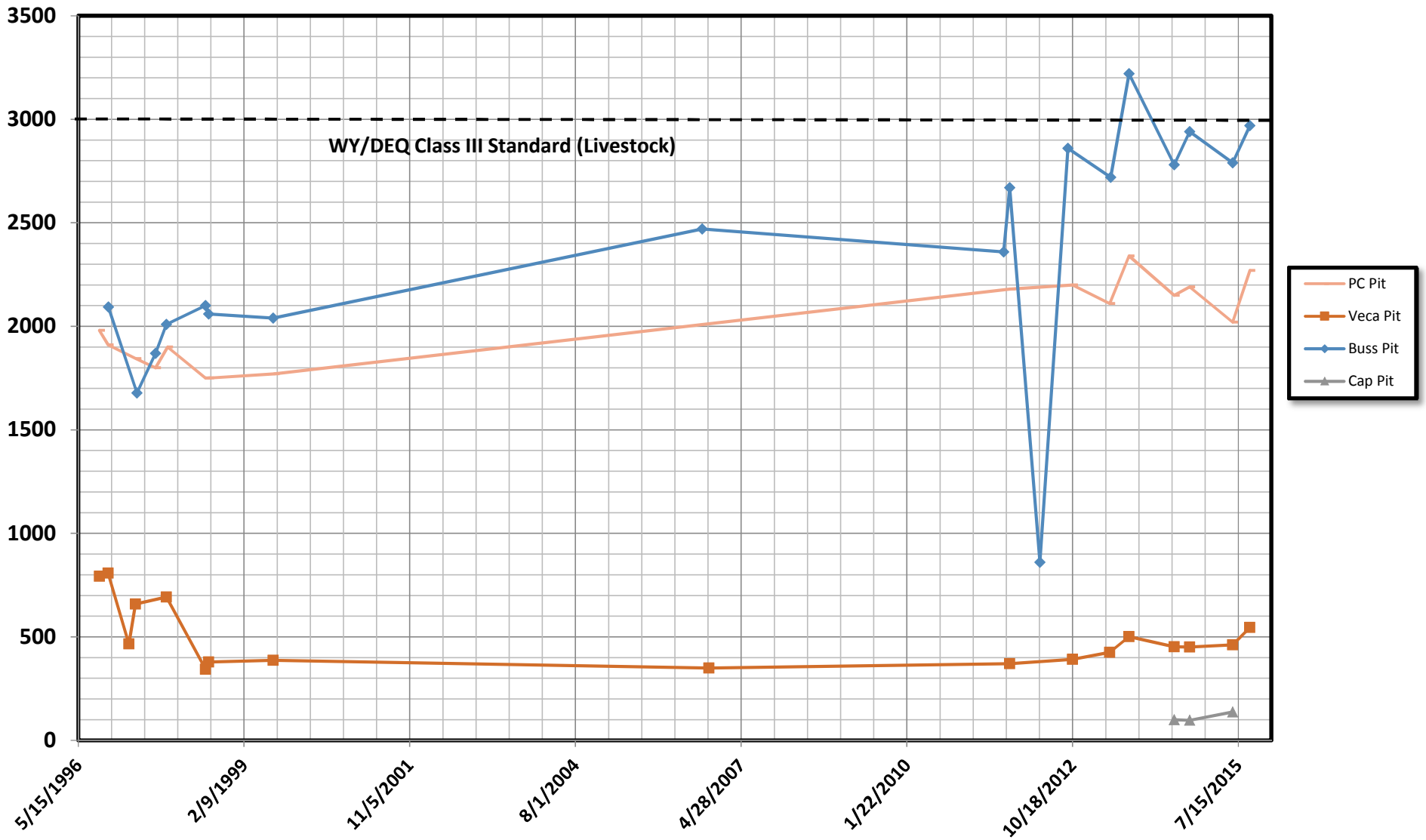


Figure 4.5-8 East Gas Hills Surface Water Quality - Radium 226 vs. Time

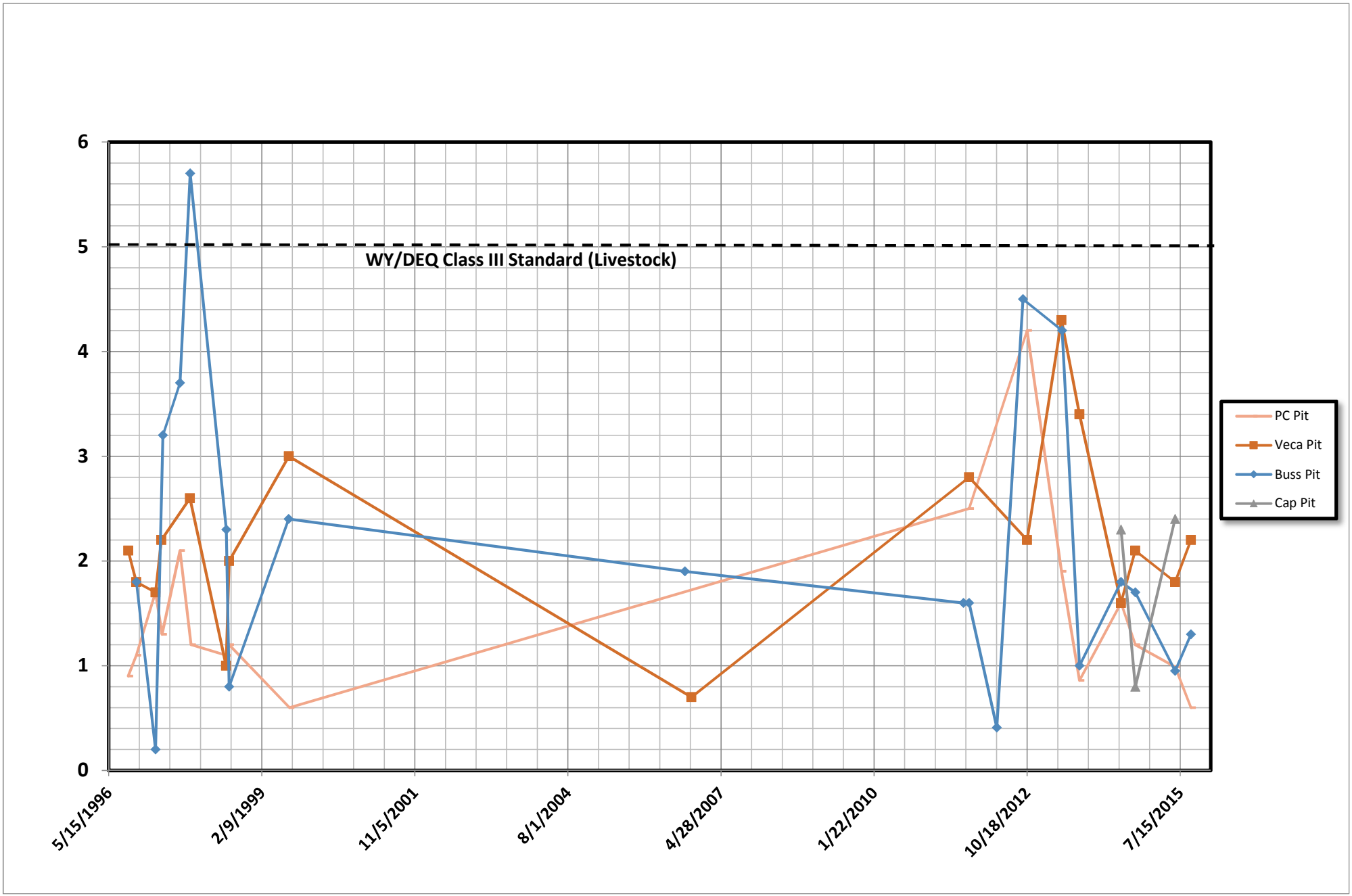
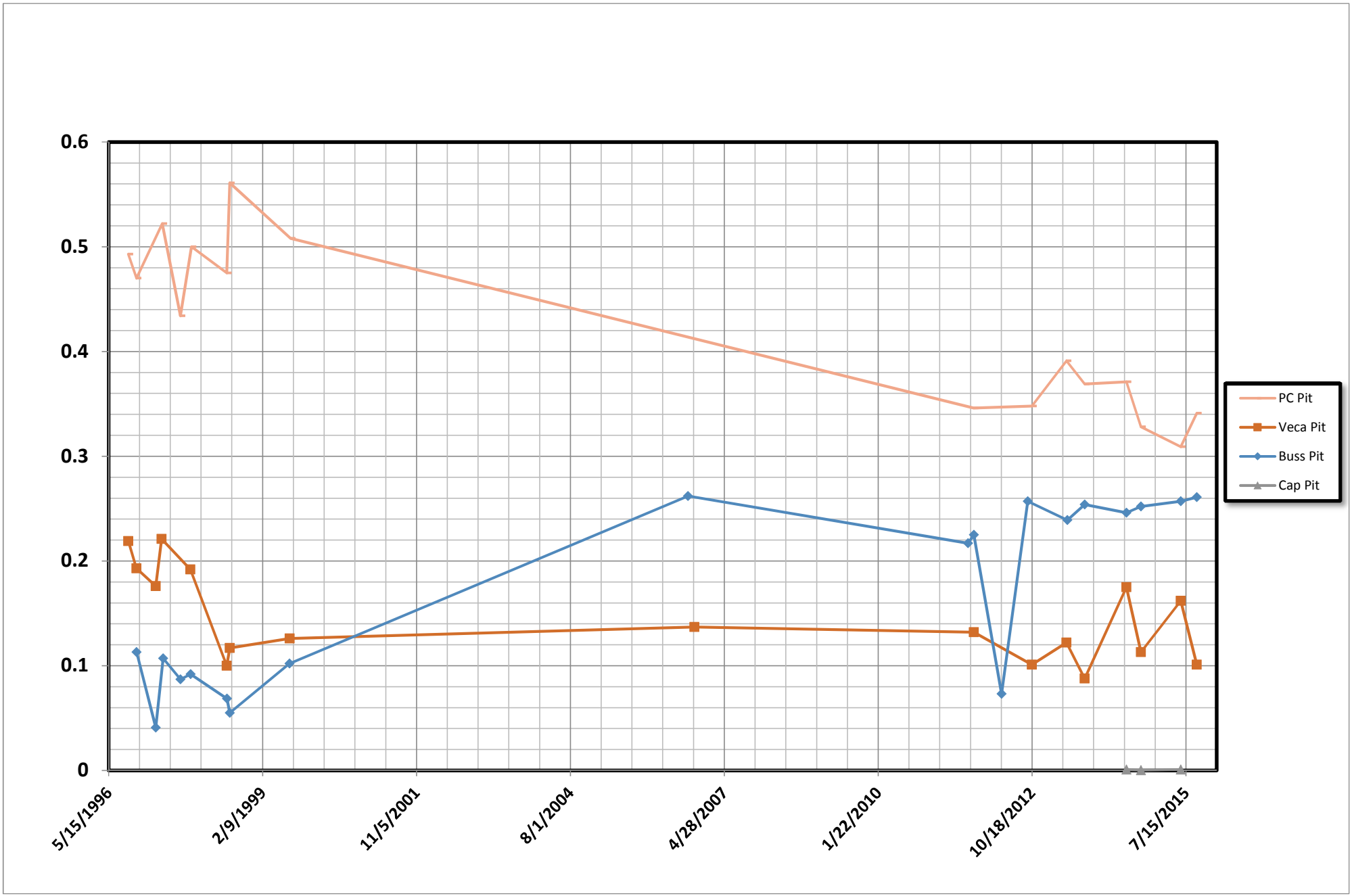
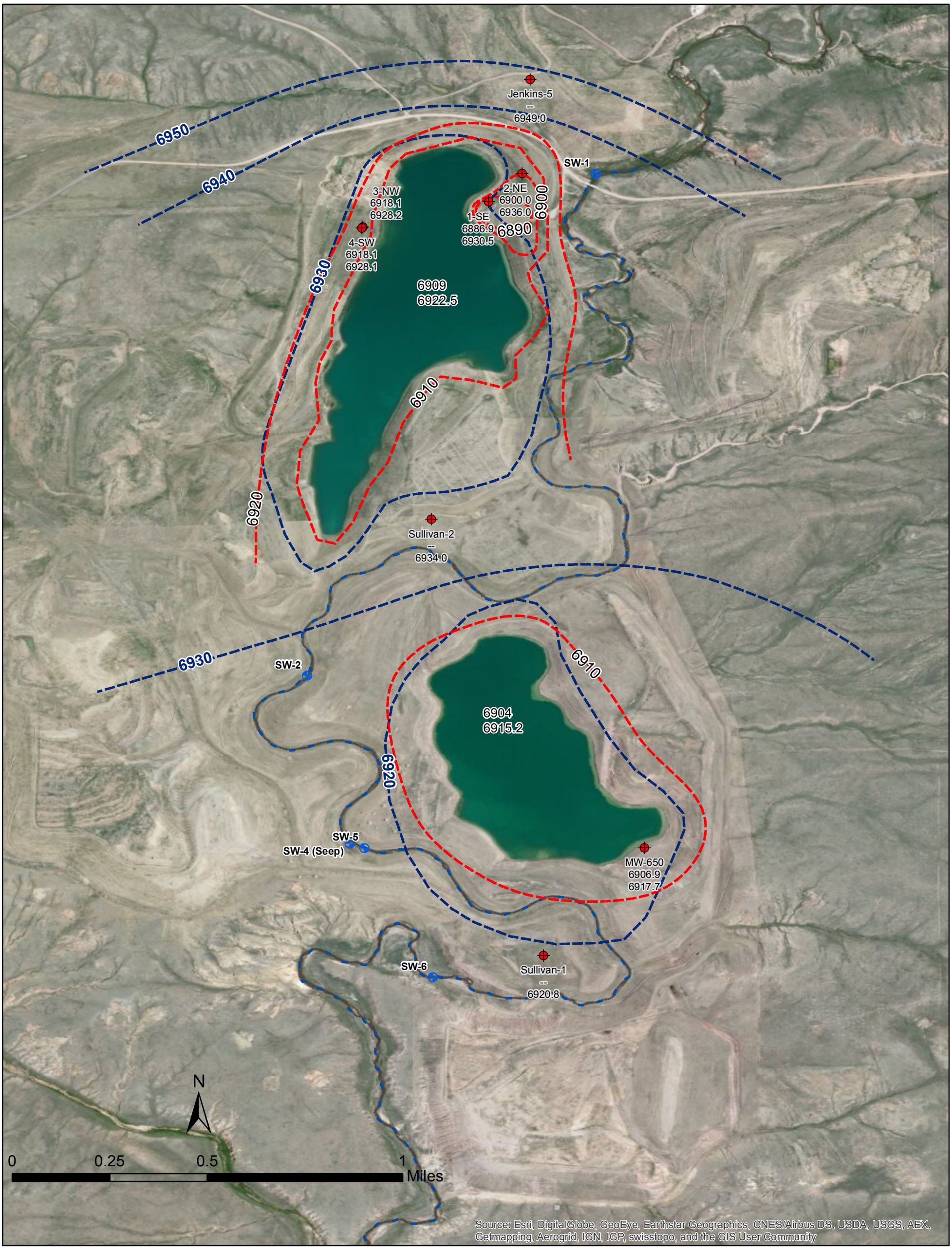


Figure 4.5-9 East Gas Hills Surface Water Quality - Uranium vs. Time





Lidstone and Associates - A Wenck Company

PROJECT NUMBER	WYAML102
DATE:	4/12/2016
DESIGN:	GHS
CHECKED:	KJL
APPROVED:	CDL

FIGURE 4.6-1
Shirley Basin Area-
Wind River Aquifer
Potentiometric Surface Map
Fall 2015

Legend

- 1989 POTENTIOMETRIC SURFACE
- FALL 2015 POTENTIOMETRIC CONTOURS
- Surface Water Sampling Location
- Groundwater Sampling Location
- Little Medicine Bow River

Top El. 6438.4 (1989 SWL)
Bottom El. 6444.2 (Fall 2015 SWL)
(--) No Data

Document Path: Z:\project\WYAML102 3.2\1 DATA\2 GIS_maps_locations_figures\GIS\2014 Maps and Data\Gas Hills\WYAML102_SHIRLEY BASIN_GW POTENTIOMETRIC SURFACE MAP-R.mxd

Figure 4.6-2 Shirley Basin Monitoring Well and Pit Water Quality - Total Dissolved Solids vs. Time

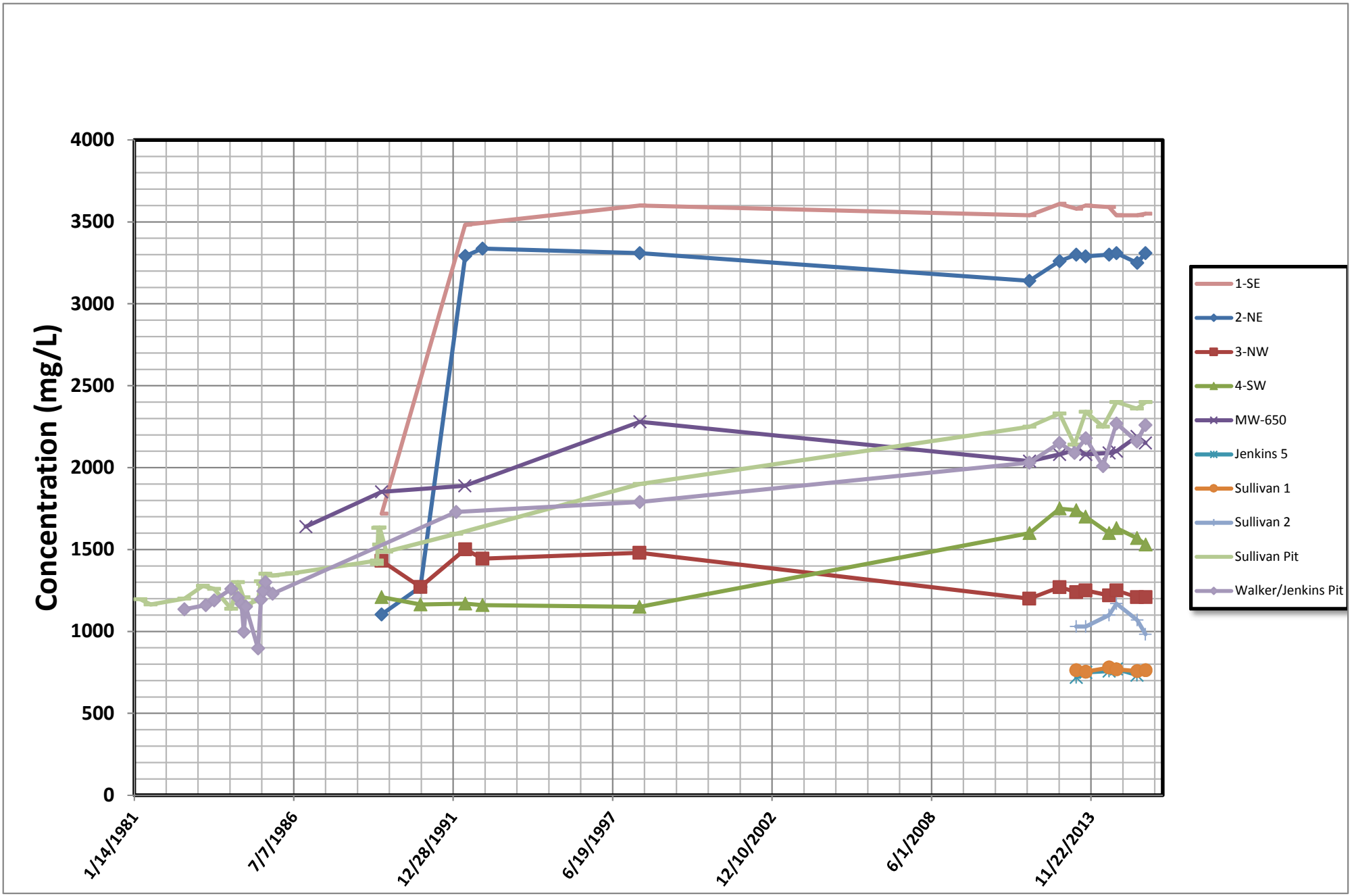


Figure 4.6-3 Shirley Basin Monitoring Well and Pit Water Quality - Sulfate vs. Time

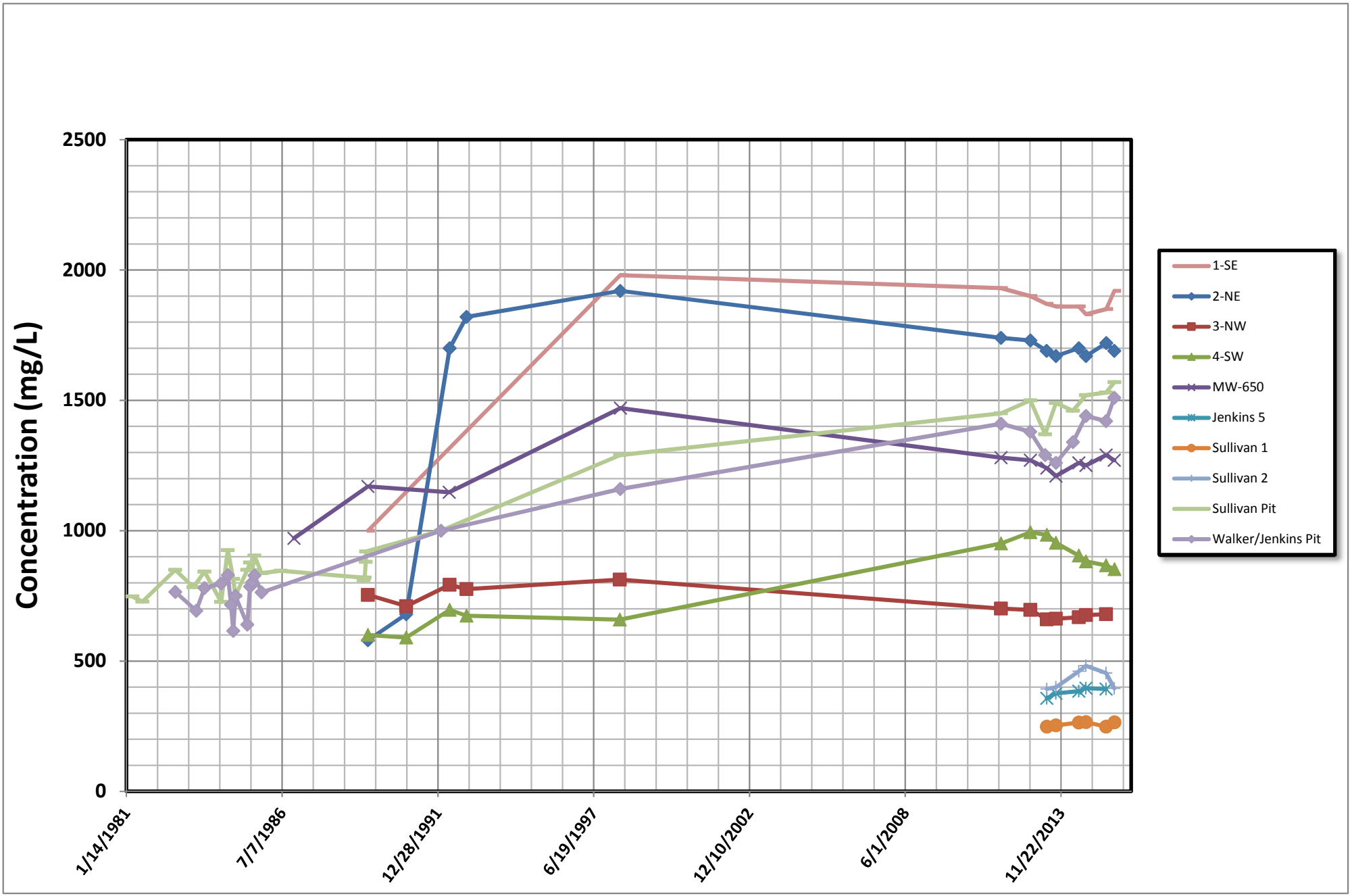


Figure 4.6-4 Shirley Basin Monitoring Well and Pit Water Quality - Radium 226 vs. Time

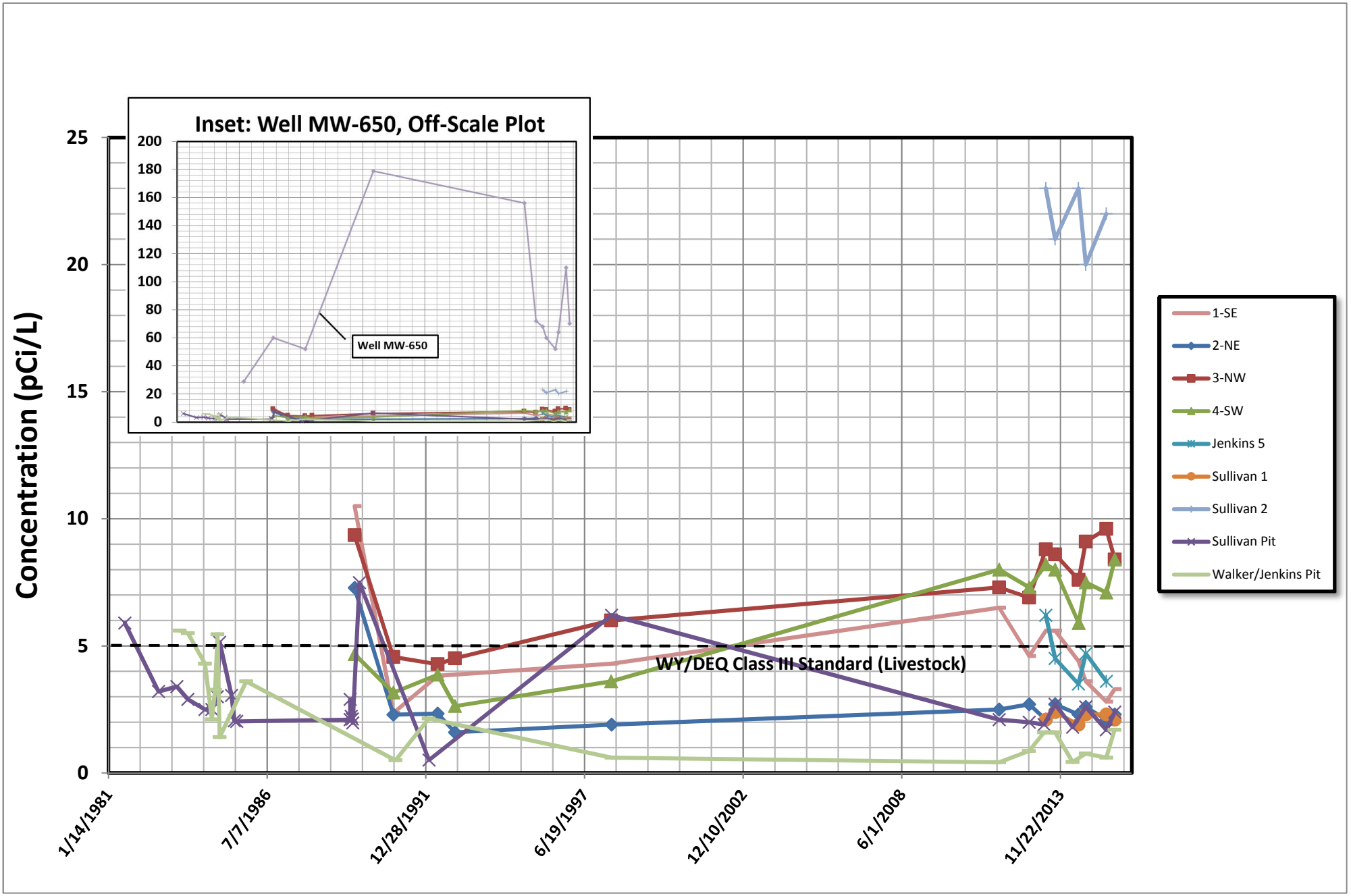
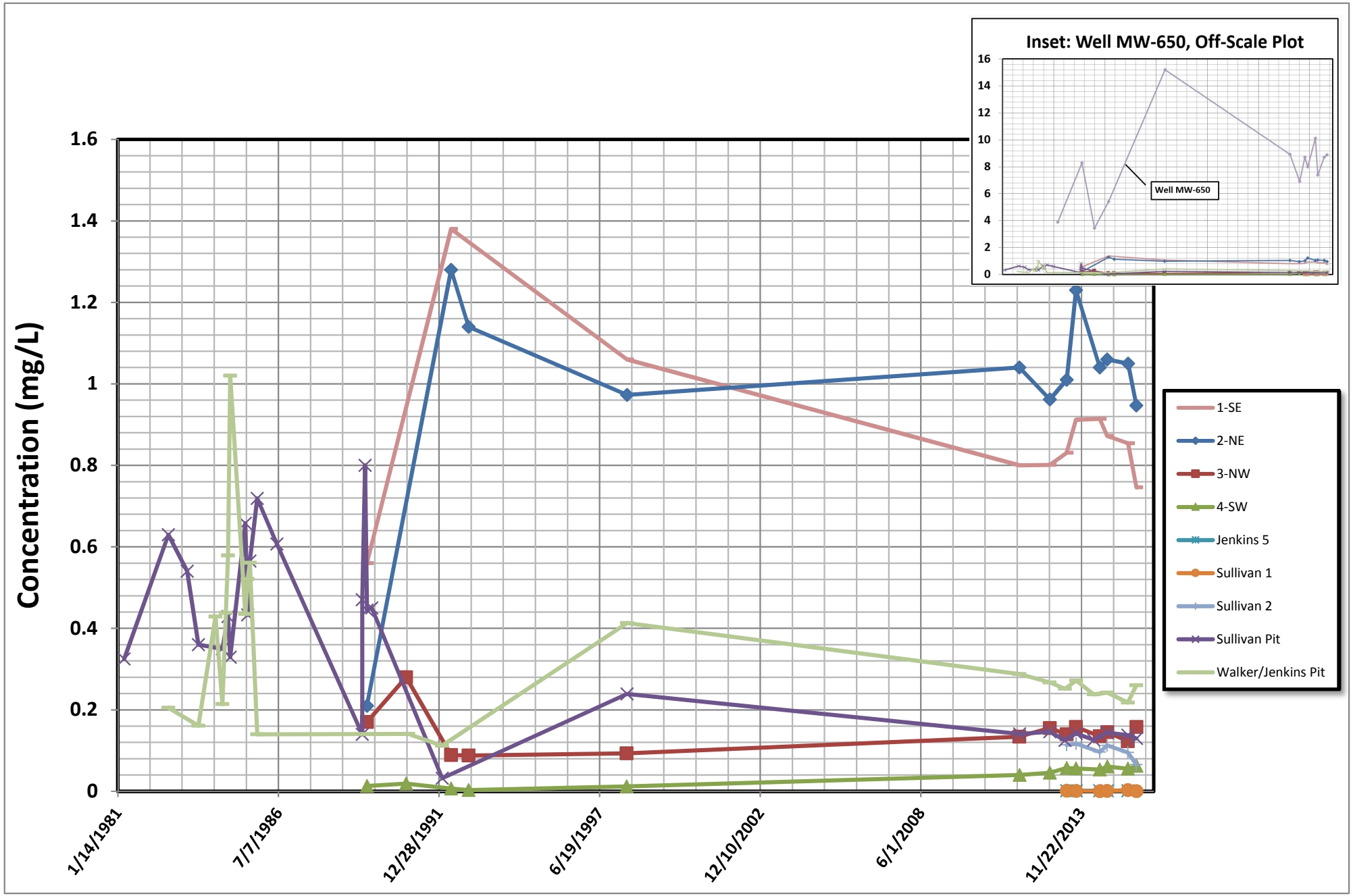


Figure 4.6-5 Shirley Basin Monitoring Well and Pit Water Quality - Uranium vs. Time



5.0 General Conclusions and Recommendations

A broad and generalized comparison of water level data collected from the early 1980s through the biannual sampling, which occurred under this project, indicates that water levels in the vicinity of reclaimed disturbances continue to recover and in some areas may be fully recovered. Monitoring wells have seen continued poor quality in backfill wells with improvements in some areas and deterioration in others. Down gradient water quality has largely remained of similar quality with up gradient water, indicating that reclamation-affected water quality has yet to be detected. The exception to this is the East Gas Hills, where reclamation is approximately 5 years older than the West Gas Hills and the Day Loma area. In some cases down gradient wells are indicating highly variable water quality and this may suggest that an initial front may be migrating through the aquifer.

The Johnny Potatoes Well, which lies immediately down gradient of the West Gas Hills disturbance and up gradient from the ANC tailings area, has seen a significant deterioration in the last 3 years. The reason for this water quality change may be a reflection of degraded water quality movement from the West Gas Hills disturbances or perhaps a compromise in the condition of this 50 year old well. LA recommends further investigation of this well and construction of two intervening nested wells- located between Johnny Potatoes and P-4. One well nest could be located northeast of P4 and the other well should be located northwest of P-4. Well completion of the nested intervening wells is a critical consideration. Nested wells can define individual sands at stratigraphic completion depths similar to the lowest sands intercepted by the mine pits.

The East Gas Hills groundwater and surface water monitoring network is a critical water monitoring area because of the longevity and the quality of the data. Nearly 30 years of data documents current site conditions and these data sets should be continued. The Day Loma and Shirley Basin areas provide key data on mine reclamation and backfill of groundwater-fed mine pits that are dominantly influenced by AML reclamation with a much lesser component of Company reclamation. The cone of depression remains significant in the Shirley Basin area and is beginning to be mitigated within the Day Loma area.

Variability in radium concentrations have been observed across the study area because of inherent variability in radionuclides; the limited data set does not allow us to predict the long term behavior of radium concentrations across the AML reclaimed area. Radium concentrations do remain significantly elevated above WQD standards and appears to be a reflection of the reclamation process.

Water quality across the monitoring network had regular and frequent exceedances of Class III livestock standards, particularly with gross alpha. These exceedances occurred more frequently in mine impacted areas but have also occurred in up gradient wells.

In summary, the LA data set suggests that the early predictions of deterioration in groundwater quality due to backfilling of a mine pit has occurred. However the processes that were predicted to take tens to hundreds of years have taken far less time and second pore volume flushes seem to exhibit an improved water quality. Where lower pH pit water was present before AML reclamation (Sunset, B2/B3, A-8,) backfill water quality is poorer than where the premining pit waters were of a higher pH (SATA and Day Loma).

LA recommends that the existing surface and groundwater monitoring sites should continue to be sampled for a minimum of 5 years following complete recovery of the backfill potentiometric water surface. This will allow one to begin to address the down gradient impacts of the mine pit backfill process. Surface water sample sites and unconfined aquifers (backfill and alluvial wells), and select down gradient Wind River wells should be sampled on a biannual basis. Up gradient and select deeper confined Wind River wells should be sampled once a year and water surface levels checked biannually. Monitoring recommendations on a per site basis are detailed in **Tables 3-1 through 3-5**. These resulting data sets should be analyzed on a frequent basis to ensure that trends are recognized as they occur. The seasonal sampling will provide an opportunity to continue to track and compare long term trends in radium concentrations through the variability seen in the seasonal sampling. All water samples should continue to be tested for constituents listed in the 2005 WDEQ, LQD Guideline No. 8 for uranium mines, in order to remain consistent with historical sampling. A reduced parameter list may be considered for future monitoring in an effort to save on analytical costs and focus on constituents of concern. The following sections further detail conclusions and recommendations specific to each area.

5.1 Specific Conclusions and Recommendations

5.1.1 Day Loma

The Day Loma area provides a window into the impacts of AML reclamation on both surface and groundwater quality, with little influence from Company reclamation and its general disregard for unsuitable material backfill into the water table. At the time AML reclamation commenced there were two groundwater-fed open pits (Clyde and Day Loma Pits). The Clyde 4 Bret 11 had encountered groundwater but was backfilled by the mining company. When AML reclamation commenced, they instituted an extensive drilling and materials characterization program. On-site construction supervision ensured that backfill below the water table was closely controlled to ensure that unsuitable materials were segregated above the water table. Results of recent water quality monitoring reflects variability in parameter concentrations across the monitoring wells and a lack of a broad improvement of water quality toward up gradient quality levels, suggesting that conditions throughout the mining area have not yet reached stability. As water levels continue to rise toward more stable levels and earthwork reclamation activities continue in the Clyde Pit area, changes in water levels and quality will also continue. As water levels rise into oxidized backfill materials, migration of contaminant fronts seen through parameter variability down gradient from the Clyde Pit are expected to expand and intensify. Water levels in the vicinity of the historic (currently dry) Coyote Creek Springs are experiencing the greatest rise, currently within approximately 12 feet of the expected springs outflow. LA recommends that continued seasonal groundwater and surface water data are collected through the period of active reclamation in order to evaluate effects of reclamation and characterize the observed contaminant fronts as they migrate through the site. Biannual sampling in backfill wells, downgradient wells, and surface water sites will provide the data to ascertain ongoing changes and characterize livestock and wildlife water supply quality. Annual sampling in the remaining up gradient and Wind River wells will provide for long term baseline water quality characterization. Seasonal water quality samples in Lake Day Loma will provide a range of background constituent concentrations in surface water and reflect the effects of precipitation, evaporation, and concentration on background water

quality. In addition, renewed efforts should be made to visit and sample up gradient wells DL-4 and DL-7 to ascertain potentiometric surface recovery and background water quality east of the Day Loma Pit. Ongoing sampling of the Day Loma monitoring wells will provide insight into the long term behavior of metals and radionuclides as well as major anions and cations down gradient from AML reclamation. Data also will continue to characterize the water quality performance of the Day Loma impoundment. Finally, LA recommends that the integrity of well P-4 be investigated for possible cross connection with the screened zone of adjacent well DL-9 and updated measuring point elevation surveys should be completed at wells P-1 and P-6.

5.1.2 West Gas Hills

AML backfill and reclamation of the SATA Pit has been followed by significant recovery of groundwater levels in the northern half of the West Gas Hills area, while groundwater levels around the southern Sunset Pit area have remained stable, matching equilibrium levels achieved prior to AML reclamation. The former cone of depression around the SATA Pit has been significantly reduced and in some wells equilibrium appears to have been reached. A mix of stable, continued moderate rise and variability in water levels around the SATA Pit suggests that there remains a slight cone of depression and influences on water levels from historic mining activities. Reclamation prior to AML along with spatial variability within the system may be contributing to these differences. Some continued water level rise is anticipated to continue in some wells around the SATA Pit.

Groundwater quality data, as seen in TDS and sulfate concentrations, indicates slowly degrading water quality conditions in backfill wells. With the exception of the Johnny Potatoes South well, significant impacts on water quality from AML reclamation activities have not been observed in Wind River Formation wells, though water quality and water levels in the region have not yet stabilized. Increases in TDS, sulfate, iron, manganese and radium 226 concentrations have been observed in some of the monitoring wells completed in native material, but these changes vary by the water quality parameter and the well location. Water quality in backfill wells should not be expected to improve until groundwater levels have stabilized, backfill materials have become fully saturated for an extended period, and flow through cycles have begun to dilute and disperse dissolved minerals.

LA recommends continued monitoring and analyses to help determine when water levels reach equilibrium. Continued seasonal sampling in backfill and select downgradient wells will allow for comparison of backfill material water quality versus Wind River Aquifer water quality. In addition, given the observations in the Johnny Potatoes South well, LA anticipates that water quality deterioration in down gradient Wind River wells due to reclamation will occur and should be monitored on a frequent basis to ensure that trends are recognized as they occur. Monitoring and sampling will also allow for evaluation and analysis of the presence and migration of contaminant fronts, improvement in water quality in backfill materials following water level stabilization and pore flow through cycles, and the long term water quality impacts on the Wind River Aquifer. Continued seasonal surface water sampling will inform changes over time, groundwater-fed 2RS Pit evaporative

concentration effects, and general livestock and wildlife environmental conditions. Consideration should be given to investigate the mechanical integrity of the Johnny Potatoes South well (video and MIT) and perform aquifer testing to characterize the groundwater movement. In addition top of casing surveying of the Sage 2 and Sun 1 wells should be completed. Finally, additional deep nested groundwater monitoring wells near the Johnny Potatoes South well, each selectively screening over different Wind River sands to provide valuable monitoring points and better understand the behavior of contaminant plumes migrating from reclamation backfill.

5.1.3 Central Gas Hills

Groundwater elevation changes in the H&I well, 5F-1 Pit, and 4R Pit show rising water levels at rates around 1.5 to 3 ft/yr, with the up gradient 4R Pit at the top of that range. These changes indicate that saturation of backfill materials and dissolution of minerals are actively occurring, particularly at the up gradient end of the area. It is anticipated that water levels will continue to rise toward equilibrium. As water levels stabilize in and around the pits, evaporative effects will result in increases in TDS, sulfate, and other ions. Acidic groundwater in the H&I well (average pH of 6.1 s.u.) exacerbates dissolution of trace metals into the groundwater. High gross alpha concentrations were also observed in the H&I well, suggesting that selective handling of radionuclides may not have been successful. Though the limited data set shows little evidence of deteriorating water quality, changes observed in water levels and water characteristics are expected to continue and accelerate, having potential to negatively affect livestock, wildlife, and environmental health and safety. For these reasons, LA recommends that continued seasonal groundwater and surface water data are collected to monitor the changing conditions in the area. Also, elevation monument pins at the Pits should be re-surveyed to provide more precision in monitoring water level changes. Consideration should be given toward expanding the monitoring network in the area to discretize AML and Company reclamation zones and their subsequent water quality impacts.

5.1.4 East Gas Hills

Groundwater elevation data from monitoring wells in the East Gas Hills suggest that water levels are approaching an equilibrium state in up gradient and down gradient wells. However, variable water levels in monitoring wells within reclamation areas including LA-3, LA-8, LA-9, LA-10, and MW-3A indicate that equilibrium has not been reached. Water levels in the A-8 Pit area are 57 feet higher than predicted during reclamation, saturating backfill materials intended to not come into contact with groundwater and creating deteriorated water quality pulses to down gradient wells. Water quality is better in up gradient baseline wells and poorer with variability in wells within reclamation areas and down gradient. The influence of up gradient Umetco disturbances including the A-7, B-5 and several of the C-Pits has not been defined.

Due to a lack of outflow, water quality in the groundwater fed Buss and PC Pits and the Veca Pit show long term trends of rising TDS and sulfate concentrations due to evaporative concentration effects In the Buss Pit, the recovered water table encountered an oxidized

sulfide zone and is now acidic. Water quality of the Buss Pit has reached a geochemical equilibrium with pH and metals.

With observations of variable groundwater quality conditions, trends in changing groundwater level elevations, possible contaminant plumes, and deteriorating water quality at some monitoring sites continued monitoring in the East Gas Hills is recommended. LA anticipates that changes in water levels and water quality characteristics will continue. Surface and groundwater quality sampling should continue in order to further clarify down gradient reclamation water quality and elevation effects as well as livestock consumption risks from surface water impoundments and pits. Given the extensive long term database in the East Gas Hills and the regional approach towards equilibrium (flow through water levels), LA recommends the development of an updated groundwater model to address both groundwater flow and geochemistry. The extensive data set and new modeling techniques offer a great opportunity to forecast future changes which will in turn help inform predictions and water quality expectations in other reclamation areas.

5.1.5 Shirley Basin

Water level elevations in monitoring wells and groundwater-fed pits in the Shirley Basin were stable during the most recent sampling period. A significant cone of depression or groundwater sink surrounds the Walker Jenkins and Sullivan Pits. As such, up gradient groundwater and alluvial waters along the Little Medicine Bow River must pass through backfill and will introduce dissolved minerals and salts into the reclamation impoundments. Evaporative concentration effects in the Pits have created rising levels of TDS, sulfate and chloride concentration. Water quality in backfill wells is poorer than water quality in the Wind River Formation wells, suggesting additional pore flow through volumes, particularly in low permeability areas in the backfill material will eventually lead to improving water quality closer to background levels. Radium 226 in wells 3-NW and 4-SW trend toward increasing levels. These wells are good references for monitoring backfill water quality improvements through a change in that trend.

A lack of clear and obvious water quality degradation trends, contaminant plumes, constituent concentration spikes, or drastic water level changes indicates that water quality in the Shirley Basin is generally stable. AML reclamation efforts were successful in addressing public health and safety and environmental degradation and the hydrogeochemistry will continue to recover through natural processes over time. Given the long term existence of a cone of depression and the presence of saturated backfill, LA anticipates that the reclamation impoundments will continue to see moderate water quality deterioration through time.

LA recommends continued biannual monitoring of backfill groundwater wells, pits, and select river sites to observe regional and local trends. The increase in TDS in the Pits due to evaporative concentration effects is important relative to the public, livestock, and wildlife use of these reservoirs. The Walker Jenkins Reservoir is a fishery and as such not only do livestock and wildlife, but also aquatic standards apply. The Pits are expected to gradually increase in dissolved solids until they reach a relatively steady state concentration based on

the average inputs and precipitation outputs of particular constituents. Continued biannual sampling at river sites SW-1 and SW-6 are recommended to address the overall impact of AML reclamation on the Little Medicine Bow Watershed as the river flows through the reclamation area. This will monitor possible changes to river water quality from upstream to downstream as groundwater levels equalize and interactions between pits and the alluvial aquifer create possible mixing and water quality changes. The intermediate sampling sites (SW2 – SW5) can be discontinued.

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Appendices

Appendix A

Appendix A – Monitoring Well Improvements

Table A-A-1: Well Maintenance and Security Improvements Summary

Area / Well	Work Completed	Completion Date
East Gas Hills		
LA-1	Installed lock	June-14
LA-2	Installed lock	June-14
LA-3	Installed lock	November-13
LA-7	Installed lock	June-14
LA-8	Installed lock	November-13
LA-9	None	
LA-10	None	
Central Gas Hills		
H&I	None	
West Gas Hills		
Sage 1	Fabricated and installed locking "T" bar and lock	September-15
Sage 2	None	
Sun 1	None	
Sun 2	Installed 8" diameter threaded nipple pipe extension, aluminum locking cap, and lock	September-14
Sun 3	Installed 8" diameter threaded nipple pipe extension, aluminum locking cap, and lock	September-14
P-2	Installed lock	November-13
P-4	Installed lock	November-13
Johnny Potatoes S.	None	
K2 Pit	Installed lock	November-13
Day Loma		
DL-2	Extended PVC well casing, placed concrete sanitary seal and pad around new steel protective casing, and locked	September-15
DL-4	None (Dry Well)	
DL-5	Placed concrete pad over existing sanitary seal, installed aluminum cap on existing steel casing, and locked	September-15
DL-6	Placed concrete pad over existing sanitary seal, installed aluminum cap on existing steel casing, and locked	June-15
DL-7	None (Dry Well)	
DL-8	Installed lock	June-14
DL-9	Installed lock	June-14
DL-10	None (Within active reclamation)	
DL-11	None	
P-1	Placed concrete seal and pad around existing steel casing, installed aluminum cap, and locked	June-15

P-3	Cemented annulus, installed aluminum cap, and locked	June-15
P-4	Placed concrete sanitary seal and pad around new steel protective casing and locked	September-15
P-5	Placed concrete sanitary seal and pad around new steel protective casing and locked	September-15
P-6	Placed concrete seal and pad around existing steel casing, installed aluminum cap, and locked	September-15
Shirley Basin		
1-SE	Placed concrete sanitary seal and pad around existing PVC casing, installed aluminum cap and locked	October-14
2-NE	Placed concrete sanitary seal and pad around existing PVC casing, installed aluminum cap and locked	October-14
3-NW	Installed aluminum cap on PVC and locked	July-14
4-SW	Installed aluminum cap on PVC and locked	July-14
MW-650	Installed aluminum cap on PVC and locked	October-14
Jenkins 5	None	
Sullivan 1	None	
Sullivan 2	None	

Appendix A: Photo Log

West Gas Hills – Sun 3 Well before and after

Day Loma – DL-2 Well before and after

Day Loma – DL-5 Well before and after

Day Loma – DL-6 Well before and after

Day Loma – P-1 Well before and after

Day Loma – P-3 Well before and after

Day Loma – P-4 Well before and after

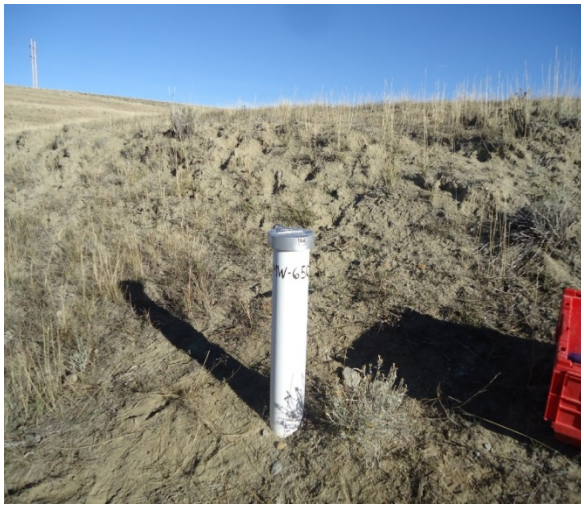
Day Loma – P-5 Well before and after

Day Loma – P-6 Well before and after

Shirley Basin – 1-SE Well after

Shirley Basin – 3-NW Well after

Shirley Basin – 4-SW Well after

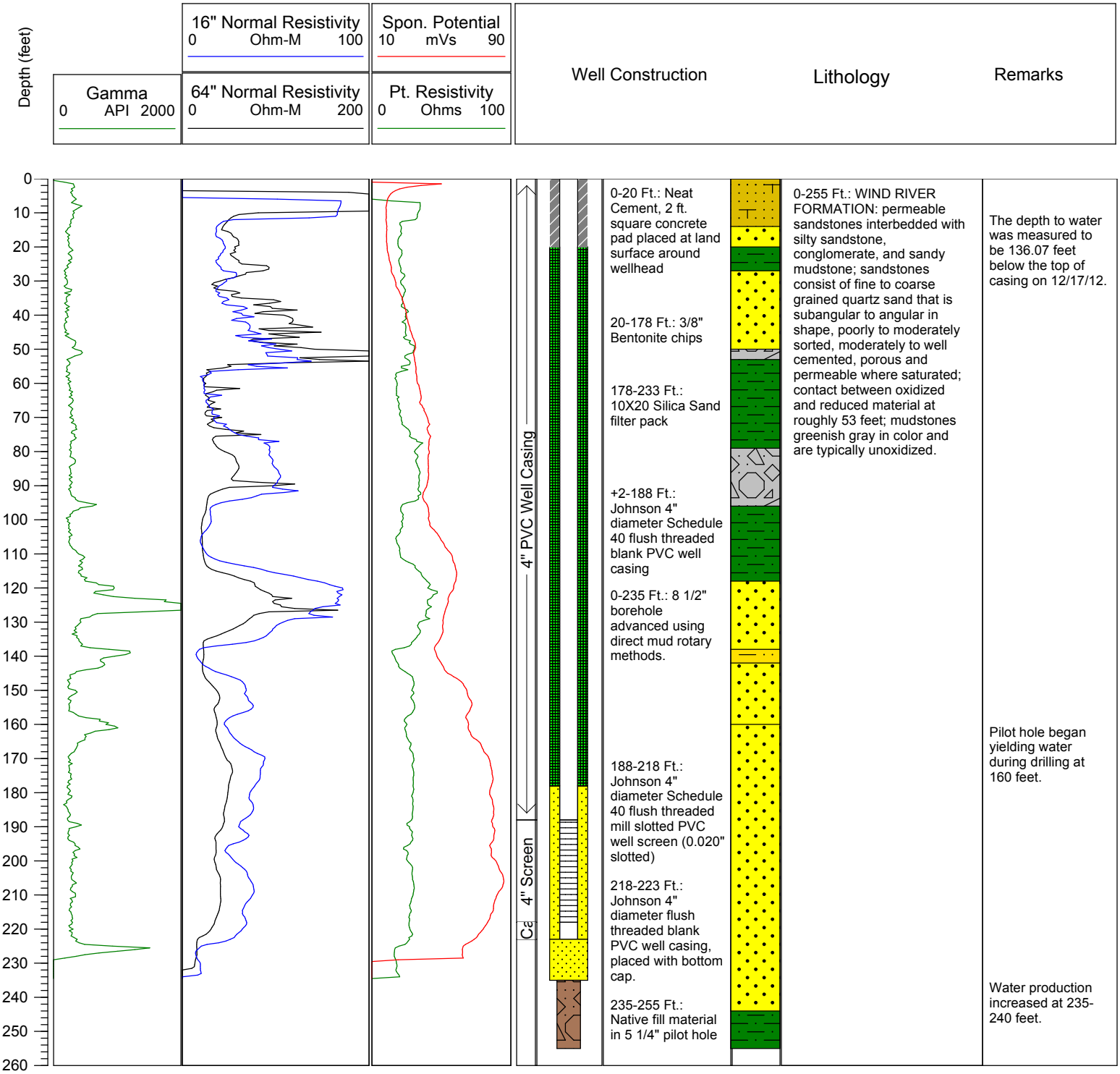


Shirley Basin – MW-650 Well after

Appendix B

Lidstone and Associates, Inc.

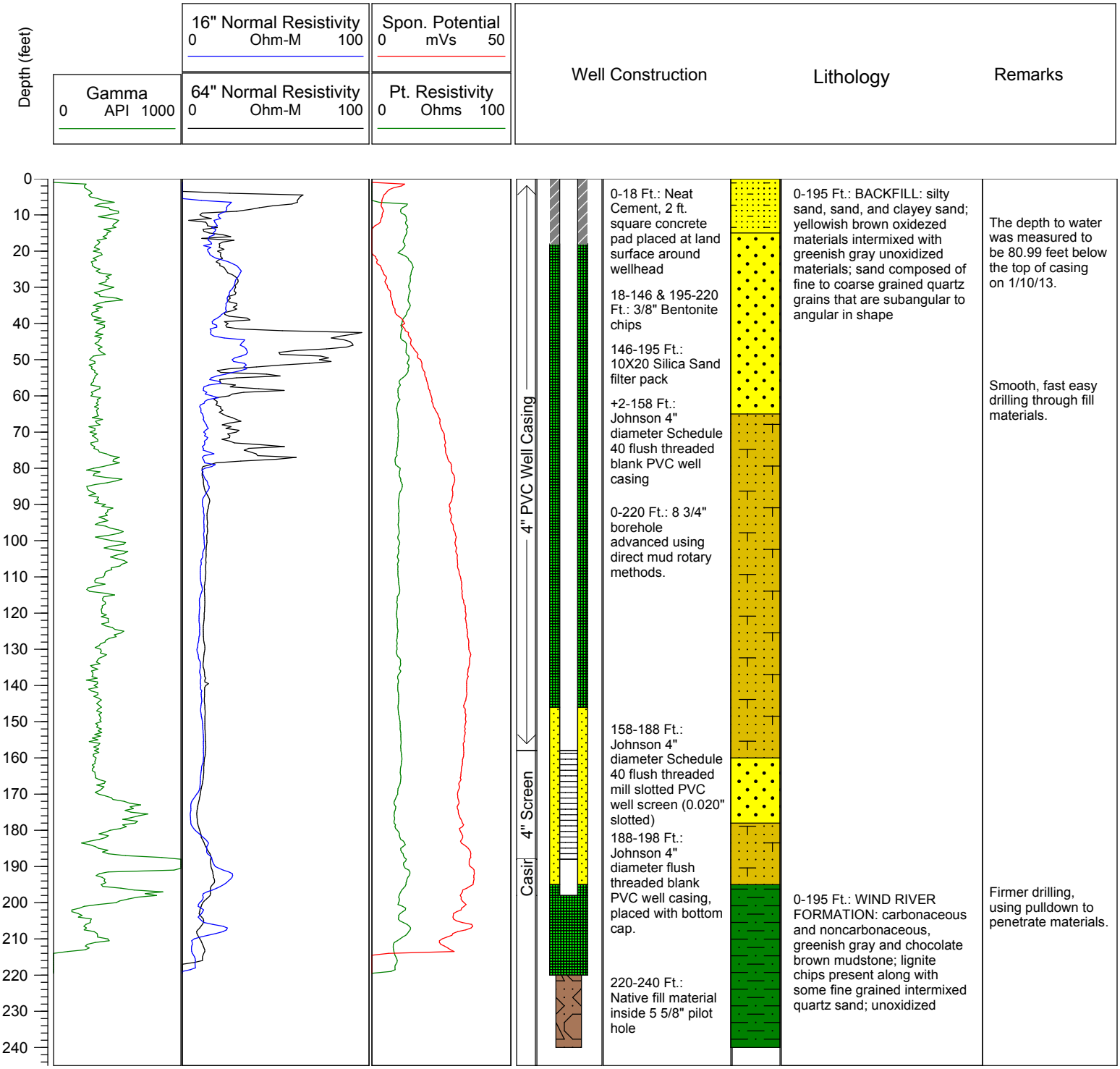
Project: WYOMING AML	Well Name: DL 11
Location: T32N, R91W, Sec. 14 SESE	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: J. Nielsen
Date started: December 10, 2012	Total depth: 223 Ft.
Date completed: December 12, 2012	Elev.: 6,600 Ft.



Notes: This figure presents the completion details for the DL 11 monitoring well. The well lies northwest of the reclaimed Clyde Pit at the former Day Loma Mine on BLM property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 2 hours. LA recorded airlifting discharge measurements of 20-21.6 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 8.01, temperature = 8.9C, and electrical conductivity = 1,530 uS.

Lidstone and Associates, Inc.

Project: WYOMING AML	Well Name: H&I 1
Location: T33N, R90W, Sec. 35 SWNE	Drilling Method: Direct Mud Rotary
Drilled by: Douglas Exploration	Logged by: M. Stacy
Date started: January 8, 2013	Total depth: 198 Ft.
Date completed: January 10, 2013	Elev.: 6,912 Ft.



Notes: This figure presents the completion details for the H&I 1 monitoring well. The well was completed in the backfill of the PMC 4-X Pit in the Central Gas Hills on UR Energy property. Douglas Exploration drilled the well in two passess utilizing direct mud rotary techniques for both the pilot and the reamed boreholes. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 2.5 hours. LA recorded airlifting discharge measurements of 2.2-2.5 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.80, temperature = 14.0C, and electrical conductivity = 3.27 mS.

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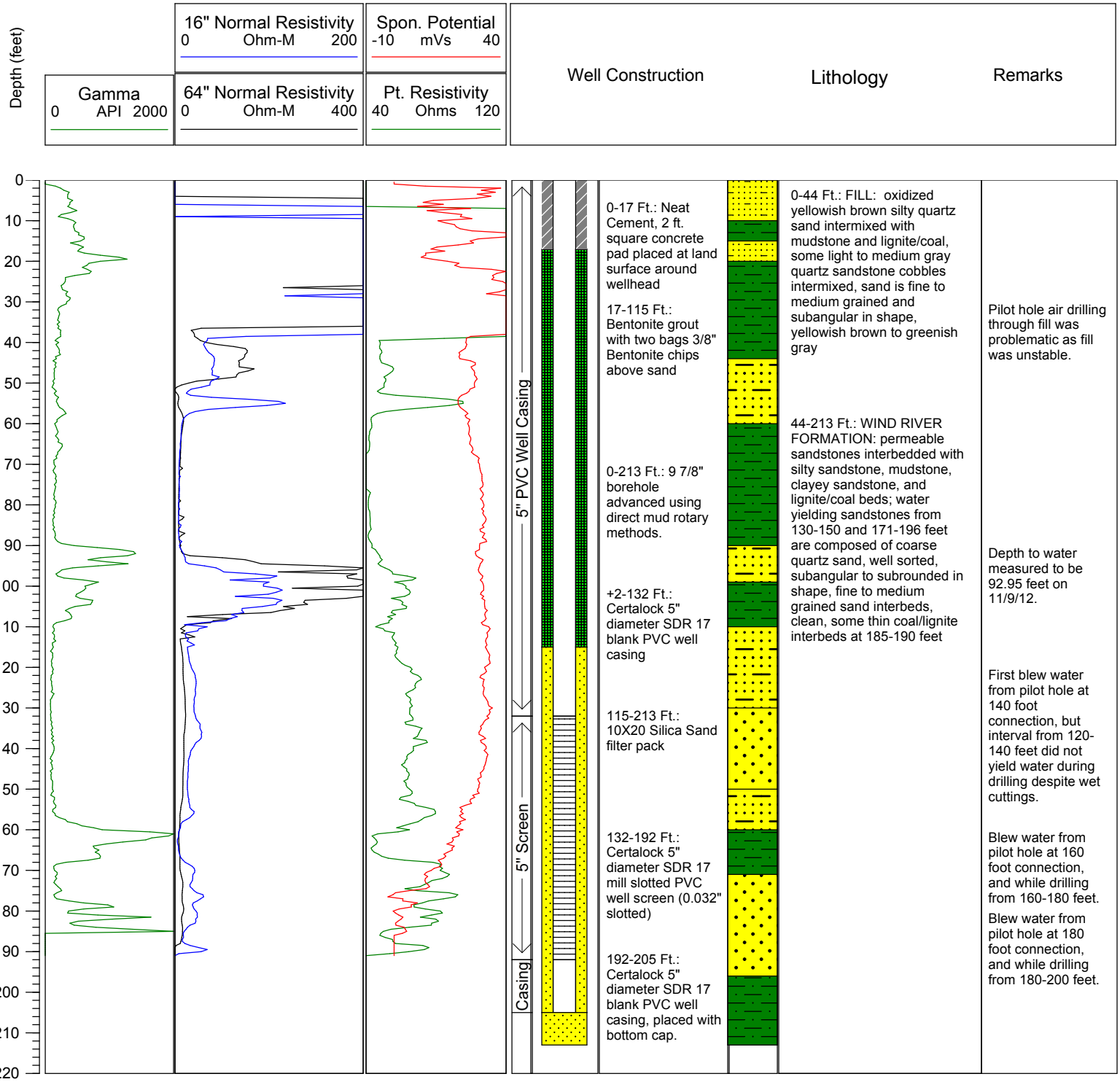
Project: WYOMING AML	Well Name: Jenkins 5
Location: T27N, R78W, Sec. 2 SWSW	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: M. Stacy
Date started: November 5, 2012	Total depth: 205 Ft.
Date completed: November 9, 2012	Elev.: 7,037 Ft.



Notes: This figure presents the completion details for the Jenkins 5 monitoring well, which was drilled under Wyoming State Engineer's Office Permit No. 198912. The well lies north of the Walker Jenkins Pit in the Shirley Basin on 7E Ranch property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and five inch diameter Certalock PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately two hours. LA recorded airlifting discharge measurements of 25-30 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.79, temperature = 9.6C, and electrical conductivity = 933 uS.

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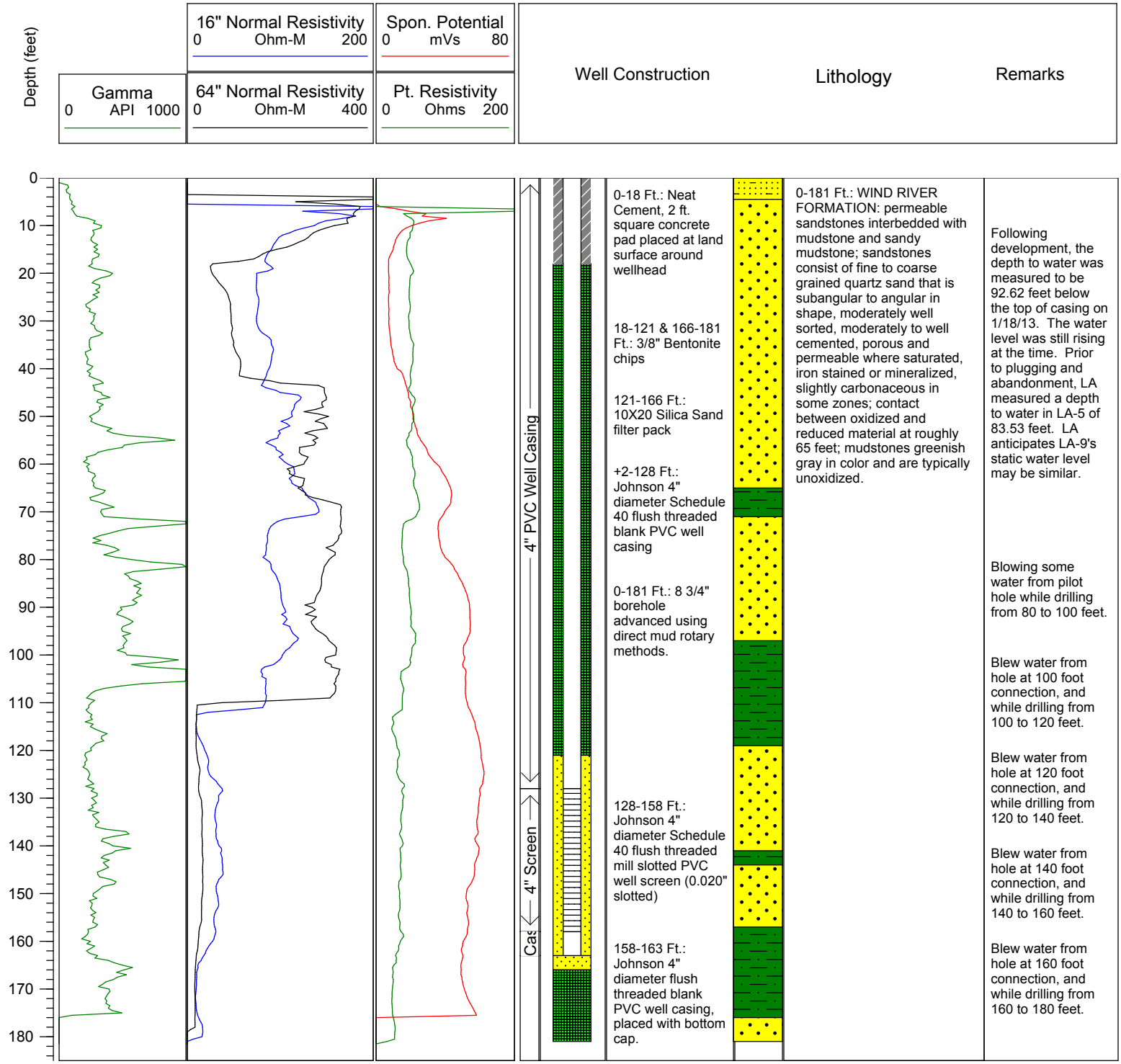
Project: WYOMING AML
Location: T33N, R89W, Sec. 22 NWNE
Drilled by: Douglas Exploration
Date started: January 16, 2013
Date completed: January 17, 2013

Well Name: LA-9
Drilling Method: Direct Air/Mud Rotary
Logged by: M. Stacy
Total depth: 163 Ft.
Elev.: 6,974 Ft.



Notes: This figure presents the completion details for the LA-9 monitoring well, which replaced the plugged and abandoned LA-5 monitoring well. The well lies immediately west of the backfilled A8 Pit in the East Gas Hills on BLM property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 2 hours. LA recorded airlifting discharge measurements of 3.4-4.5 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.49, temperature = 12.1C, and electrical conductivity = 2.92 mS.

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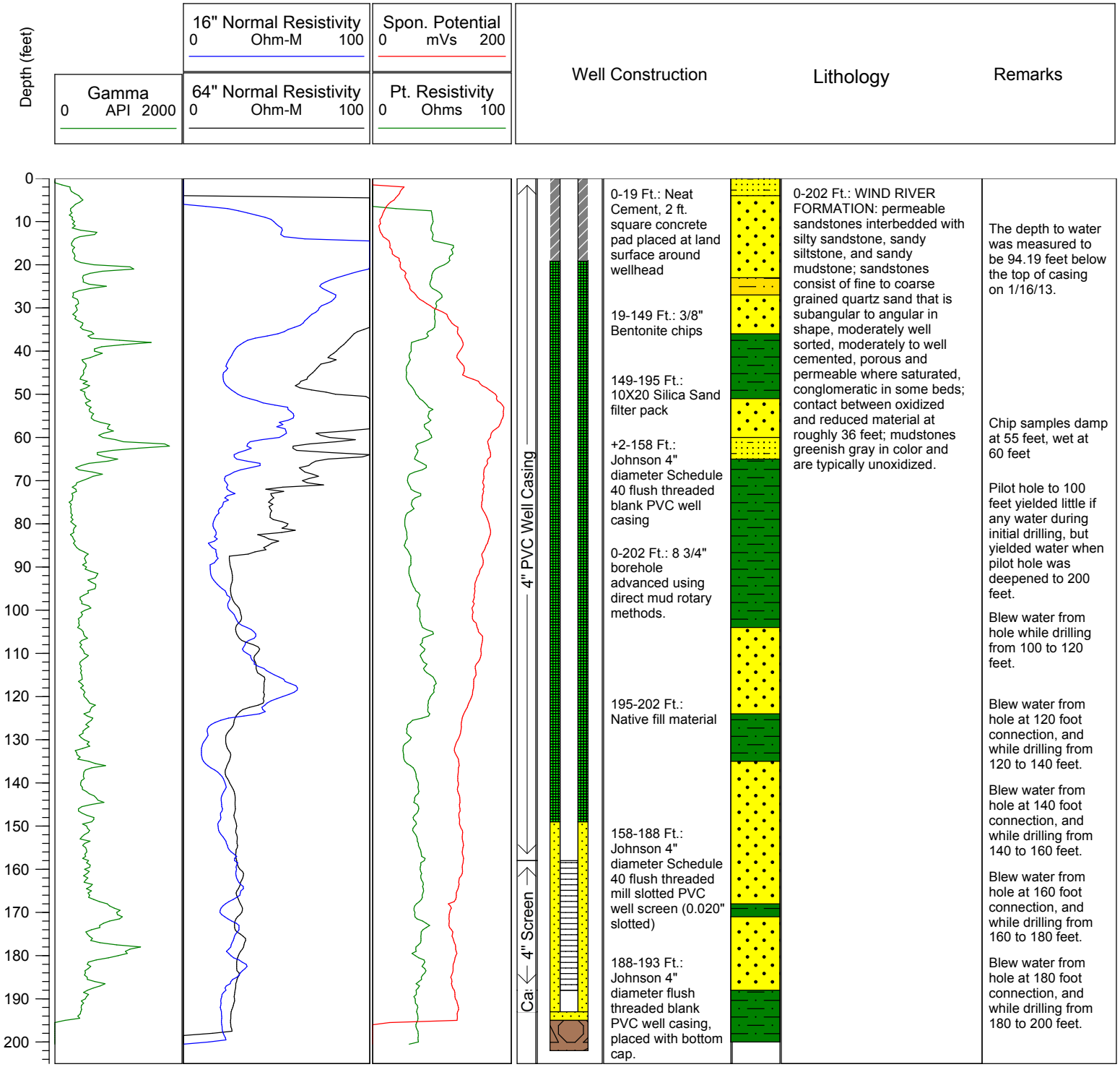
Project: WYOMING AML	Well Name: LA-10
Location: T33N, R89W, Sec. 22 NENW	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: M. Stacy
Date started: January 10, 2013	Total depth: 193 Ft.
Date completed: January 15, 2013	Elev.: 6,909 Ft.



Notes: This figure presents the completion details for the LA-10 monitoring well. The well lies immediately west of the backfilled C-18 Pit in the East Gas Hills on BLM property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 1.75 hours. LA recorded airlifting discharge measurements of 10.3-12.5 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.63, temperature = 8.0C, and electrical conductivity = 2.36 mS.

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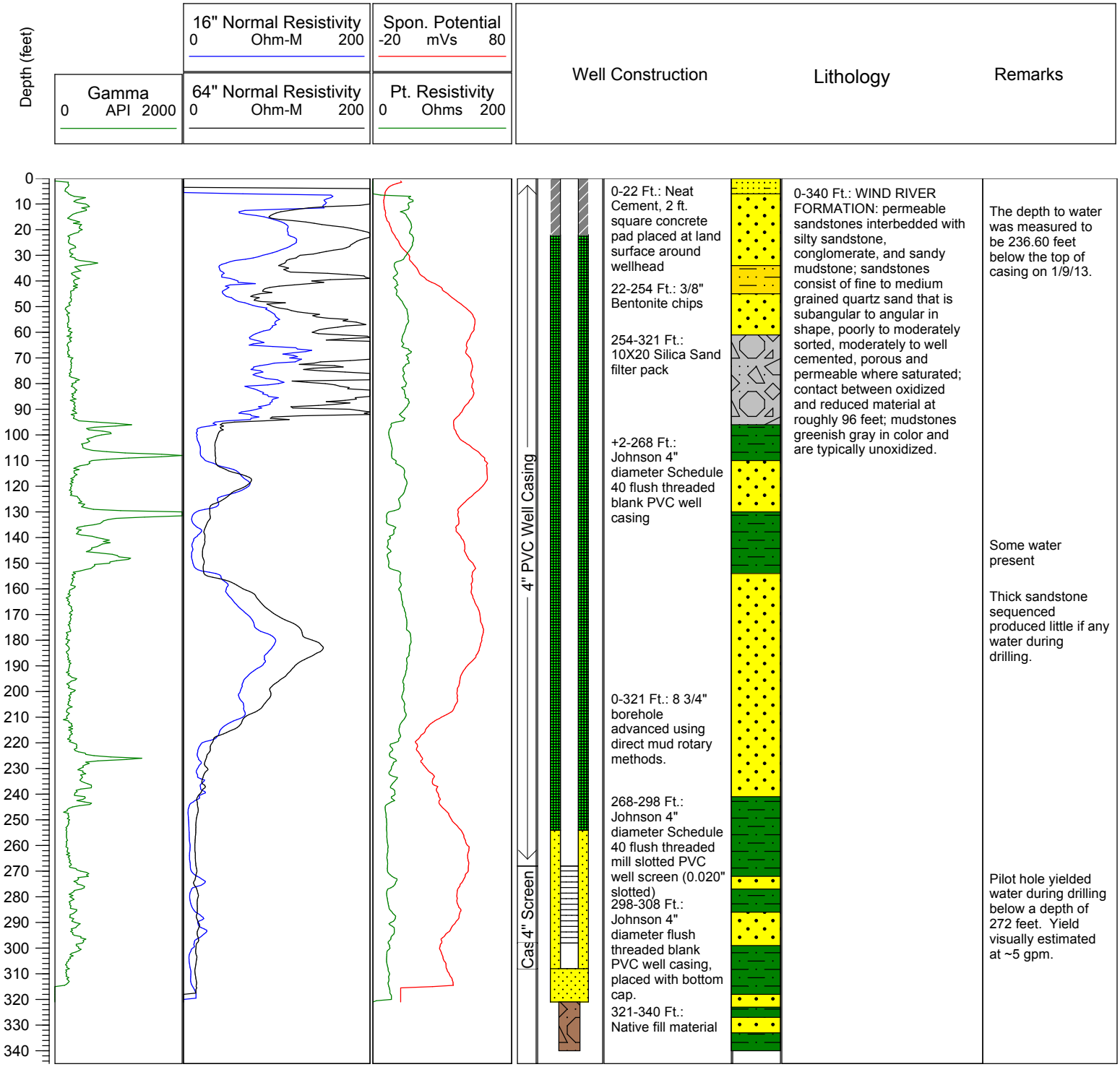
Project: WYOMING AML	Well Name: Sage 2
Location: T33N, R90W, Sec. 32 SESW	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: J. Nielsen
Date started: December 20, 2012	Total depth: 308 Ft.
Date completed: January 7, 2013	Elev.: 6,684 Ft.



Notes: This figure presents the completion details for the Sage 2 monitoring well. The well lies immediately south of the reclaimed D-9 Pit in the West Gas Hills on BLM property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 3.5 hours. LA recorded airlifting discharge measurements of 1.5-1.8 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 8.41, temperature = 19.9C, and electrical conductivity = 1,834 uS.

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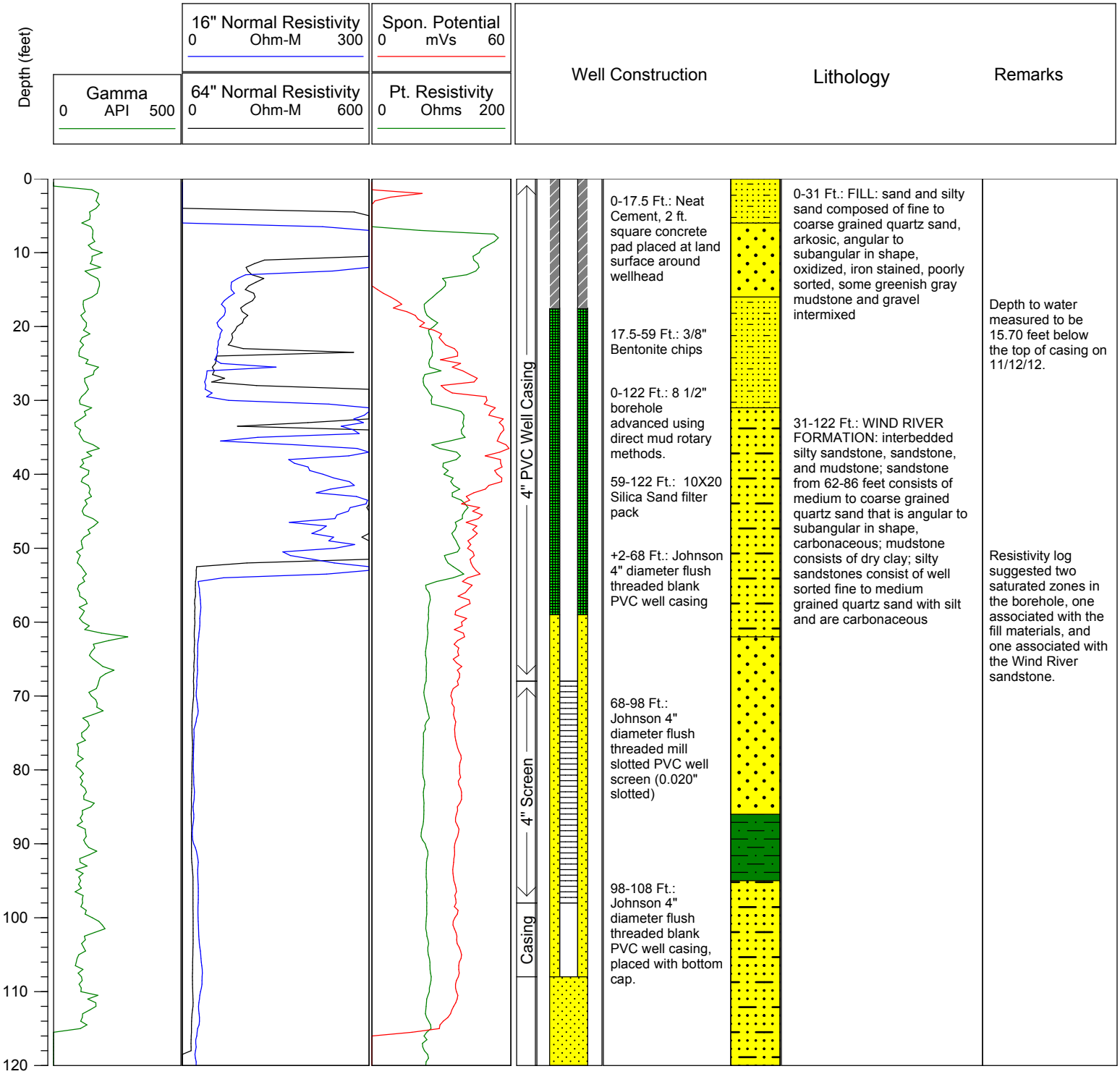
Project: WYOMING AML	Well Name: Sullivan 1
Location: T27N, R78W, Sec. 23 NWNW	Drilling Method: Direct Mud Rotary
Drilled by: Douglas Exploration	Logged by: M. Stacy
Date started: November 11, 2012	Total depth: 108 Ft.
Date completed: November 11, 2012	Elev.: 6,930 Ft.



Notes: This figure presents the completion details for the Sullivan 1 monitoring well. The well is located south of the Sullivan Pit in the Shirley Basin on Medicine Bow Energy Partners property. Douglas Exploration drilled the well in two passess utilizing direct mud rotary methods for both the pilot and reamed boreholes to minimize sloughing of the upper saturated fill materials. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately one hour. LA recorded airlifting discharge measurements of 20 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.68, temperature = 7.5C, and electrical conductivity = 918 uS. An initial 40 foot borehole drilled with direct air rotary methods approximately 20 feet east of this location was plugged and abandoned.

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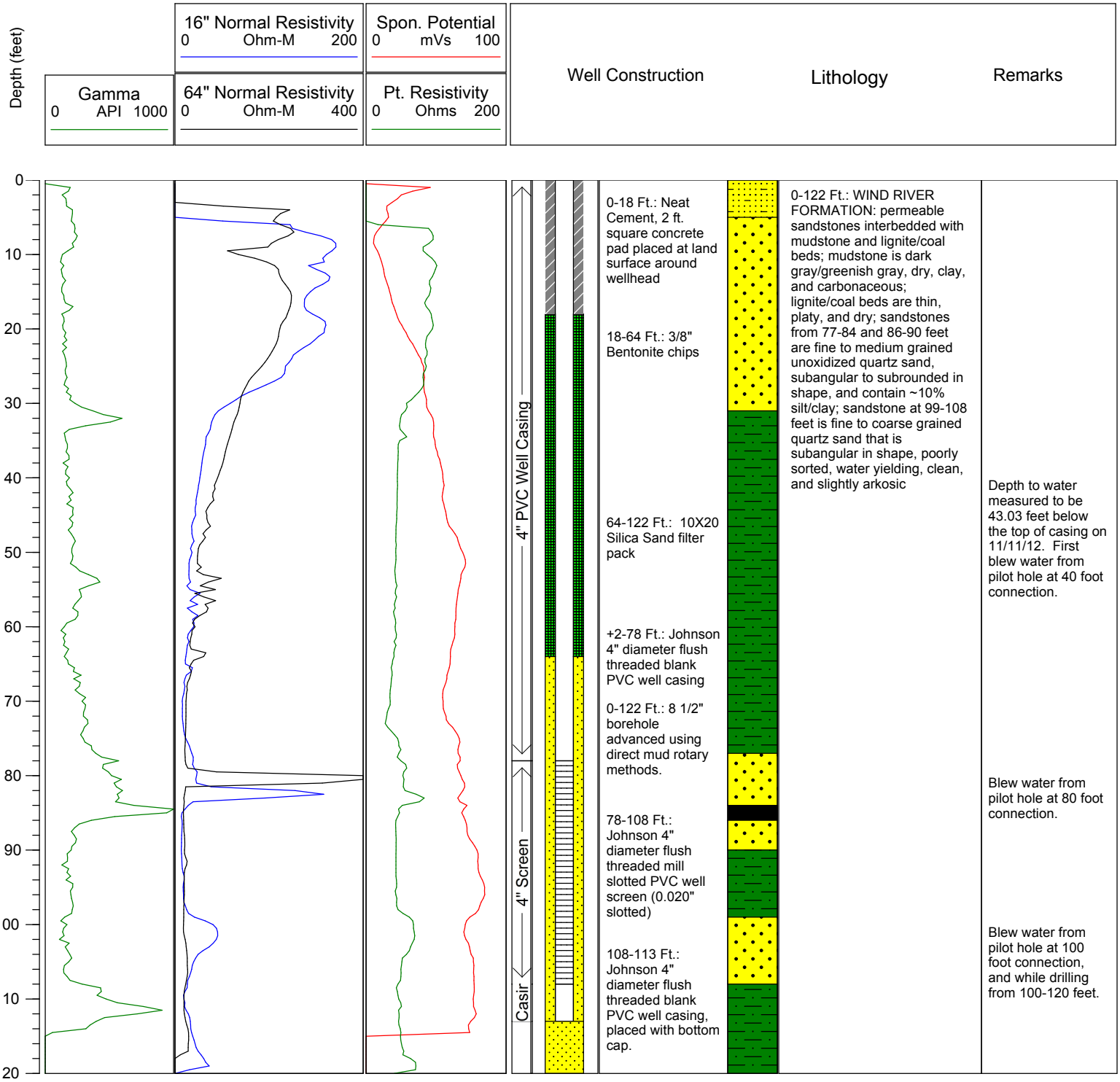
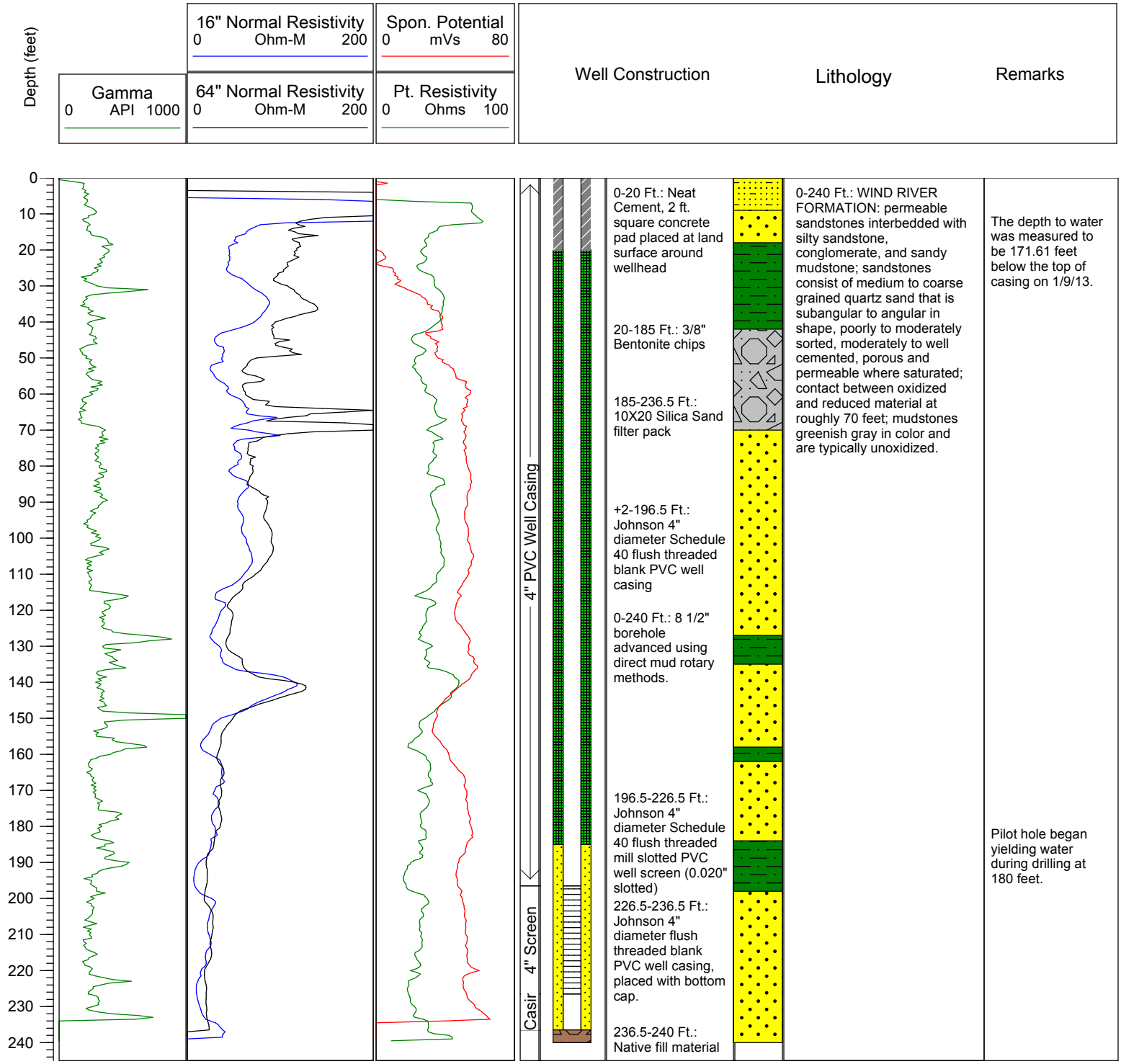
Project: WYOMING AML	Well Name: Sullivan 2
Location: T27N, R78W, Sec. 14 NWNW	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: M. Stacy
Date started: November 9, 2012	Total depth: 113 Ft.
Date completed: November 9, 2012	Elev.: 6,970 Ft.



Notes: This figure presents the completion details for the Sullivan 2 monitoring well. The well lies between the Walker Jenkins and Sullivan Pits in the Shirley Basin on Medicine Bow Energy Partners property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 1.5 hours. LA recorded airlifting discharge measurements of 20 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 7.92, temperature = 8.2C, and electrical conductivity = 1,429 uS.

Lidstone and Associates, Inc.

Project: WYOMING AML	Well Name: Sun 1
Location: T32N, R90W, Sec. 7 NWNW	Drilling Method: Direct Air/Mud Rotary
Drilled by: Douglas Exploration	Logged by: J. Nielsen
Date started: December 17, 2012	Total depth: 236.5 Ft.
Date completed: December 19, 2012	Elev.: 6,647 Ft.



Notes: This figure presents the completion details for the Sun 1 monitoring well. The well lies immediately south of the reclaimed Sunset Pit in the West Gas Hills on BLM property. Douglas Exploration drilled the well in two passess utilizing direct air rotary methods for the pilot hole and direct mud rotary techniques for the reamed borehole. Following geophysical logging and four inch diameter flush threaded PVC casing and screen installation, Douglas developed the well using airlifting and surging techniques. The well screens were developed for approximately 2.5 hours. LA recorded airlifting discharge measurements of 2.6-4.5 gallons per minute. Final water quality parameters upon completion of development included the following: pH = 8.21, temperature = 10.6C, and electrical conductivity = 1,654 uS.

Appendix C

Appendix C – Sampling and Analysis Plan

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Attachments

Attachment 1 Sample Field Data Sheet
Attachment 2 Sample Groundwater Sampling Form
Attachment 3 Sample Chain-of-Custody Form

1.0 Introduction

An effective surface water and groundwater sampling plan is necessary to ensure consistency throughout sampling as well as adequate Quality Assurance/Quality Control (QA/QC). This Sampling and Analysis Plan (SAP) provides instructions for surface water and groundwater sampling techniques, sample preservation, documentation, and QA/QC protocols. The information in this SAP is consistent with guidance provided in Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) Guideline 8, the U.S. Environmental Protection Agency, and U.S. Geological Survey.

2.0 Water Sampling Locations

Surface water and groundwater will be collected from the site locations listed in **Tables 1 through 5** of the Monitoring Report. The majority of the surface water sampling sites are impoundments, but there are several stream sites as well. Groundwater samples will be collected from the specified monitoring wells.

3.0 Sampling Equipment

- Maps.
- 1-gallon Ziploc bags.
- Cooler(s).
- Nitrile gloves.
- Hand-held GPS.
- Deionized water.
- Paper towels.
- Camera.
- Tape measure.
- Logbook or field sheet (see **Attachment 1** for an example surface water sampling sheet and **Attachment 2** for an example groundwater sampling sheet).
- Chain-of-Custody records and custody seals (see **Attachment 3** for an example Chain-of-Custody form).
- Appropriate personal protection equipment (PPE), including safety glasses, hard hat, safety shoes, and latex or nitrile gloves.
- Sampling containers.
- Sample bottles/preservatives/labels (provided by the laboratory).
- Ice.
- Multi-parameter meter or multiple probes/instruments to measure field parameters. Typically, the water quality field indicator parameters monitored are pH, specific conductance, turbidity, and temperature. Calibration fluids for all field instruments will be National Institute of Standards and Technology traceable and will meet the manufacturer's shelf life criteria; equipment calibration will be performed on at least a daily basis in accordance with the manufacturers' instructions.

- Filter if needed. Water samples will be filtered in the field if the sample hold time is greater than 48 hours. A 0.45 micron in-line disposable filter is needed if sampling for dissolved concentrations and a nominal 1 micron filter is needed if sampling for suspended concentrations.

3.1 Specific for Surface Water Sampling

- Waterproof wading boots.
- Shovel and sheeting to allow diversion of flow into sampling containers.
- Parshall flume or current meter.

3.2 Specific for Groundwater Sampling

- Water level measuring device. An electron water level indicator capable of measuring to 0.01 foot.
- Weighted steel tape to measure the total depth of the well to 0.01 foot (lead should not be used for weight).
- Sampling pump. Submersible pumps will be used to sample all monitor wells. Pumps will be capable of delivering variable controlled flow rates.
- Power source. If a gasoline or diesel powered generator is used, it must be located downwind of the well to be monitored.
- Flow measuring equipment. A calibrated bucket or drum and a stopwatch or a flow meter that can be disconnected prior to sampling.

4.0 Sampling Procedures

4.1 Pre-Sampling Activities

- Review information pertaining to the sampling locations, including previous sampling records, site drawings, well completion diagrams, drilling logs etc.
- Evaluating what information will be collected during the sampling event and what analyses will be required.
- Obtaining appropriate sample containers and preservatives from the laboratory prior to starting the sampling event.

4.2 Sampling Procedures

- Use appropriate PPE.
- Photo document sites.
- Record GPS coordinates for sampling sites.
- Record sample site identification in the logbook and/or surface water or groundwater field sheet.

4.2.1 Specific Procedures for Surface Water Sampling

All surface water samples will be collected manually as grab samples. Samples will either be collected with a sampling container and then transferred to a sample bottle or will be collected directly into a sample bottle. When possible, stream samples will be collected from the middle of the stream at mid-depth. Sampling will always occur upstream of the sampler and care will be taken to prevent stirred up

sediments from contaminating the water sample. When possible, impoundments will be sampled off-shore at a depth of about 6 inches. Specific procedures are outlined below.

- Flush all sampling equipment prior to sampling with water to be sampled. For example if plastic sheeting is used to divert flow into sampling container, this sheeting should be thoroughly flushed with water from spring, impoundment or stream.
- Estimate discharge for all flowing water. When a staff gage is unavailable, a flow meter or Parshall flume can be used to measure flow. The flow velocity can also be estimated by measuring the time required for a floatable object to travel a measured reach of the stream.
- Record discharge flow and method of measurement in the logbook or on the surface water field sheet (**Attachment 1)**.
- If an impoundment is present, record estimated depth and approximate spatial area. Take notes and photos to estimate if the impoundment water has recently flushed through the system or if water is in an evaporative basin.
- Sampling procedures specific to grab samples from drainages and impoundments are as follows:
    - Access the sampling location by appropriate means.
    - Obtain field parameters (pH, EC, Turbidity and Temp). Document results in logbook or on the SW field data sheet (**Attachment 1**). Decontaminate the probes with deionized water prior to taking the first sample and between samples.
    - Use a sample collection container or an unpreserved sample bottle to collect the sample (a Pyrex or polyethylene measuring cup can be used as a sample collection container).
    - Prior to collecting the sample, rinse the sample collector with stream/spring/ impoundment water.
    - For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream.
    - For deeper water sampling stations, slowly submerge the sample container, opening first, into the water. Invert the container so that the opening is upright and pointing towards the direction of water flow (if applicable). Allow water to slowly run into the container.
    - The sample container must be upstream of the sampler if applicable.
    - Avoid disturbing the substrate as this may cause contamination of the sample due to sediments getting into the sample.
    - Return the filled container quickly to the surface.
    - Filter the sample if the hold time is greater than 48 hours, or as needed.
    - Pour out a small volume of sample away from and downstream of the sampling point. This will allow for the addition of preservatives and sample expansion.
    - Add preservatives, if required, securely cap the sample container, label and complete field notes.
    - If preservatives have been added, invert the capped container several times to ensure sufficient mixing of sample and preservatives.

4.2.2 Specific Procedures for Groundwater Sampling

Upon arrival, visually inspect each site and well condition. Check that well caps are in place and not damaged. Check the well casing and concrete pads for the presence of cracks or fissures that could compromise the integrity of the surface completion. Additionally inspect each well for damage due to vandalism, animals and/or heavy equipment operations. Any apparent well damage or conditions that may allow surface runoff into the well or well annulus should be photographed, noted on the field sheet/logbook (**Attachment 2**) and reported to Management so that repair/replacement of the well can be performed as soon as possible.

Purging and Sampling Procedures

Well Depth/Static Water Level Measurement

Each well should have a permanent, easily identified reference point from which all depth measurements are taken (usually a V-cut or indelible mark at the top of the well casing). The elevation of the reference point should be surveyed. All measurements must be taken from the established reference point. Total well depth measurements allow the calculation of the volume of standing water in the well and documentation of the amount of siltation that may have formed at the bottom of the well. These measurements are made at each sampling event during baseline sampling. During operations, the calculated volume may vary, depending on sediment conditions in each well and the measured static water level. Measurements should be to the nearest 0.01 foot and are usually made with a weighted tape. Measurements are made before sampling in a manner that will avoid increased turbidity caused by sediment at the bottom of the well being disturbed during the measurement process. Lead should not be used as weight. Static water level measurements are made in each well prior to each purging and sampling event. Measurements are made from the reference point using an electronic water level indicator. Measurements should be to the nearest 0.01 foot. Care must be taken to minimize water column disturbance.

Static Water Volume

Based on the information collected for casing diameter, total well depth and static water level, the volume of standing water in the well can be calculated using the following calculation:

$$V \text{ (gallons)} = ((\pi \bullet (D/2)^2 \bullet H)) \bullet 7.48$$

Where:

π = approximately 3.1416;
D = inside diameter of well casing in feet;
H = height of water column in the well in feet; and
7.48 = gallons per cubic foot

This value can then be used to determine the purge volume to be evacuated from the well prior to sampling. The following table provides volumes per foot of casing for common casing diameters.

Typical Well Casing Volumes

Nominal Casing Diameter (inches)	Casing Volume (gallons per foot)
4	0.65
5	1.02
6	1.46

Purging/Sampling

In a well that is not being continuously pumped, there will be little or no vertical mixing in the water column, and stratification may occur. The water within the screen may mix with fresh ground water, but the water above the screen will remain isolated and become stagnant, resulting in unrepresentative water quality.

To begin the purging and sampling process, slowly lower the pump into the well to avoid disturbing the water column. The pump intake should be set as near as possible at the midpoint of the zone to be sampled. The intake should be at least 2 feet above the bottom of the well to minimize particulate mobilization. Record the depth of the pumping intake on the field sheet.

Before starting the pump, re-measure and record the water level, or, if a pressure transducer is being used, initialize the starting condition.

Begin purge pumping at the lowest possible flow rate and slowly increase the rate until discharge appears at the surface. Check the water level and adjust the pump speed until there is little or no drawdown. Purging should not cause substantial drawdown when pumping at a rate of at least 1 gallon per minute. The water level should remain above the top of the screened interval during purging and sampling. Check the discharge rate of the pump using the flow meter or bucket and stopwatch. Record both the flow rate and water level on the field sheet. Continue purging. Monitor and record the water level and pumping rate every three to five minutes during purging. Record any pump rate adjustments. The pumping rate should be the minimum required to ensure stabilization of indicator parameters with minimal drawdown.

After the water level has stabilized, a minimum of one calculated well volume must be purged prior to initiating measurement of indicator parameters. Monitor and record the field parameter values at three to five minute intervals during purging. Purging is considered complete and sampling may begin when all field parameters have stabilized. Stabilization is considered achieved when three consecutive readings, taken at three to five minute intervals are within the following stabilization limits.

Ground Water Field Stabilization Criteria

Parameter	Stabilizaton Criteria
Temperature	±3% degrees C
pH	±0.1 pH unit
Electrical Conductance	13% S/cm

Maintain the sampling pumping rate at or slightly less than the purging rate to minimize disturbance of the water column.

If samples are collected for dissolved gases, the pump tubing needs to be completely full of water to prevent aeration as it flows through the tubing. Typically, samples for gas sensitive parameters should be collected first. These may include alkalinity and ferrous iron. The sampling sequence for most inorganic constituents does not matter unless filtered samples are being collected, since they must be

collected last using in-line filters. All sample bottles should be filled with minimal turbulence by allowing the water to gently flow down the inside of the container. If the water is turbid (i.e., greater than 10 NTUs), a filtered sample for dissolved metals should also be collected.

For filtered (dissolved species) samples, place an in-line filter at the end of the discharge line and collect the sample after the filter. The filter should be rinsed in accordance with the manufacturer's recommendations or, with a minimum of 0.5 to 1 liter of ground water prior to sampling.

Samples should be placed into a cooler with ice to maintain sample temperature at 4°C. Samples must arrive at the laboratory within prescribed sample holding times (overnight delivery is preferable).

After sampling of the well has been completed, the pump may either be dedicated to the well for resampling or removed and decontaminated for use in another well.

4.3 Sample Containers and Preservation

- Place samples in a cooler with ice to maintain the sample temperature at 4°C.
- Label the sample containers for identification purposes. The label should include Site ID, date and time of sample collection, preservatives used, and the name of the sampler.
- Complete a Chain-of-Custody that will accompany the samples (**Attachment 3**).
- Transport the samples to the contract laboratory within the required sample holding times (normally within 48 hours of sample collection if unpreserved).

5.0 Sample Analysis

Laboratory analyses will be consistent with the old DEQ/LQD Guideline No. 8 list of constituents (**Appendix B** of the Monitoring Report) as well as Gross Alpha. Formal QA/QC protocols will be followed for sampling, preservation, and analyses.

5.1 Sampling Quality Assurance/Quality Control

To detect any potential data errors that may result from improper sampling or analytical methods, poor sample preservation, or collection from non-representative samples, the following quality measures will be implemented when applicable:

- QC samples are required to verify that the sample collection and handling process has not compromised the quality of the water samples. All field QC samples will be collected and prepared in the same manner as the regular samples with regard to sample volume, containers and preservation. Following are the field QC samples to be collected during each sampling event:
  - Field Duplicates – These samples are collected at randomly selected locations to evaluate sampling procedure precision. One duplicate sample will be collected per sampling event or one per 20 samples, whichever is more.
  - Sample Preservation Blanks – The same quantity of appropriate preservative is added to sample bottles filled with distilled water. These blanks check for analytical recognition of zero values, any positive bias from contaminated sample bottles or preservatives, and any contamination from atmospheric sources, such as airborne dust.

- Temperature Blank – This blank consists of a bottle filled with deionized water and is checked by the laboratory upon receipt of the samples to ensure that the temperature of the samples has been maintained at 4°C.

- Analytical data for each site sampled will be checked against previous data for consistency and precision.
- Field parameter measurement instruments for water samples will be calibrated daily.
- For water samples that are to be sent to an offsite contract laboratory, the contract laboratory will be consulted to determine proper preservation techniques.
- All water samples will be properly preserved and cooled to 4°C prior to shipment to the laboratory, and will be shipped to ensure delivery to the laboratory within the shortest holding time, normally 24-48 hours after sampling.
- Chain-of-Custody forms will be filled out and signed by the sampler and will accompany every sample or set of samples to the offsite laboratory (see Section 5.2).
- Within two days of the time the water samples are shipped, sampling personnel should call the laboratory to verify that the samples have been received within the specified holding time.

5.2 Chain-of-Custody

After sampling is completed, appropriate Chain-of-Custody procedures will be implemented to protect sample integrity and to provide technically and legally defensible water and sediment quality data. For each sampling event, a Chain-of-Custody must be completed (**Attachment 3**), inserted into a sealable plastic bag, and placed inside the cooler with the samples. The completed Chain-of-Custody form will accompany the samples at every step from the field to the laboratory and will be signed by the sampler and the laboratory upon receipt. Coolers should be sealed with signed and dated custody seals and tamper-resistant tape. Chain-of-Custody forms, sample labels, and custody seals are typically provided by the contract laboratory.

5.3 Laboratory QA/QC

The contract laboratory will be certified by the National Environmental Laboratory Accreditation Program (NELAP), or an equivalent laboratory accreditation program. The laboratory's quality control procedures will be outlined in their QA/QC manual which may be provided with the water quality data, if requested. Laboratory QA/QC data are typically provided with each set of sample analysis data. Routine laboratory procedures typically follow NELAP, or equivalent accreditation program requirements.

6.0 References

U.S. Environmental Protection Agency, 1994, Surface Water Sampling SOP# 2013.

U.S. Geological Survey, 2006, National Field Manual for the Collection of Water-Quality Data, TWRI Book 9-Collection of Water Samples, Version 2.0, Chapter A4, pp 159.

Attachment 1 - Sample Field Data Sheet

Spring/Surface Water Sampling Field Data Sheet							
Location:							
Sample Retrieval	Time:			Date:			
Sampled By:							
FIELD PARAMETERS							
pH:			Temperature:				
Specific Conductance:			DO:				
Turbidity:			Other (specify):				
Discharge (units and method of measurement):			Other (specify):				
STREAMS (circle all that apply)							
Location	Wading	Bank	Station Gage: at / above / below				
	Bridge: upstream / downstream		Side Bridge ____ ft/mile		Boat	Ice	
	Other (specify):						
Sampling Site	Pool	Riffle	Open	Braided	Backwater		
	Sample Type:						
Bottom	Bedrock	Rock	Cobble	Gravel	Sand	Mud	Concrete
Stage Conditions	Not Determined		Stable: normal / low / high				
	Falling	Rising	Peak	Other (specify):			
Hydraulic Event	Routine Sampling		Regular Flow				
	Snowmelt	Flood	Drought	Spill			
	Ice Cover: Thickness _____ inches			Other (specify):			
Stream Color	Brown	Clear	Green	Blue	Gray		
	Other (specify):						
Stream Mixing/Flow Type: Turbulent / Laminar / Stagnant		Excellent	Good	Fair	Poor		
SPRINGS (circle all that apply)							
Sampling Site	Pool	Riffle	Braided	Backwater			
Bottom	Bedrock	Rock	Cobble	Gravel	Sand	Mud	
Stage Conditions	Not Determined		Stable: normal / low / high				
Stream Color(s)	Brown	Clear	Green	Blue	Gray		
	Other (specify):						
Spring Water Mixing and Sample Location Distance from Source		Excellent	Good	Fair	Poor		

Notes:

SAMPLE

Attachment 2 - Sample Groundwater Sampling Form

Groundwater Field Sampling Sheet

Client _____ Sampling Date _____

Well No. _____ Casing Type/Dia. _____

Static Water Level _____ Pump Depth _____

Total Well Depth _____ Well Volume _____

Type of Analysis _____ Sample Handling _____

Time	Pumping Rate (GPM)	pH (±0.1)	Temp (˚C) (±1˚)	Conductivity (±3%)	Depth to Water (ft)	Comments

Total Minutes Pumped _____

Total Gallons Pumped _____

Time Sampled _____

SAMPLE

Attachment 3 - Sample Chain-of-Custody Form

Project Name and Project Number					Number of Containers	Type of Analysis Requested						Company Name and Address	Tel: Fax: Email:
Location													
Date	Time	Composite	Grab Sample	Send Invoice to: Send Report to: Sample I.D.:								Sampled by: Turn Around Time: Comments:	

Relinquished by:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:
Relinquished by:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:
Relinquished by:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:

WERE SAMPLES RECEIVED IN GOOD CONDITION?	Remarks:

SAMPLE