## ALBANY COUNTY SEPTIC SYSTEM IMPACT ANALYSIS

Prepared for:

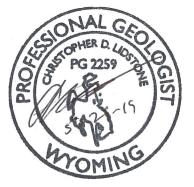
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and

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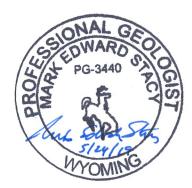
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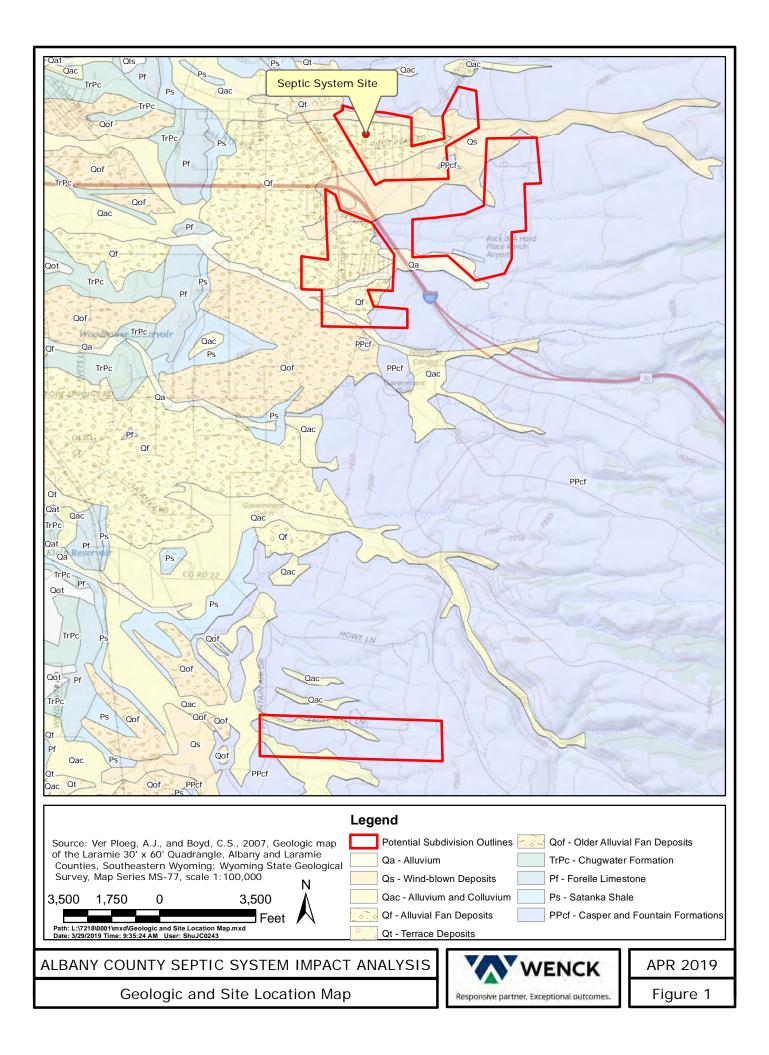
Nitrogen exists in many other forms in our environment and changes forms as it moves through the nitrogen cycle. The main source of nitrogen in soils is from plant and animal residues but is also introduced through septic systems. When changed into nitrate, a nitrogen/oxygen ion becomes an important plant food. Nitrate is highly leachable and under certain circumstances will be leached below the plant-root zone and may reach groundwater. Although nitrogen is an essential component of protein in our bodies, excessive concentrations of nitrate in drinking water can be hazardous to health, for infants and pregnant women. The U.S. Environmental Protection Agency (EPA) has determined that levels of nitrate in drinking water should not exceed 10 parts per million or milligrams per liter (mg/L).

The principal health concern with nitrate is methemoglobinemia, sometimes referred to as "blue baby syndrome." This occurs when bacteria in the digestive system transforms nitrate to nitrite. The nitrite oxidizes iron in the hemoglobin of red blood cells to form methemoglobin, which lacks the oxygen-carrying ability of hemoglobin. The transformation of nitrate to nitrite is more likely to occur when the pH level in the digestive tract is high (low acidity), allowing bacteria levels to rise. This condition typically affects infants under six months of age because the digestive system has an underdeveloped capability to secrete gastric acid, and the bacteria count in the digestive system may rise. The condition may also be of concern for anyone with a gastrointestinal condition producing high pH or an impaired enzyme system for metabolizing methemoglobin back to hemoglobin (American Ground Water Trust, 2019).

The purpose of this report is to present the approach and results of the Septic System Impact Analysis that has been performed in the Casper Aquifer Protection Area (CAPA) for Albany County east of Laramie, Wyoming. Albany County initiated this study due to potential contamination of the Casper Aquifer from septic systems, particularly nitrate. The Casper Aquifer consists of saturated portions of the Casper Formation that crops out east of Laramie. The vadose zone consists of the unsaturated sediments and rock that overlie the aquifer. To assess the water quality conditions beneath one septic system, Wenck Associates (Wenck) installed a vadose zone monitoring network to monitor septic leach field denitrification over Casper Formation outcrop.

While analysis of several septic systems would have been preferred for this evaluation, funding for this project only allowed the completion and evaluation of one septic system within the CAPA. To that end, this investigation relied on the willingness of an existing landowner to allow monitoring of their septic system. Wenck collaborated with Albany County to identify a landowner willing to allow the installation and monitoring of this system. As shown on **Figure 1**, the monitored system is located southeast of Laramie within the Sherman Hills Estates subdivision. This was one of the subdivisions that had been identified as potentially suitable for the study. This investigation was completed in accordance with the work plan that was submitted to the Wyoming Department of Environmental Quality (DEQ) Water Quality Division in January 2018. That work plan is included as **Appendix A**.





## Site Hydrogeology

The Casper Aquifer consists of saturated portions of the Casper Formation along the western margin of the Laramie Range east of the City of Laramie. This aquifer provides high quality drinking water to the City of Laramie. While its saturated thickness varies, the Casper Formation includes up to 800 feet of interbedded sandstone and limestone with minor siltstone and shale (Ver Ploeg and Boyd, 2007). In this portion of Albany County, the formation is made up of approximately 85% sandstone, with the remainder being composed of limestone. Groundwater is primarily stored and transmitted through the intergranular permeability of the sandstone. Various fractures and faults that cut through the sandstone and limestone sequence hydraulically connect the different rock types with the Casper Aquifer (WWC, 2006). The local geology of the Casper Formation is shown relative to the rural subdivisions southeast of Laramie on **Figure 1**.

The Casper Formation is recharged through its outcrop area shown on the east half of **Figure 1** and yields groundwater to local domestic and public supply wells. Its outcrop extends from the Wyoming state line on the south to Wyoming Highway 34 on the north, and dips about 3 to 5 degrees west into the Laramie Basin. The aquifer is principally recharged through snowmelt runoff over outcrop areas in March and April (WWC, 2015), and may receive some component of recharge from the underlying Precambrian Granite along fractures. Recharge due to these runoff events typically occurs within days to weeks indicating rapid movement through the unsaturated zone. Groundwater production from the Casper Aquifer is generally limited to 5 to 50 gallons per minute where intergranular permeability is predominant but ranges up to 2,000 gallons per minute where aquifer permeability has been enhanced by geologic structures, faults, fractures, and bedding surfaces. It is this high capacity production that renders the aquifer suitable for use by the City of Laramie at its Turner, Pope, and Soldier Springs wellfields (WWC, 2006).

As shown on **Figure 1**, the Casper Aquifer is confined by several formations as it dips westward into the Laramie Basin. These geologic formations in ascending stratigraphic order are the Satanka Shale, Forelle Limestone, and the Chugwater Formation. As a result, the Casper Aquifer responds as an unconfined aquifer through its recharge area, semi-confined where the confining units first appear, and confined where overlain by these geologic formations. Groundwater generally flows from the recharge area on the east in a westward direction into the Laramie Basin (WWC, 2006). In the vicinity of the Laramie Plains subdivision, the Satanka Shale is present and overlies the Casper. At the Sherman Hills Estates and the monitored septic system site, the Casper Formation is directly overlain by a veneer of alluvial fan deposits and soil. According to Ver Ploeg and Boyd (2007), these deposits range from 0 to 25 feet thick.

#### **Nitrates in Groundwater**

Recent water quality testing near the Turner Wellfield and East Grand subdivisions has indicated the presence of high nitrate groundwater in upgradient areas of the Casper Aquifer (WWC, 2015). Water quality data collected annually at the City of Laramie municipal wellfields since the early 1970s indicate background nitrate levels in the aquifer of 2 mg/L. Although nitrate concentrations at the wells appear stable, nitrate concentrations in upgradient areas to the east suggest the Casper Aquifer has been affected by local septic system use. In 2009, 29% of the wells sampled in the East Grand area had nitrate-nitrogen levels greater than 5 mg/L, and three of the wells had results above the 10 mg/L drinking



water standard (City of Laramie, 2009). In 2015, nitrate concentrations at some residences near Sherman Hills Estates subdivision were found to range from 7 to 9.4 mg/L (WWC, 2015). The elevated nitrate concentrations have been attributed to the high density of septic systems (City of Laramie, 2009). Groundwater generally flows to the northwest through these areas, toward City Springs, and is unobstructed by the Sherman Hills Fault Zone. Nitrate concentrations in the downgradient City's Turner Wells remain at approximately 2 mg/L but could potentially be impacted in the future.

#### **Project Objectives**

Because of the Casper Aquifer's vital role in providing water to Albany County and the City of Laramie, Wenck understands the importance of protecting the aquifer for current and future generations. The CAPA is particularly susceptible to contamination from septic systems due to the permeability characteristics of the aquifer, exposure of the Casper Formation at land surface, and thin soil cover as the formation dips westward toward the Laramie Basin.

The purpose of this study has been to evaluate how effective septic systems and the underlying strata (vadose or unsaturated zone) are in removing nitrate prior to reaching the Casper Aquifer. Our objectives for this study included the following:

- 1. Assess the effectiveness of a septic system and the underlying low carbon soils in removing nitrate and other associated contaminants from septic effluent prior to reaching the Casper Aquifer;
- 2. Identify nitrate concentrations that will exist after treatment by the septic system, leach field, and shallow soils; and,
- 3. Provide a specific analysis of the performance of the monitored septic facility.

Wenck has had several additional goals associated with this project. One principal goal has been to provide a portion of the data that Albany County needs to determine the appropriate density of septic systems for future development within the CAPA and further establish septic system design or modified design requirements for this area. Another goal has been to assist the City of Laramie in an effort to protect their water supply, and perhaps address the need for extension of wastewater service outside City limits.



This section provides pertinent details regarding the drilling and completion of the vadose zone monitoring network. The vadose zone includes both the unsaturated unconsolidated sand/alluvial fan deposits and underlying unsaturated Casper Formation sandstone below the site. While the Casper Formation is saturated below the site, saturated conditions were not encountered during drilling for this project. The monitoring network was installed in February 2018 and sampled through December 2018. Wenck subcontracted Authentic Drilling (Authentic) of Kiowa, Colorado, to complete the drilling and completion of the monitoring network with a CME 75 drill rig.

#### **Monitoring Network Siting**

Wenck installed a vadose zone monitoring network below a septic system within the Sherman Hills Estates subdivision at the western edge of the CAPA. This site was identified through Wenck's collaboration with Albany County personnel. The selection criteria for the particular septic system included the following:

- 1. Located over Casper Formation outcrop or subcrop east of where the Satanka Shale is present.
- 2. Located east or southeast of Laramie and part of a subdivision built in this area.
- 3. Landowner willingness to allow access, installation, and monitoring of the system during 2018.
- 4. A conventional septic system built within the last 10 years if possible, for which we have detailed construction records on file with Albany County.
- 5. Preferably used by a family of 4 to 5 people.

In January 2018, Wenck initiated the site selection process by providing Albany County with geologic data on an area east and southeast of Laramie where suitable septic systems might be located. Based on that area, Albany County created a list of potential landowners through review of their records and contact with local residents. Wenck also contacted several residents to discuss additional possibilities and provided that information to Albany County. By late January, the potential site list included 19 different properties. Wenck reviewed and updated the list based on the physical properties of the site, the criteria listed above, and the type of septic system. Wenck's principal concerns with respect to the physical properties of the site included the soil type, soil thickness, geologic formation underlying the site, and the particular type of septic system that was installed. Sites with 10 or more feet of soil directly overlying Casper Formation outcrop were preferred, which reduced the site list to 11. Albany County then researched its septic system records and provided details for those systems. Based on the geologic and system information, Wenck recommended Albany County contact seven of the landowners to ascertain their willingness to allow installation of the monitoring network and provided an advisory letter of intent to share with residents. Two of those seven expressed interest, and ultimately, Albany County was able to obtain consent from a landowner in the Sherman Hills Estates Subdivision on February 6, 2018.

The septic system well met the site selection criteria for this project. As shown on **Figure 1**, the site is located over Casper Formation outcrop east of Laramie and is directly overlain by alluvial fan deposits. While this particular system was constructed in 1999 and is typically



used by two people, the system was built with infiltrators which are commonly used in Albany County for septic systems, had detailed permit documents, and most importantly, included a landowner willing to allow and support the study. The location of this property and the layout of the septic system and monitoring network are shown on **Figure 2**. The two septic system infiltrators are located in a vacant lot south of the house, extend approximately 75 feet, and are buried approximately 3.5 feet. The residents obtain their water supply through a 176-foot-deep Casper Aquifer well (Wyoming State Engineer's Office Permit No. U.W. 3166) that is completed at the northeast corner of their house, upgradient of the septic system. Depth to water in this well is reportedly 50 feet, but the depth at which groundwater was encountered in the Casper Aquifer is not noted on the completion report. **Appendix B** includes details on this septic system from its application, a scaled site plan, and information on the residential water well.

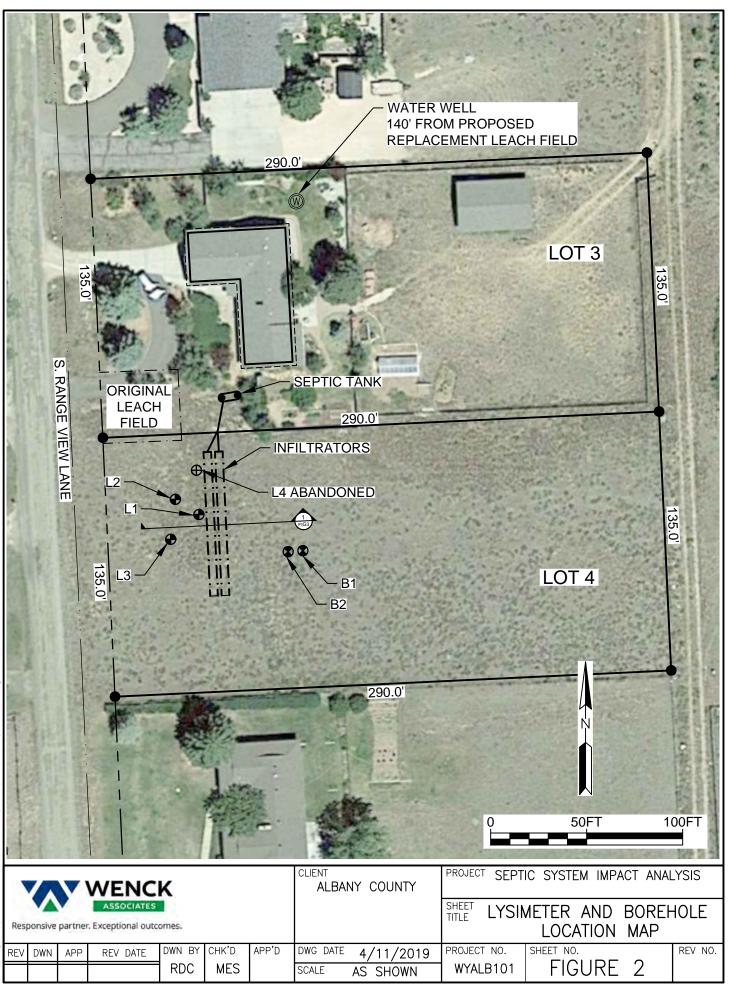
## **Test Hole Drilling**

At the locations shown on **Figure 2**, two test holes, B-1 and B-2, were drilled on February 12, 2018, east of the septic system. Groundwater was not encountered in either test hole. Both of these holes were drilled outside the septic system footprint. B-1 was drilled to initially assess the subsurface conditions. B-2 was drilled to determine the thickness and composition of the soil, unconsolidated sand, and Casper Formation material; obtain samples of the unconsolidated sand and Casper Formation; and evaluate shallow groundwater conditions close to the septic system. Because groundwater was not encountered in either test hole, monitoring wells were not installed. Given the reported depth to water in the residential well, the Casper Aquifer (saturated Casper Formation) underlies the site, but the depth at which groundwater would have been encountered is uncertain. Wenck discussed the possibility of completing a monitoring well west and downgradient of the septic system to monitor nitrate concentrations in near surface groundwater, but Albany County and the City of Laramie opted not to pursue its completion. Lithologic logs of these two test holes are included in **Appendix C**.

Drilled to a depth of 34 feet, Test Hole B-1 confirmed that the Casper Formation at the site is overlain only by unconsolidated deposits. Test Hole B-2 that was drilled to a depth of 46.5 feet revealed similar conditions in greater detail closer to the septic system. Driven split spoon samples were collected at B-2 every 5 feet, but only one driven sample was collected at B-1 at a depth of 29 feet. For this reason, the depths and lithology noted for B-2 are considered most representative of the subsurface. The split spoon samples from B-2 were submitted for soils analysis and testing. At both test holes, Authentic only encountered 1 foot of poorly developed soil composed of light reddish-brown sandy silt. The underlying alluvial fan deposit extended to a depth of approximately 25 feet and was composed of either sand or sand with gravel. The sand was fine to coarse grained in texture, poorly sorted, calcareous, unconsolidated, loose, and dry to slightly moist. It did not appear to contain organic matter and appeared to be porous and permeable. Casper Formation sandstone was encountered from 25 to 46.5 feet below ground surface. This sandstone was porous and permeable to 46 feet, but at that depth, was well cemented and prevented further drilling below 46.5 feet with the CME 75 drill rig.

The geologic and soils data from the test holes were used along with vegetation conditions and the scaled septic system layout map to plan the surface location and drilling angles of the lysimeter holes, as well as the lysimeter installation depths.





## Lysimeter Drilling and Construction

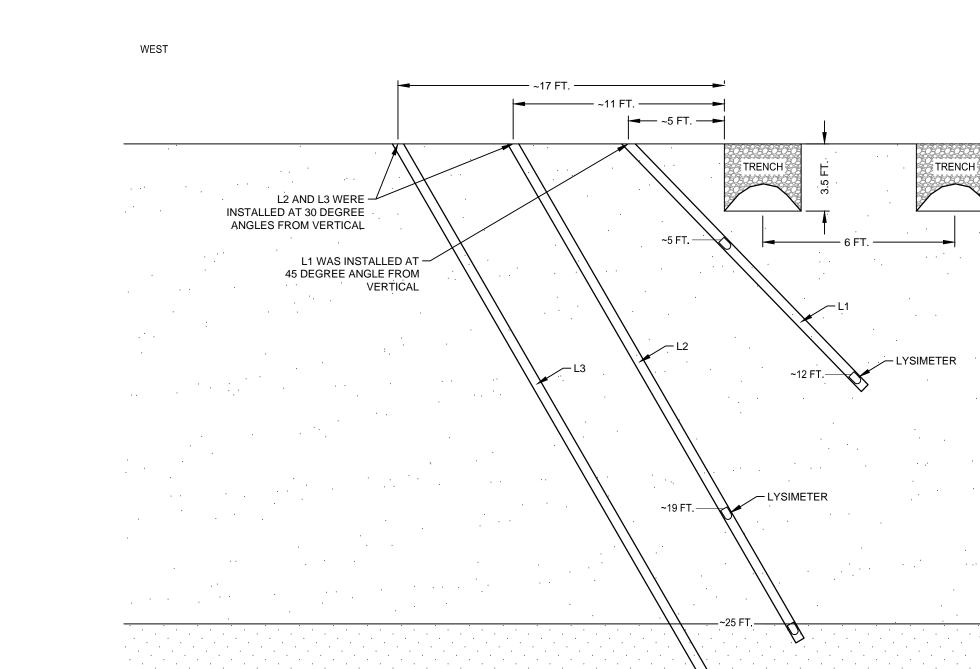
Monitoring of the vadose (unsaturated) zone was an essential part of this investigation. The ability to detect contaminants as they travel through the vadose zone toward the water table is possible with the use of lysimeters. Model 1920 lysimeters from Soilmoisture Equipment Corporation were used in this study. Lysimeters are soil moisture (pore water) collection devices that are designed for installation beneath the ground surface. Each lysimeter is a closed tubular device with a porous ceramic cup at one end and is equipped with two ports on the other end: one to allow application of a vacuum or pressure, the other to allow delivery of collected water samples to the surface.

Lysimeters operate by establishing continuity between the soil pores and those on the porous ceramic cup of the lysimeter. Surrounding the lysimeter with a fine mesh silica flour enhances contact with the surrounding soil and effectively increases the operating range. An equilibrium is established between the water in the soil pores, the silica flour, and the porous ceramic cup. Application of a vacuum to the inside of the lysimeter causes the pore water to flow from the soil pores through the silica flour and porous cup into the lysimeter body. The soil pore water may then be transferred to the ground surface via the sample recovery line, by pressurizing the vacuum/pressure line.

The locations and installation depths of the lysimeters were established from discussions with Authentic regarding their angle drilling capabilities, drilling of the test holes, and the configuration of the septic system infiltrators. Wenck determined that the shallowest lysimeter hole would be drilled at a 45-degree angle, and that the two deeper lysimeter holes would be completed at 30-degree angles from vertical. L-1 was set back approximately 5 feet from the western infiltrator, while L-2 and L-3 were set back approximately 11 and 17 feet, respectively. These offsets and angles would allow for lysimeter placement at the respective vertical depths of 5, 12, 19, 25, 30 and 35 feet below land surface. The purpose of installing these lysimeter holes at different angles and offsets was to allow for collection of vadose zone moisture samples at six different depths below the septic system infiltrators within either the unconsolidated alluvial fan deposits (above 25 feet) or the Casper Formation (below 25 feet). The lysimeter locations shown on **Figure 2** were selected because it was anticipated that most of the effluent would likely infiltrate on the down slope western side close to the discharge head of the infiltrator due to the permeable sand composition of the near surface sediments.

As shown on **Figures 2** and **3**, four lysimeter holes were drilled west of the western infiltrator at the site for the vadose zone monitoring network. Between February 13 and 14, 2018, Authentic completed the installation of the lysimeters in L-1 through L-4. L-4 was drilled first but was plugged and abandoned after damaging the western infiltrator. All In One Septic Systems and Plumbing Service (All In One) excavated and repaired the damaged infiltrator after the other lysimeters had been installed. The lysimeter holes were drilled with new 8.25-inch diameter hollow stem augers that had not been used prior to this project. Each auger was decontaminated between holes. Bulk soil samples from each lysimeter hole (L-1 through L-3 only) were also collected for laboratory testing and analysis. At L-1 and L-2 beneath approximately 1 foot of silty sand or sandy silt soil, unconsolidated sand of the alluvial fan deposits was encountered to the bottom of each lysimeter hole as shown on Figure 3. L-1 was completed with lysimeters set at vertical depths of 5 and 12 feet below ground surface in the unconsolidated sand. L-2 was completed with lysimeters set at depths of 19 and 25 feet, respectively, in the unconsolidated sand. However, the lysimeter at 25 feet was set at or near the interface between the unconsolidated sand and Casper Formation. At L-3, similar sediments were observed to a depth of 33 feet, at which point a





SANDSTONE (CASPER FORMATION) STARTS AT A DEPTH OF 25 FEET BELOW SURFACE

- INFILTRATORS

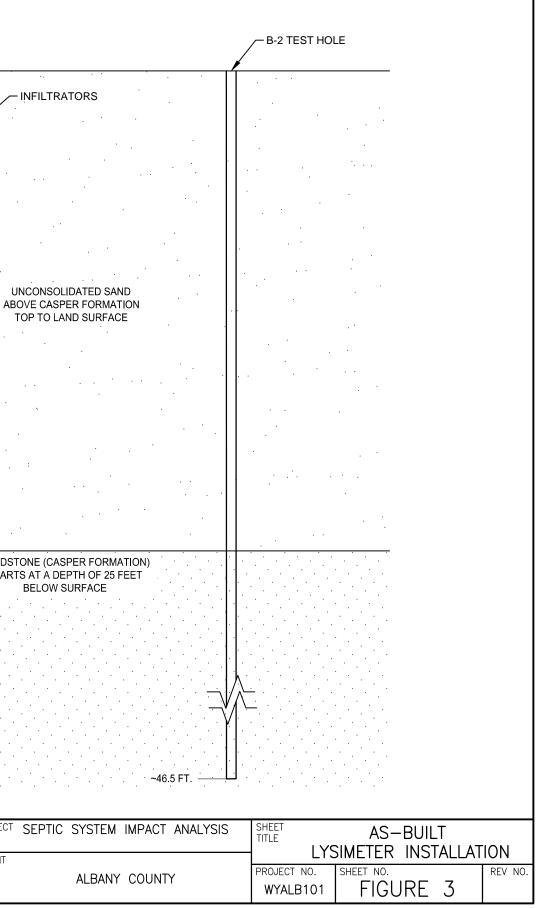
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~30 FT. -

~35 FT

- LYSIMETER

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EAST

sandstone of the Casper Formation was encountered. L-3 was completed with lysimeters set at depths of 30 and 35 feet, both in the unsaturated Casper Formation. Lysimeter completion diagrams and lysimeter materials information are included in **Appendix D**.

Within each lysimeter hole, Wenck directed the construction of the six porous tension-cup lysimeters at the depths noted above. No water was placed into the lysimeter holes during construction, and all materials were installed under dry conditions through the hollow stem augers. The respective details for each lysimeter hole are shown on the completion diagrams in Appendix D. Two, 2-foot-long, 2 bar cup lysimeters were installed in each of the three lysimeter holes, L-1 through L-3, at the site. Two lengths of ¼-inch O.D. polyethylene nylon access tubing (black for pressure/vacuum and green for sample recovery) were securely connected to each lysimeter and extended to land surface as the lysimeter was installed point down in the lysimeter hole. Each lysimeter was surrounded with 200 mesh silica flour. The two lysimeters in each hole were separated from each other by 10X20 silica sand and bentonite pellets that filled the annular space. The lysimeter and annular materials were installed as the hollow stem augers were progressively removed from each hole. Above the uppermost layer of bentonite pellets, drill cuttings were placed to land surface. The access tubing was terminated at land surface in 6-inch neoprene tubing that was clamped, colored, and taped to distinguish between pressure/vacuum and sampling ends and labeled with the lysimeter location and depth below the infiltrator. The access tubing at each lysimeter hole was placed within a flush mounted well cover that was installed at grade. As of this report, the lysimeters have not been abandoned.



Using the vadose zone monitoring network at the site described in Section 3.0, Wenck collected vadose zone moisture samples on six occasions, septic tank water samples on two occasions, and soil samples on one occasion in 2018 as noted in **Table 4.1**. To assess the seasonality of Casper Aquifer recharge influences and potential changes in nitrate concentrations, moisture samples were collected from the lysimeters during February, April, May, June, September, and December 2018.

Sample Collection Date	Vadose Zone Moisture Samples Collected	Septic Tank Samples Collected	Soil Samples Collected
02/15/2018			Х
02/26/2018	Х	Х	
04/04/2018	Х		
05/15/2018	Х		
06/25/2018	Х		
09/05/2018	Х		
12/04/2018	X	X	

Table 4-1: Sample Collection Events

## **Soil Sample Collection**

During drilling of the test and lysimeter holes, soil samples were collected using directly driven split spoons and bulk auger samples from different depths for laboratory analysis. A total of three samples were collected from both the septic impacted area at each lysimeter hole (L-1, L-2 and L-3) and the non-septic impacted area at Test Hole B-2 (B2-1, B2-2 and B2-3). A summary of these samples is presented in **Table 4.2**. All soil samples and soil intervals were logged by a Wyoming licensed geologist in the field and notes were made regarding color, texture, and visible constituents including organic matter, gypsum and calcium carbonate. Samples were then sealed in Ziploc plastic bags and shipped to the University of Wisconsin-Stout Discovery Center Laboratory following standard chain-of-custody procedures.

At the University of Wisconsin-Stout Laboratory, the soil samples were analyzed for the following parameters: sediment total Kjeldahl nitrogen (TKN), sediment nitrate+nitrite-N, dry bulk density, organic content, ammonium-N maximum adsorption and nitrate+nitrite-N maximum adsorption. The sediment TKN and nitrate+nitrite-N laboratory analyses were performed by Pace Analytical Services in Minneapolis, Minnesota. The sediment samples for these analyses were packaged and sent by the University of Wisconsin-Stout Laboratory to Pace Analytical according to the chain-of-custody procedures.

Dry bulk density and organic matter content were assessed by University of Wisconsin– Stout Laboratory by drying a known volume of sediment at 105 degrees C and 550 degrees C, respectively. For the ammonium-N and nitrate+nitrite-N adsorption analyses, the sediment samples were subjected to a range of ammonium-N and nitrate-nitrite N concentrations to examine Langmuir-type adsorption isotherms and potential maximum adsorption capacity using a modification of Pierzynski (2000). Ammonium-N and nitratenitrite N stock solutions ranging between 0 and 500 mg/L (0 mg/L, 50 mg/L, 100 mg/L, 250 mg/L, and 500 mg/L) were prepared using a 0.01 M CaCl<sub>2</sub> solution to preserve ionic integrity. Ten grams of subsoil and 100 milliliter (mL) of standard solution were added to 125 mL glass assay tubes to create a soil to solution ratio of 10:1. Assay tubes were gently



shaken for 24 hours, centrifuged, decanted, and filtered through a type A/E glass fiber filter (Pall). Samples were preserved with sulfuric acid to a pH < 2 and shipped to Pace Analytical for analysis of ammonium-N and nitrate-nitrite N. Additional standards were also shipped to Pace Analytical for analysis. **Appendix E** contains a more detailed description of the University of Wisconsin-Stout's Laboratory methods along with the Langmuir equation calculations and chain-of-custody laboratory results from Pace Analytical.

Soil Sample ID	Depth (ft)	Description	Laboratory Analyses
L-1	7-10.5	Unconsolidated sand, septic impacted area (lysimeter hole)	
L-2	23-28	Unconsolidated sand, septic impacted area (lysimeter hole)	Dry bulk density,
L-3	33-38	Sandstone (Casper Formation), septic impacted area (lysimeter hole)	organic content, TKN, NO <sub>3</sub> +NO <sub>2</sub> , NH <sub>4</sub> -N max
B2-1	4-10.5	Unconsolidated sand, non-septic impacted area (Test Hole B2)	adsorption, NO <sub>3</sub> +NO <sub>2</sub> max adsorption
B2-2	14-20.5	Unconsolidated sand, non-septic impacted area (Test Hole B2)	
B2-3	>29	Sandstone (Casper Formation), non- septic impacted area (Test Hole B2)	

Table 4-2: Description of Soil Samples and Laboratory Analyses

#### Septic Tank Water Sampling

Wenck collected effluent samples from the septic tank during the first and last sampling events on February 26 and December 4, 2018. The samples were collected from the middle zone of the septic tank, between the scum and sludge layers. Wenck tried to disturb the water as little as possible prior to or during sampling. Both samples were collected using new bailers and sample containers. After the final sampling event, the landowner's septic tank was pumped out by All In One. Temperature, electrical conductance, and pH were analyzed in the field during the December 4, 2018, sampling event using an Extech DO700 meter.

During sample collection, Wenck observed that bailers captured more suspended materials in the top and bottom quarters of the withdrawn water column. Therefore, sample bottles were filled with water from the middle of the bailer water column to minimize scum and sludge content in the samples. Samples for laboratory analysis were sealed, labeled, and placed into a cooler and shipped to Inter-Mountain Labs in Sheridan, Wyoming, following chain-of-custody procedures.

## Vadose Zone Moisture Sample Collection

Wenck attempted to collect vadose zone moisture samples from each of the six lysimeters during all six of the sampling events noted in **Table 4.1**. To protect samples from contamination, the sampler wore clean nitrile gloves, and cleaned the pump prior to applying vacuum or pressurizing the lysimeters. Samples were not filtered, resulting in total (rather than dissolved) results for constituent analysis. When sufficient sample volume was obtained from a lysimeter, field water quality parameters including temperature, electrical conductance, and pH were measured using calibrated field instruments.

Vadose zone moisture samples were collected using the following standard procedure. As noted in Section 3.3, each lysimeter was connected to land surface by two tubes, one for applying vacuum/pressure and the other for obtaining sample water from the lysimeter. First, a vacuum of 45 to 50 centibars (cBar) was applied to each lysimeter using a hand



pump. The vacuum/pressure tube was then sealed with a clamp and removed from the hand pump. The lysimeters were kept under vacuum for approximately 5 to 6 hours during the last five sampling events. During the first sampling event, the lysimeters remained under vacuum for a cumulative time of nearly 30 hours. During this time, samples were collected intermittently to determine the vacuum duration required to collect sufficient sample volume for submittal to the lab. Our results indicated that, if a lysimeter did not produce sample water after six hours under vacuum, additional time did not improve sample collection. After applying vacuum to all lysimeters, the sampler left the site and returned later the same day to recover sample moisture.

Upon return to the site, the sampler measured the remaining vacuum at the lysimeter prior to pressurizing the lysimeter for sample recovery. To recover sample moisture, the vacuum was released, the sample recovery tube was unclamped, and the hand pump was connected to the vacuum/pressure tube. Before pressurizing the lysimeter, the sample collection tube was cleaned to prevent sample contamination. The sample collection tube was then placed in the sample bottle and the lysimeter was pressurized to approximately 50 cBar with the hand pump. Pressure was maintained by pumping until the full sample volume was recovered.

The volume of sample recovered varied widely between lysimeters during individual sample events and for individual lysimeters across sampling events. The tables presented in **Appendix F** provide details on the volumes of sample recovered as well as field water quality parameters measured at the lysimeters and septic tank. For a single lysimeter, the volume of sample recovered during a sampling event ranged from zero to 100 mL. The cumulative sample volume recovered from all lysimeters during a sampling event ranged from 15 to 300 mL. When greater than 30 mL of sample volume was recovered from a lysimeter, sample pH, conductivity, and temperature were measured using an Extech DO700 meter. To measure field parameters, a portion of the sample was transferred to a new container where parameters were measured. The remaining sample was sealed, labeled, and placed in a cooler on ice for shipment to Inter-Mountain Labs in Sheridan, Wyoming.

At Inter-Mountain Labs, samples were analyzed for nitrate, nitrite, TKN, phosphorus, and chloride. If insufficient sample volume was obtained to analyze all five constituents, analytes were prioritized in the following order: Nitrate, nitrite, chloride, TKN, and phosphorus. Analytical methods and reporting limits are reported in **Table 4.3**.

# Table 4-3: Analytes, Method, and Reporting Limit for Vadose Zone Moisture Sampling

Parameter	Method	Reporting Limit
Nitrogen, Nitrate (As N)	EPA 300.0	0.05 mg/L
Nitrogen, Nitrite (As N)	EPA 300.0	0.05 mg/L
Nitrogen, Total Kjeldahl (TKN)	EPA 351.2	1 mg/L
Chloride	EPA 300.0	1 mg/L
Phosphorus	EPA 200.7	0.1 mg/L



## Septic Tank Water Sampling Results

Septic tank sample results for the February 26 and October 4, 2018, sample events are presented in **Table 5.1**. As expected, nitrate+nitrite concentrations were below method detection limits, which indicates anaerobic conditions are present within the septic tank. Average TKN concentration (sum of organic-nitrogen and ammonia-nitrogen) was 84.5 mg/L, which was slightly higher than the average ammonia-nitrogen concentration (82.7 mg/L). Thus, it can be assumed that nearly all of the total nitrogen (TN; sum of TKN and nitrate+nitrite) in the septic tank is in an ammonia form prior to being discharged to the drain field. Laboratory analytical reports on the septic tank samples are included in **Appendix G**.

Water quality data from two Casper Aquifer wells completed in Sherman Hills Estates subdivision to depths of 163 and 300 feet are also included in **Table 5.1**. These wells were sampled by the U.S. Geological Survey in 2012 and 2016 (NWIS, 2018). Neither of these wells had detectable concentrations of ammonia, but the 163-foot-deep well at the northwestern margin of the subdivision had a nitrate concentration of 6.29 mg/L. The deeper 300-foot well at the southeastern edge of the subdivision had no detectable nitrate.

## Vadose Zone Moisture Sampling Results

Presented in **Table 5.2**, lab analytical data for the vadose zone moisture samples obtained from the lysimeters indicate effluent from the septic system is affecting the vadose zone moisture quality. Laboratory analytical reports on the lysimeter samples are included in **Appendix H. Figure 4** displays the nitrate+nitrite, TKN and TN results for each lysimeter and sample date. Notice in **Table 5.2** that the sampled concentrations that exceed DEQ limits for Class I domestic groundwater use are highlighted in bold (DEQ, 2014). Nitrate concentrations generally exceeded these limits through both the unconsolidated sand alluvial fan deposits and in the Casper Formation below a depth of 25 feet. Nitrite concentrations exceeded these limits at the 5 and 25-foot depths in the unconsolidated sands. Given 0.7 to 41 mg/L concentrations in the septic tank and nearby Casper Aquifer wells, elevated chloride concentrations were present throughout the vadose zone, and exceeded DEQ limits at depths of 19 and 30 feet in both the unconsolidated sand and Casper Formation.

As discussed in in the previous section, nearly all of the nitrogen in the septic tank is in ammonia form prior to being discharged to the infiltrators. The lysimeter profiles shown on **Figure 4** indicate that TKN concentrations decrease significantly in the top 12-feet of the vadose zone as the average TKN concentration (all sample events) for the lysimeter located 12-feet below grade is approximately 92% lower (6.5 mg/L) than the average TKN concentration in the septic tank (84.5 mg/L). TKN levels continue to decrease between the 12-foot and 35-foot lysimeters, however, not as dramatically as the TKN decrease in the upper 12 feet of the vadose zone. Average TKN concentrations decrease from 6.5 mg/L at the 12-foot lysimeter to 0.8 mg/L at the 35-foot lysimeter, suggesting nitrification and/or ammonia adsorption continues to occur throughout this part of the vadose zone.



#### Table 5.1: Septic Tank Water Quality Data

	Analyte	Wyoming DEQ, Chapter 8	Septic Tank Results (mg/L)		USGS Well 1 (mg/L)	USGS Well 2 (mg/L)
Sample Date		Domestic Water Quality Standards	2/26/2018 12/4/2018		9/11/2012	9/13/2016
	Total Dissolved Solids (180)	500.0	440	460	227	276
General Parameters	Alkalinity, Total (as CaCO3)		586	530	204	186
icheral Falameters	Nitrogen, Ammonia (as N)	0.5	94.4	70.9	ND	ND
	Nitrogen, Total Kjeldahl	-	89	80	NM	NM
	Alkalinity, Bicarbonate as HCO3	-	714	646	252	199
	Alkalinity, Carbonate as CO3	-	ND	ND	ND	ND
Anions	Chloride	250.0	41	30	0.7	31
Anions	Flouride	4.0	0.1	0.1	ND	ND
	Nitrogen, Nitrate-Nitrite (as N)	10.0	ND	ND	ND	6.29
	Sulfate	250.0	12	2	7.1	26
	Calcium		57	57	60	67
Cations	Magnesium	-	17	18	15	17
Cations	Potassium		24	23	ND	1.1
	Sodium		37	40	1.7	12
	Aluminum	-	ND	ND	ND	ND
	Arsenic	0.05	ND	ND	ND	0.002
	Barium	2.0	0.2	0.2	0.19	0.26
	Boron	0.75	ND	ND	ND	ND
	Cadmium	0.005	ND	ND	ND	ND
	Chromium	0.1	ND	ND	ND	ND
Dissolved Metals	Copper	1.0	0.01	0.01	ND	ND
DISSOIVED IVIELAIS	Iron	0.3	ND	0.06	ND	ND
	Lead	0.015	ND	ND	ND	ND
	Mercury	0.002	ND	ND	NM	NM
	Molybdenum	1	ND	ND	ND	ND
	Nickel	-	ND	ND	ND	ND
	Selenium	0.05	0.003	ND	ND	0.0017
	Zinc	5.0	ND	ND	ND	ND
	Iron	0.3	0.18	1.82	ND	ND
Total Metals	Manganese	0.05	ND	0.07	ND	ND
	Phosphorus	-	5.2	11.0	NM	NM

Footnotes: ND = Not Detected; NM = Not Measured; -- = No Standard; Bold = Exceeds Standard

USGS Well 1
USGS 411727105305901 15-072-07bba01
41°17'27.2"
105°30'59.3"
300 ft.
https://nwis.waterdata.usgs.gov/nwis/qwdata?

2	USGS Well 2
ID:	USGS 411754105314601 15-073-01caa01
Latitude:	41°17'54.0"
Longitude:	105°31'46.1"
Well Depth:	163 ft.
Source:	https://nwis.waterdata.usgs.gov/nwis/qwdata?

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May 2019

#### Table 5.2 - Lysimeter Moisture Quality Data

		Water Quality	Data Summary for	Lysimeters		
Lysimeter Depth (ft)	Date Collected	Nitrogen, Nitrate (as N) (mg/L)	Nitrogen, Nitrite (as N) (mg/L)	Nitrogen, Total Kjedahl (TKN) (mg/L)	Chloride (mg/L)	Phosphorus (mg/L)
Wyoming DEQ, Chap Water Quality		10.0	1.0	-	250.0	
	2/27/2018	2.74	0.85	56	61	6.9
10.2	4/4/2018	0.11	0.1	61	NM	NM
L-1 5'	5/15/2018	6.92	0.2	53	26	8.4
	6/25/2018	49.2	6.44	30	227	5.9
	9/5/2018	26.3	5.18	20	27	4.5
	6/25/2018	91.8	ND	NM	52	NM
L-1 12'	9/5/2018	69.0	ND	6	75	1.9
	12/4/2018	69.7	0.06	7	121	NM
	5/15/2018	75.9	ND	5	366	0.9
L-2 19'	6/25/2018	69.3	ND	6	366	1
2100	9/5/2018	65.9	ND	1	224	1.5
	2/27/2018	66	0.08	3	101	1.1
	4/4/2018	72.5	0.08	2	NM	NM
L-2 25'	5/15/2018	74.7	0.17	2	202	1.4
10.00	6/25/2018	72.3	1.41	3	210	1.2
	9/5/2018	70.6	ND	ND	187	1.3
	2/27/2018	63	ND	4	2540	1
L-3 30'	6/25/2018	55.5	ND	10	489	2
L-3 30	9/5/2018	54.7	ND	7	321	2.3
	12/4/2018	55.4	0.16	4	291	NM
	2/27/2018	51.2	0.09	ND	142	1.4
A	4/4/2018	51	0.09	1	NM	NM
L-3 35'	5/15/2018	53.1	ND	1	238	1.3
	6/25/2018	54.1	ND	2	239	1.2
	9/5/2018	55.9	ND	ND	211	1.3

#### Footnotes

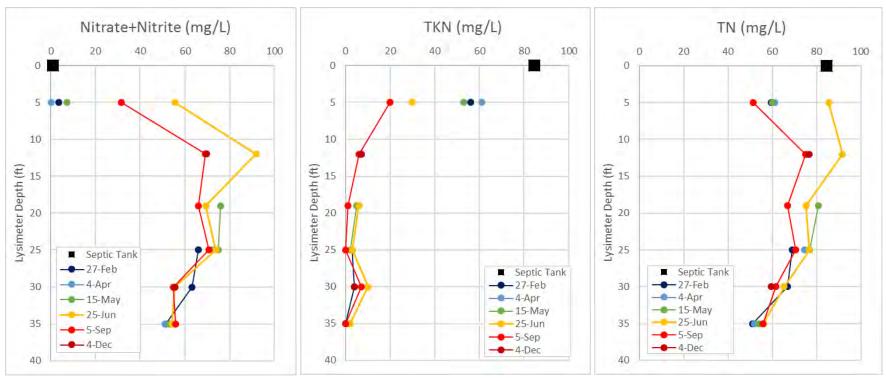
ND = Not Detected

NM = Not Measured

Bold = Exceeds WY DEQ Domestic Water Quality Standard

-- = No standard





#### Figure 4: Lysimeter Moisture Quality Depth Profiles



The lysimeter profiles also indicate that the TKN changes in the upper 12-feet of the vadose zone coincide with significant increases in nitrate+nitrite concentrations. As discussed in Section 5.1, nitrate+nitrite concentrations in the septic tank were below laboratory reporting limits. Nitrate+nitrite concentrations for the samples collected within the unconsolidated sand at the 5-foot and 12-foot lysimeters averaged 19.6 mg/L and 76.9 mg/L, respectively. These increases indicate a majority of the TKN (i.e. ammonia) discharged from the septic tank is adsorbed to the soil and/or converted to nitrate in the upper 12-feet of the vadose zone. The data shows these processes occur more rapidly in the upper 5-feet of the vadose zone during the warmer summer months, because the June and September nitrate+nitrite samples (55.6 mg/L and 31.5 mg/L) were significantly higher than the nitrate+nitrite samples collected in the 5-foot lysimeter in February, April, and May (3.6 mg/L, 0.2 mg/L and 7.1 mg/L, respectively).

The lysimeter profiles show that nitrate+nitrite levels begin to decrease in the deeper part of the vadose zone below 12 feet. Average nitrate+nitrite concentrations go from 76.9 mg/L at the 12-foot lysimeter to 53.1 mg/L at the 35-foot lysimeter (~31% reduction), suggesting that some denitrification and/or dilution with non-septic water occurs as water moves through this portion of the vadose zone. Unlike the upper vadose zone, the TKN and nitrate+nitrite changes in the deeper vadose zone appear to be relatively consistent between the six sample events which suggests that denitrification rates in the lower vadose zone are relatively consistent throughout the year. Nitrate concentrations in the upper 10 feet of the Casper Formation (i.e. lysimeter depths 30 and 35 feet) range from 51 to 63 mg/L.

## Soil Sample Results

Physical and chemical analysis results for the vadose zone soil samples collected from the lysimeter holes beneath the septic infiltrators and the non-septic impacted area east of the leach field (Test Hole B-2) are presented in **Tables 5.3** and **5.4**, respectively. **Figures 5** and **6** display vertical profiles of the soil dry bulk density, organic content, TKN, nitrate+nitrite, and ammonia sorption maximum for the septic and non-septic impacted areas. **Appendix E** contains a more detailed laboratory report of the analytical methods along with a brief discussion of the results.

Soil dry bulk density was measured in three layers at the lysimeter holes (L1, L2 and L3) and ranged from 2.41 g/cm<sup>3</sup> to 2.46 g/cm<sup>3</sup> suggesting soil physical properties are very similar throughout the entire vadose zone beneath the infiltrators. Soil bulk density was also measured in three layers at B-2 (B2-1, B2-2 and B2-3) east of the leach field. Results ranged from 2.32 g/cm<sup>3</sup> to 2.60 g/cm<sup>3</sup> indicating soil physical characteristics were also consistent through the vadose zone in this area and spatially between the two areas.

Soil sample results show that soil organic content, TKN and nitrate+nitrite concentrations at the lysimeter holes were higher in the upper vadose zone (L1) compared to the deeper vadose zone layers (L2 and L3). Organic content went from 1.07% at station L1 (7-10.5 feet depth) to 0.50% and 0.52% at stations L2 (23-28 feet depth) and L3 (33-38 feet depth), respectively. TKN concentration at station L1 was 209 mg/kg but was below detection limit at stations L2 and L3. Nitrate+nitrite content was approximately 38% to 41% higher at station L1 (3.2 mg/L) compared to stations L2 (2.9 mg/L) and L3 (2.0 mg/L).



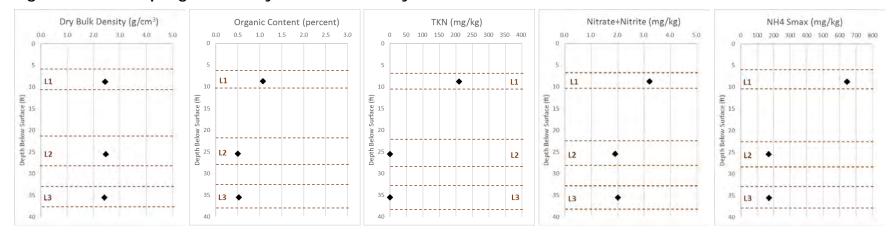
Station	Depth (ft)	Dry Bulk Density (g/cm³)	Organic Content (%)	TKN (mg/kg)	Nitrate+Nitrite (mg/kg)	Ammonia Sorption Max (mg/kg)	Nitrate+Nitrite Sorption Max (mg/kg)
L1	7-10.5	2.44	1.07	209	3.2	645	<rl< td=""></rl<>
L2	23-28	2.46	0.50	<rl< td=""><td>1.9</td><td>170</td><td><rl< td=""></rl<></td></rl<>	1.9	170	<rl< td=""></rl<>
L3	33-38	2.41	0.52	<rl< td=""><td>2.0</td><td>171</td><td><rl< td=""></rl<></td></rl<>	2.0	171	<rl< td=""></rl<>
Note: <rl indicat<="" td=""><td>es concentration wa</td><td>is less than the repo</td><td>orting limit.</td><td></td><td></td><td></td><td></td></rl>	es concentration wa	is less than the repo	orting limit.				

Table 5.3: Soil Sampling Results for the Lysimeter Holes Beneath the Infiltrators

Table 5.4: Soil Sampling Results for the B-2 Test East of the Infiltrators

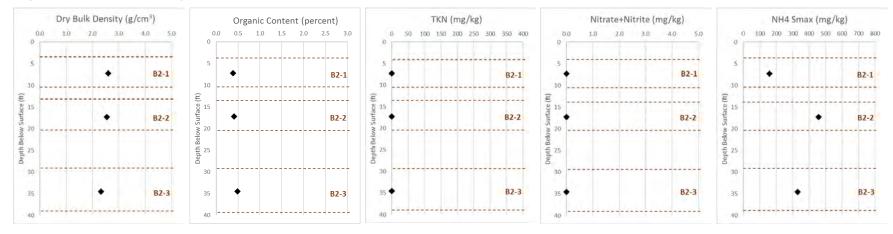
Station	Depth (ft)	Dry Bulk Density (g/cm <sup>3</sup> )	Organic Content (%)	TKN (mg/kg)	Nitrate+Nitrite (mg/kg)	Ammonia Sorption Max (mg/kg)	Nitrate+Nitrite Sorption Max (mg/kg)
B2-1	4-10.5	2.60	0.39	<rl< td=""><td><rl< td=""><td>158</td><td><rl< td=""></rl<></td></rl<></td></rl<>	<rl< td=""><td>158</td><td><rl< td=""></rl<></td></rl<>	158	<rl< td=""></rl<>
B2-2	14-20.5	2.55	0.41	<rl< td=""><td><rl< td=""><td>458</td><td><rl< td=""></rl<></td></rl<></td></rl<>	<rl< td=""><td>458</td><td><rl< td=""></rl<></td></rl<>	458	<rl< td=""></rl<>
B2-3	>29	2.32	0.49	<rl< td=""><td><rl< td=""><td>329</td><td><rl< td=""></rl<></td></rl<></td></rl<>	<rl< td=""><td>329</td><td><rl< td=""></rl<></td></rl<>	329	<rl< td=""></rl<>





#### Figure 5: Soil Sampling Laboratory Results for the Lysimeter Holes

#### Figure 6: Soil Sampling Results for Test Hole B-2 East of the Infiltrators (non-septic impacted area)





Soil sample results at Test Hole B-2, which reflects the non-septic impacted area, did not show any variability in organic content, TKN and nitrate+nitrite concentrations throughout the vadose zone. Soil organic content was consistently low at all three stations (B2-1, B2-2 and B2-3) throughout the vadose zone. Similarly, TKN and nitrate+nitrite concentrations were below reporting limits at all three stations.

Not surprisingly, laboratory analyses of nitrate+nitrite sorption capacity suggests very little, if any, nitrate+nitrite adsorbs to the soils at both the lysimeter holes beneath the infiltrators and at Test Hole B-2. As discussed in **Appendix E**, nitrate is an anion and therefore does not typically adsorb to soil/sand sorption sites which are also negatively-charged (Gaines & Gaines, 1994). As a result, nitrate+nitrite generally remains soluble throughout the vadose zone and, aside from losses via denitrification, leaches into groundwater.

Soil results did show that the vadose zone beneath the infiltrators is able to adsorb some ammonia. Ammonia sorption maximums are relatively low as less than 15% of the ammonia in the laboratory standard was adsorbed to the soil. Ammonia sorption maximum for the upper vadose zone (station L1) was approximately four times higher (645 mg/kg) than the deeper vadose zone (stations L2 and L3) beneath the infiltrators.

Soils at Test Hole B-2 also showed some capacity to adsorb ammonia. Ammonia sorption maximums were generally low and less than 10% of the ammonia standard was adsorbed. Unlike the septic impacted area beneath the infiltrators, ammonia sorption maximums were higher in the deeper vadose zone.

#### **Final Results and Conclusions**

Using the vadose zone monitoring network, Wenck evaluated trends, transformations, and changes in nitrogen levels of septic tank effluent as it moves through the vadose zone and enters the unsaturated Casper Formation beneath the leach field. This effort included: septic tank effluent sampling, monitoring of vadose zone moisture, and analysis of soil physical and chemical properties both below the leach field and below an unimpacted area adjacent to the leach field. Below is a summary of the principal findings of Wenck's septic system impact analysis:

Septic tank sampling:

- Total nitrogen levels of the effluent in the septic tank are high (~80-85 mg/L).
- Nearly all (>85%) of the nitrogen in the septic tank effluent is in ammonia form.

Vadose zone water monitoring:

- Nearly all of the ammonia from the septic tank effluent is converted to nitrate in the upper (top ~12 feet) vadose zone.
- Nitrate removal (20 to 39%) occurs in the lower (12 to 35 feet) vadose zone. This is likely driven by denitrification and/or dilution with non-septic vadose zone water.
- Soil moisture with nitrate concentrations in excess of EPA and DEQ Class I domestic water quality standards (51 to 63 mg/L) is percolating through the unconsolidated sand alluvial fan deposits into the unsaturated Casper Formation beneath the leach field.



Soil physical and chemical properties:

- Organic content, TKN and nitrate+nitrite in the upper (top ~10.5 feet) vadose zone beneath the infiltrators are elevated compared to the deeper (23 to 38 feet) vadose zone. Soils in the upper vadose zone adsorb nitrogen from the septic effluent.
- Soils throughout the vadose zone have limited capacity to adsorb nitrate.
- Beneath the infiltrators, soils in the upper vadose zone have higher capacity to adsorb ammonia compared to the deeper vadose zone; adsorption capacity at all depths is limited.

Final Conclusions:

- The vadose zone, on average, at this particular site is approximately 39% efficient in removing nitrogen (all forms) from the septic tank to a depth of 35 feet through a combination of adsorption, denitrification processes, and/or dilution at different depths.
- While both the vadose zone moisture monitoring data and the soil sampling results indicate the vadose zone is capable of removing some nitrogen from the septic effluent, nitrate concentrations entering the unsaturated Casper Formation 25 feet below ground surface are consistently high (51 to 63 mg/L). These conditions indicate that the vadose zone does not remove sufficient nitrogen to protect the Casper Formation and by inference the Casper Aquifer from nitrate contamination.



Based on the results and conclusions of this investigation, Wenck offers the following recommendations for Albany County's consideration:

- 1. Continue monitoring the vadose zone sampling network for the same water quality parameters. The intent of this recommendation is to develop a longer-term data set to further evaluate any changes through time. Given the low variability in sample results, Wenck anticipates that sampling twice a year in May and September for two to three more years would provide adequate data.
- 2. Install several vadose zone monitoring networks at different properties with an effort to evaluate the behavior of different soil types and/or septic systems. While this investigation's findings indicate that the soils at this property are inadequate to protect the Casper Aquifer, the results reflect a limited data set. It would be interesting to see how these results compare with those of an "enhanced treatment" septic system in the area.
- 3. Use these data to evaluate septic system design requirements in the CAPA. While additional data should be obtained, the results of this investigation indicate that further consideration to development in the CAPA is warranted and may require amending existing development practices to protect the Casper Aquifer.
- 4. To the extent possible, the City of Laramie should consider extension of City wastewater service to the rural subdivisions, or perhaps consider regional collection and treatment systems.
- 5. Estimate nitrate loading to the Casper Aquifer in the area for the purpose of evaluating appropriate residential density for future development as warranted. This study did not focus on volumetric loading to the Casper Aquifer, but such calculations could now be made with these data.



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Work Plan

# ALBANY COUNTY SEPTIC SYSTEM IMPACT ANALYSIS WORK PLAN

Prepared for:

Wyoming Department of Environmental Quality Groundwater Pollution Control Program 200 West 17<sup>th</sup> Street, 4<sup>th</sup> Floor Cheyenne, Wyoming 82002

Prepared by:

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January 2018

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Figure 1: Geologic Map Figure 2: Conceptual Lysimeter Installation Design Figure 3: Conceptual Borehole Locations Figure 4: Conceptual Well Diagram

## Appendices

A Lysimeter Instructions



The purpose of this report is to present both the Sampling and Analysis Plan, and Quality Control and Quality Assurance Plan for the Septic System Impact Analysis to be performed in the Casper Aquifer Protection Area (CAPA) for Albany County east and southeast of the City of Laramie. Wenck Associates (Wenck) has prepared this work plan for the installation of a vadose zone sampling network to monitor septic leach field denitrification over Casper Aquifer outcrop. Wenck is currently working with Albany County to identify a landowner willing to allow the installation and monitoring of this system. The monitored system will be located somewhere within the area shown on the geologic map in **Figure 1**. This work plan is also presented to document the activities performed at the site for compliance with the requirements of the Wyoming Department of Environmental Quality (DEQ). These monitoring and reporting activities will also be performed in accordance with the rules and regulations pertaining to the projects funded under Wyoming Nonpoint Source Section 205(j) grants.

This work plan is composed of seven sections and two appendices. The regional geologic and hydrogeologic setting is described in Section 2. Proposed vadose zone monitoring network installation activities are described in Section 3, and proposed soil and water sampling and analysis activities are described in Section 4. Section 5 addresses the quality assurance and quality control plan. Deliverables and project schedule are presented in Section 6, and references cited are presented in Section 7. Details on planned suppliers and equipment specifications are presented in **Appendix A**.



#### 2.1 SITE HYDROGEOLOGY

The Casper Aquifer consists of sufficiently saturated portions of the Casper Formation along the western margin of the Laramie Range east of Laramie. The aquifer is rated as a Class 1 aquifer by the DEQ and provides high quality drinking water to the City of Laramie. The aquifer includes up to 700 feet of interbedded sandstone and limestone with minor siltstone and shale. In this portion of Albany County, the aquifer is made up of approximately 85% sandstone. Groundwater is primarily stored and transmitted through the intergranular permeability of the sandstones, but various fractures and faults that cut through the sandstone and limestone sequence hydraulically connect the different rock units.

The Casper Formation is recharged through its outcrop and yields groundwater to local domestic and public supply wells. Its outcrop extends from the Wyoming state line on the south to Wyoming Highway 34 on the north, and dips about 3 to 5 degrees west into the Laramie Basin. The aquifer is principally recharged through snowmelt runoff over outcrop areas in March and April and may receive some component of recharge from the underlying Precambrian Granite along fractures. Recharge due to these runoff events typically occurs within days to weeks indicating rapid movement through the unsaturated zone. Groundwater production from the Casper Aquifer is generally limited to 5 to 50 gpm where intergranular permeability is predominant but ranges up to 2,000 gpm where aquifer permeability has been enhanced by faults, geologic structures, fractures, and along bedding surfaces. It is this high capacity production that renders the aquifer suitable for use by the City of Laramie at its Turner, Pope, and Soldier Springs wellfields.

The Casper Aquifer is confined by several formations as it dips westward into the Laramie Basin. These geologic formations in ascending stratigraphic order are the Satanka Shale, Forelle Limestone, and the Chugwater Formation. As a result, the Casper Aquifer responds as an unconfined aquifer through its recharge area, semi-confined where the confining units first appear, and confined where overlain by these geologic formations. Groundwater generally flows from the recharge area on the east in a westward direction into the Laramie Basin. In the vicinity of the Laramie Plains subdivision, the Satanka Shale is present and overlies the Casper. Several other subdivisions to the east are underlain directly by the Casper Formation that is covered by a thin veneer of alluvium and soil. This veneer may be only 10 to 15 feet thick depending upon location and depths to bedrock.

#### 2.2 NITRATES IN GROUNDWATER

Recent water quality testing near the Turner Wellfield and East Grand subdivisions has indicated the presence of high nitrate groundwater in upgradient areas of the Casper Aquifer (WWC, 2015). Water quality data collected annually at the City of Laramie municipal wellfields since the early 1970s indicates background nitrate levels in the aquifer of around 2 mg/L. Although nitrate concentrations at the wells appear stable, nitrate concentrations in upgradient areas suggest the Casper Aquifer has been affected by local septic system use. In 2009 29% of the wells sampled in the East Grand area had nitrate-nitrogen levels over 5 mg/L, and three of the wells had results above the 10 mg/L drinking water standard (City of Laramie, 2009). In 2015, nitrate concentrations at the nearby Sherman Hills subdivision were found to range from 7 to 9.4 mg/L (WWC, 2015). The elevated nitrate concentrations have been attributed to the high density of septic systems, many of which were installed too

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deeply to function properly (City of Laramie, 2009). Groundwater generally flows to the northwest through these areas, toward City Springs, and is unobstructed by the Sherman Hills Fault Zone. Nitrate concentrations in the downgradient City's Turner Wells remain around 2 mg/L but could potentially be impacted in the future.



This section provides pertinent details regarding the drilling and completion of the vadose zone monitoring network. Wenck intends to install this system in early to mid-February so that we can collect the first soil moisture samples in late February.

#### 3.1 PROPOSED MONITORING NETWORK

Wenck plans to install a vadose zone monitoring system below one individual septic system within a rural subdivision to evaluate the effectiveness of the system and the underlying soils in removing nitrates and other contaminants from effluent prior to reaching the Casper Aquifer. The selection criteria for the particular septic system includes the following:

- 1. Located over Casper Formation outcrop or subcrop east of where the Satanka is present.
- 2. East or southeast of Laramie in the subdivisions built in this area.
- 3. Landowner willingness to allow access, installation, and monitoring of the system over the next year.
- 4. A conventional septic system built within the last 10 years if possible for which we have detailed construction records.
- 5. Preferably used by a family of 4-5 people.

To characterize the subsurface conditions and thickness of the soil and unconsolidated material at the selected site, a vertical investigation borehole will first be drilled outside the leach field footprint. This borehole will be drilled to a depth of up to 50 feet and will be completed as a monitoring well if groundwater is encountered. Albany County may opt to install a nitrate monitoring well at the site assuming landowner consent and funding from a separate source.

Geologic and soils data from the investigation hole will be used to plan the surface location and drilling angle of the vertical or angled lysimeter holes, as well as the lysimeter installation depths. The monitoring system will consist of six nested lysimeters installed in three lysimeter boreholes, with two lysimeters in each hole installed at various depths. The lysimeter holes will be drilled from different sides of the selected leach field and drilled such that lysimeters can be installed beneath the leach field pipes. A conceptual plan for the arrangement of the lysimeters beneath the chosen septic field is presented in **Figure 2**.

Wenck's goal is to place lysimeters at various depths in the unsaturated soil or unconsolidated material below the leach field pipes. The locations of the proposed boreholes are shown relative to the conceptual site layout on **Figure 3**. The monitoring well in the investigation borehole is to be constructed with up to 40 feet of 2-inch diameter PVC casing and 10 feet of well screen. Wenck anticipates that all three lysimeter boreholes will be completed either within the thin overlying soil or unconsolidated material or in the upper 15 feet of the Casper Formation, depending upon specific site conditions. The three lysimeter holes will be drilled at angles up to 45 degrees and installed with two nested lysimeters each. The drilling and installation procedures to be followed for the investigation



January 2018 Z:\WPFinal\OPEN\WYALB101\WORK PLAN\Work Plan.docx borehole/monitoring well and the lysimeter boreholes are described in Section 3.2 through Section 3.5.

Six sampling events covering all four quarters of the calendar year are proposed for monitoring of the six lysimeters and a groundwater monitoring well, as described in Section 4.0 of this work plan. At the first and final sampling event, base samples of effluent will also be collected from the septic tank. Following the successful conclusion of the analysis and reporting, which are described in Sections 5.0 and 6.0, respectively, the monitoring wells and lysimeters will be abandoned in place pending negotiation between Albany County and the landowner.

#### 3.2 DRILLING PROCEDURES

Wenck will contact One-Call of Wyoming and the landowner to obtain access and utility clearances for the drill site. Any underground utility locations will be marked on the ground in the vicinity (within 50 feet) of the drill location by the utility locators. Drilling will generally not be performed within 5 feet of any known underground utility. Any overhead obstructions will also be avoided during the drilling of the vertical and angled holes.

The drilling rig and equipment will be decontaminated before and after drilling at each location in accordance with Section 3.6. Soil cuttings resulting from drilling will be used for sample analysis, as backfill during completion, or spread on the ground in the vicinity of each hole location, at the landowner's discretion. Any cuttings that cannot be used as backfill or left onsite will be collected in suitable containers and disposed of off-site.

Wenck will administer the drilling contract and plans to complete the drilling using 4 ¼ inch hollow stem as the unconsolidated and geologic formation conditions allow. All drilling will be conducted with a truck or track mounted CME 75 drill rig. All drilling activities will conform to state and local regulations and will be supervised by a Wyoming registered professional geologist. Each of the holes will be drilled starting from the surface to their total depth, to be determined at the time of drilling. Wenck will survey the locations of the vertical and angled boreholes using a Wide Area Augmentation System (WAAS) enabled handheld GPS with a minimum horizontal accuracy of 6 feet.

Wenck field personnel will maintain a log of drilling activities, including the date and time on site, personnel, weather, down time, and other pertinent information. A boring log will be completed to record lithologic descriptions, sample identification and intervals, depth to groundwater, total boring depth, moisture and organic carbon content, changes in drilling penetration rate, presence of fractures and/or voids, locations of low permeability layers, and other pertinent observations. Split spoon samples will be collected and logged at 5-foot increments or at lithologic or textural changes. Given the anticipated thickness of the unconsolidated material over the Casper bedrock, the split spoon samples will be concentrated in the surficial materials. Unconsolidated materials encountered in the boreholes will be described in accordance with the American Society for Testing and Materials 02488, Standard Practice for Description and Identification of Soils Visual-Manual Procedure. Soil units will be identified by Unified Soil Classification System group symbol. Consolidated sedimentary rocks will be described and classified according to currently accepted geologic formation names.

Soil samples for laboratory analysis will be collected from the boreholes, in agreement with the procedures outlined in Section 4.4. An estimated total of 6 soil samples will be collected for final analysis: three from the vertical exploratory hole and one from each of the angled

boreholes. It is likely that additional samples will be logged and collected during the field investigation, but not necessarily analyzed.

### 3.3 MONITORING WELL CONSTRUCTION

Within the vertical exploration borehole, Wenck will direct the construction of a monitoring well, if groundwater is encountered. A conceptual well diagram is presented in **Figure 4**. The well will be constructed of 2-inch diameter, flush threaded Schedule 40 PVC screen and blank casing. The monitoring well will consist of 10 feet of 0.010-inch, factory-slotted PVC screen installed across the water table and flush threaded Schedule 40 PVC blank casing, with a flush mounted surface completion. A filter pack consisting of new clean, inert, well-rounded, #10-20 silica sand will be installed such that the filter pack fills the annular space from the bottom of the borehole to at least 2 feet above the top of the screen interval. To create a bentonite seal immediately above the filter pack, the contractor will install bentonite chips into the annular space to a depth of 2 feet from ground surface. The bentonite chip seal will be hydrated with water during installation to ensure complete hydration of the seal. The flush mount completion will be placed from 2 feet below to ground surface and secured with soil.

#### 3.4 WELL DEVELOPMENT

After installation, Wenck will develop the monitoring well using a submersible pump or bailer, if water levels in the well allow. The monitoring well will be developed following well construction and possibly prior to the installation of the flush mount surface seal. Wenck will allow sufficient set time for the bentonite to seal before starting development activities. Developing the wells as soon as possible after drilling will help remove the fine silt and clay that can impede the flow of groundwater into the well. It will also facilitate the removal of any drilling fluids used during exploration borehole drilling and well construction. No detergents, soaps, acids, bleaches, or other additives will be used during well development.

To facilitate the development of the entire length of the well screen, Wenck will move the submersible pump or bailer thorough the screened interval while pumping. Such movement of the pump or bailer will also create a surging action through the water column which will help facilitate the removal of fine grained materials and development of the gravel pack. Development operations will commence approximately 5 feet below the static water level in the screen and proceed to the bottom of the well. Wenck will ensure that the wells are developed until temperature, pH, and electrical conductivity have, respectively, stabilized to within  $\pm 1^{\circ}$ C, 0.1,  $\pm 10^{\circ}$ , and  $\pm 3^{\circ}$  on three successive readings. During this process, Wenck will ensure that at least three well volumes of water have been removed from the well; or until six well volumes have been removed from the well if parameter stabilization is not achieved; or until the well has been pumped dry.

All well development equipment will be decontaminated in accordance with Section 3.6. Groundwater produced during well development will be allowed to infiltrate into the ground within the property, pending the landowner's approval. Wenck will collect water level measurements in the monitoring well prior to and subsequent to development. Well development activities and results will be recorded in a field notebook or on separate well development forms.

### 3.5 LYSIMETER CONSTRUCTION

Within the lysimeter boreholes, Wenck will direct the construction of the six porous tensioncup lysimeters. Details on the lysimeters to be used are included in **Appendix A**. Two lysimeters will be installed in each of the three boreholes at the leachfield. Two lengths of <sup>1</sup>/<sub>4</sub>-inch O.D. polyethylene nylon access tubing will be securely connected to each lysimeter and, if needed, cut at an angle to prevent suction to the lysimeter wall. Prior to installation the lysimeter will be soaked in water and subjected to pressure testing to insure no leaks or loose parts. Each lysimeter will be placed within the auger hole, point down, and surrounded with silica flour and sand. Wenck personnel will oversee installation and insure lysimeters are securely settled in the silica flour. The two lysimeters in each borehole will be separated from each other by sand and bentonite filled annular space. The access tubing will be terminated in 6-inch neoprene tubing, colored to distinguish between vacuum and discharge ends, connected to the sampling vault, and labeled with the lysimeter location and depth below the leach field pipe. The sampling vault will be a typical irrigation control box installed below grade. To create a bentonite seal immediately above the upper lysimeter, the contractor will install bentonite chips or slurry into the annular space and hydrate with water as needed. The drill hole will then be filled with compacted drill cuttings to 2 feet below the surface and completed with a flush mount surface cover, secured with soil. The soil surrounding the surface cover will be kept free from obstructions to avoid reducing infiltration.

#### 3.6 DECONTAMINATION

Wenck will ensure that its personnel and subcontractors appropriately decontaminate drilling, well development, and sampling equipment prior to and after use. Samples and decontaminated equipment will be prevented from contacting potentially contaminated substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.

Large pieces of drilling equipment including drill rods, bits, and coring tools will be washed with high pressure hot water, and if necessary, scrubbed until all visible dirt, grime, grease, oil, loose paint, rust flakes, and other deleterious materials have been removed. The equipment will then be rinsed with potable water.

Sampling and down hole measuring equipment, and smaller devices such as sample bottles, will be rinsed and cleaned on both the inside and outside before collection. External surfaces of submersible pumps will be scrubbed and rinsed in potable water and the pump interior will be cleaned by pumping potable water or detergent solution through the pump and any non-dedicated tubing for at least five minutes. A pre-wash of isopropyl alcohol may be used during equipment decontamination at the discretion of the field sampling crew to remove oily or other adhering contamination. The equipment will be air dried on a clean surface or rack, to the extent possible. Decontamination fluids should remain free of contaminants and will be replaced as necessary.

Used detergent wash water, rinse water, and accumulated sediment generated during decontamination will be allowed to infiltrate on the ground surface within the property, pending the landowner's consent. Isopropyl alcohol, if used will be containerized and disposed of offsite. Trash and debris generated during well installation and sampling activities will be contained and disposed of properly.



Wenck will collect water and soil moisture samples at six sampling events throughout one year. To capture the seasonality of Casper Aquifer recharge and potential changes in nitrate concentrations, sampling events will occur in or around the months of February, April, May, June, September, and December 2018. Samples will be analyzed for the parameters specified in Section 4.5. The depth to water in the monitoring well will be measured during each sampling event in accordance with Section 4.1.

#### 4.1 WATER LEVEL MEASUREMENTS

During each sampling run, the water level in the monitoring well will be measured, if possible, to determine the volume of water in the well casing. The depth to water in the monitoring well will be measured no earlier than 24 hours after well construction or well development, to allow the water levels in the well to recover. The groundwater level in the monitoring well will be measured to the nearest 0.01 foot using an electric Solinst® water level indicator. A notch or casing marking will be measured no future water level measurements. During each field visit, the water level will be measured from this reference point on the well casing and recorded in a field notebook or groundwater sampling sheet.

#### 4.2 VADOSE WATER SAMPLE COLLECTION

Wenck will collect vadose zone samples from each of the lysimeters for laboratory analysis during all six of the above sampling events. Before collecting water samples, the sampler will utilize clean nitrile protective gloves. Samples will not be filtered, resulting in total (rather than dissolved) results for constituent analysis. Wenck will also collect a number of field water quality control (QC) samples throughout the life of the test, in accordance with Section 5.4. Temperature, electrical conductance, and pH will be analyzed in the field during sampling using calibrated field instruments, if a sufficient amount of water can be obtained.

#### 4.3 SEPTIC TANK SAMPLING

Wenck will collect base effluent samples from the septic tank twice during the test. On the first and last sampling event, respectively, an effluent sample will be collected from the middle zone of the septic tank, between the scum and sludge layers. An effort will be made to disturb water as little as possible prior to or during sampling. Samples will be collected in clean containers and laboratory tested for the constituents specified in Section 4.5. After the final sampling event, a honey truck will be used to pump clean the landowner's septic tank. Temperature, electrical conductance, and pH will be analyzed in the field during sampling using calibrated field instruments.

#### 4.4 SOIL SAMPLE COLLECTION

During drilling of the investigation and lysimeter boreholes, soil samples will be collected for laboratory analysis. In the vertical exploratory borehole, a total of three samples will be collected at intervals to be determined in the field. In the three angled holes one sample each will be collected at a representative location via either Shelby Tube or Dry Core System. All soils samples and soil intervals will be logged by a licensed geologist and will describe color, texture, visible constituents including organic matter, gypsum and calcium carbonate. Samples for laboratory analysis will be collected from the boreholes, logged,



January 2018 Z:\WPFinal\OPEN\WYALB101\WORK PLAN\Work Plan.docx placed into Ziploc plastic bags, and shipped to the laboratory, following chain-of-custody procedures detailed in Section 5.3.

#### 4.5 LABORATORY ANALYSIS

Wenck will ship the water and soil samples for this project to Inter-Mountain Labs in Sheridan, Wyoming, a commercial analytical laboratory, for analysis of the following parameters.

Septic Tank Water:

LQD Guideline 8 with no radionuclides

Soil Moisture:

- Chloride
- Total Phosphorus
- Nitrate
- Nitrite
- Total Kjeldahl Nitrogen

Soil:

- Adsorption
- Total Nitrogen
- Nitrate
- Organic Matter

Soils will only be analyzed for the first sampling event, immediately after drilling and equipment installation. Base (septic tank) effluent samples will only be analyzed during the first and last sampling event. Vadose water samples will be analyzed for all six lysimeters for each sampling event. Control limits for precision and accuracy will be based on (in order of precedence) analytical method requirements, and laboratory-established control limits, and will be determined prior to sampling.



This section describes the field, quality control (QC), and analytical procedures to be followed throughout the site monitoring.

#### 5.1 GENERAL SAMPLE COLLECTION AND HANDLING PROCEDURES

All water samples will be placed in containers provided by the analytical laboratory, and the container caps will be securely fastened for shipment. Container and preservation requirements, as dictated by the laboratory providing the sample bottles, will be met.

#### 5.2 FIELD EQUIPMENT CALIBRATION

Collection of data in the field requires the use of equipment having acceptable limits of accuracy and precision. Functionality of all equipment that is used in the field will be checked and routinely calibrated. Calibration and repair logs will be maintained on all of the equipment that is used. Calibration and maintenance will follow manufacturer specifications.

#### 5.3 SAMPLE CUSTODY

Procedures to ensure the chain-of-custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records. Chain-of-custody records will be maintained for all field and field QC samples from time of collection to its arrival at the laboratory. A sample is defined as being under a person's custody if any of the following conditions exist: 1) it is in their possession; 2) it is in their view, after being in their possession; 3) it was in their possession and they locked it up, or 4) it was in a designated secure area.

When the samples are shipped, the person in custody of them will relinquish the samples by signing the chain-of-custody and noting the date and time. The sample control officer at the laboratory will verify sample integrity and confirm that it was collected in the proper container, preserved correctly, and that there is an adequate volume for analysis. If these conditions are met, the sample will be assigned a unique log number for identification throughout the analysis and reporting. The log number will be recorded on the chain-of-custody form and in the legally required logbook maintained by the laboratory.

The information documented on the chain-of-custody form will also include the sample identification, the date and time of sample collection, the analysis required, the name of the sampler, and custody transfer signatures (along with date and times) for sample transfer from the field to the analytical laboratory. Samples will be uniquely identified, labeled, and documented in the field at the time of collection, and will be transported to the laboratory as expeditiously as possible. The samples will be packed in ice to keep them cooled to less than 4° Celsius during collection and transportation.

#### 5.4 SAMPLE IDENTIFICATION

Each sample container submitted for analysis will have a securely fixed label to identify the job number, sampler, date and time of collection and a unique sample number. This information, in addition to a description of the sample, field measurements made, sample



methodology, names of on-site personnel and any other pertinent field observations will be recorded on the field sampling records.

#### 5.5 ANALYTICAL QUALITY ASSURANCE

In addition to routine calibration of the analytical instruments with standards and blanks, Wenck will collect field water QC samples for 10 percent of the analyses throughout the life of the test. These samples will include field duplicates (to assess field precision) and field blanks (to check the decontamination method) as an added measure of precision and accuracy. Accuracy is also verified through the following:

- 1) U.S. Environmental Protection Agency and state certification programs.
- 2) Participation in an inter-laboratory quality assurance program.
- Verification of results with an alternative method. For example, calcium may be determined by atomic absorption, ion chromatography or titrimetric methods. Volatile organics may be determined through either purge and trap or liquid-liquid extraction methods.

#### 5.6 MISCELLANEOUS CHECKS OF ACCURACY

Where trace analysis is involved, purity of the solvents, reagents, and gases employed is of great concern. The laboratory maintains a service contract on all major instrumentation; gas chromatographs, atomic absorption, ion chromatography and total organic carbon analyzers are all served and maintained regularly. The laboratory may also provide additional quality assurance documentation including method blanks, spikes and duplicates on the lot of samples analyzed.



The following sections detail the site contacts, proposed costs and deliverables, and project schedule for implementing the septic system impact analysis for Albany County.

#### 6.1 ADDITIONAL ANALYSIS

Following collection of the vadose water sampling results, Wenck plans to perform geochemical modeling using programs such as Geochemist's Workbench, PHREEQC, or Acuchem, depending on the primary nitrate removal mechanism that is identified. Based on the data that are obtained in this investigation and any other relevant background data, Wenck will provide (1) a review of nitrate removal mechanisms at work in the project area; and (2) predictions of nitrate removal capacity under various scenarios. These data may be helpful for comparison with future studies of this type.

#### 6.2 CONTACTS

#### Albany County

David Gertsch Planning Director 1002 South Third Street Laramie, WY 82070 (307) 721-2568 Email: dgertsch@co.albany.wy.us

#### Consultant

Chris Lidstone, PG, Regional Manager Mark Stacy, PG, Senior Hydrogeologist Wenck Associates 4025 Automation Way, Bldg. E Fort Collins, CO 80525 (970) 223-4705 Fax (970) 223-4706 Email: <u>clidstone@wenck.com</u> <u>mstacy@wenck.com</u>

#### **Regulatory Agency**

Nicole Twing, Geology Supervisor Wyoming Department of Environmental Quality Groundwater Pollution Control Program 200 West 17<sup>th</sup> Street, 4<sup>th</sup> Floor Cheyenne, WY 82002 (307) 777-8275 Email: nicole.twing@wyo.gov

#### 6.3 DELIVERABLES

In addition to this work plan, the following deliverables will be generated for this project:



A final report which will include the following:

- Description of all field activities including lysimeter and monitoring well construction, well development, and sampling;
- Well completion and lithologic logs for each borehole;
- Summary of water level data;
- Summary of analytical data for all water, soil moisture, and soil sampling events with a comparison to DEQ's protection standards, and analytical data sheets provided in an appendix;
- Recommendations for additional testing;
- Electronic submittal of analytical data in DEQ's format; and,
- Conclusions based on the monitoring results, including predictions of nitrate removal capacity under various scenarios.

Ten copies of the final report will be prepared and submitted to Albany County along with a digital copy. Wenck will also prepare interim letter reports with invoices for the sampling events for use with applying for cost reimbursement from DEQ throughout the course of the project.

#### 6.4 SCHEDULE

Following is the proposed schedule for equipment installation and sampling, which is contingent upon approvals from Albany County and DEQ:

- Work plan approved by DEQ: Early February 2018.
- Drilling, monitoring well and lysimeter installation, and development completed by the end of February 2018 (estimated to take three days). Drilling is contingent upon weather conditions and will be expedited if possible.
- First round of groundwater sampling: February 2018 (1 day).
- Second round of groundwater sampling: April 2018 (1 day).
- Third round of groundwater sampling: May 2018 (1 day).
- Fourth round of groundwater sampling: June 2018 (1 day)
- Fifth round of groundwater sampling: September 2018 (1 day).
- Sixth round of groundwater sampling: December 2018 (1 day).
- Submit final report: May 2019.
- Submit close-out files: June 2019.

This schedule is sufficient to provide DEQ and Albany County with the required data in advance of the May 15, 2019 deadline.



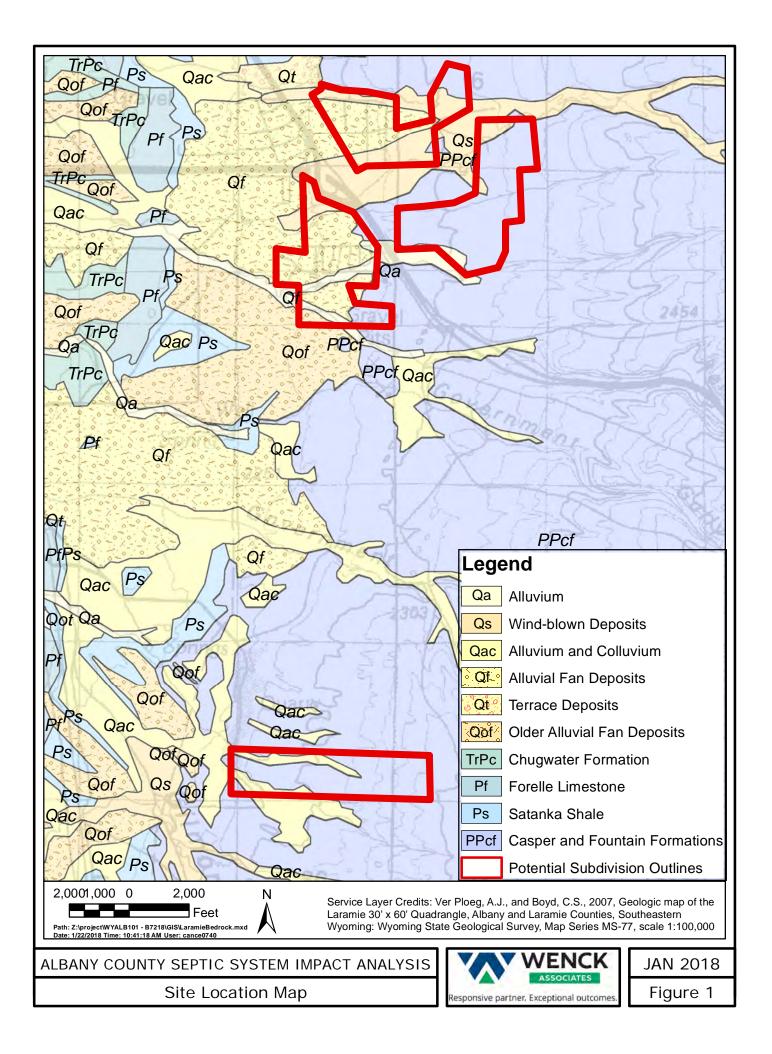
City of Laramie, 2009, Report on Summer/Fall 2009 Nitrate-Nitrogen Monitoring in the Casper Aquifer Protection Area. City of Laramie staff report to the Laramie City Council.

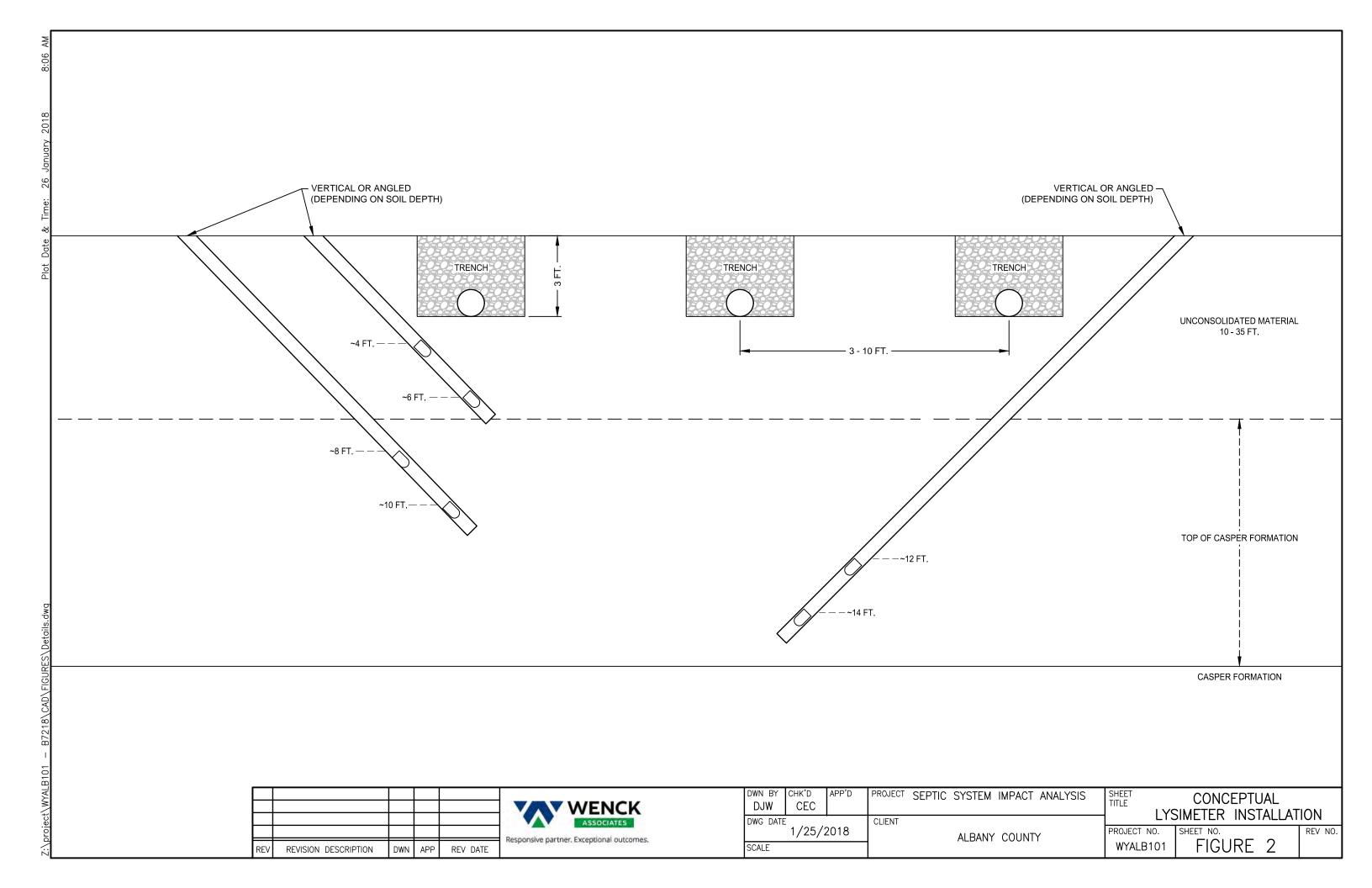
Tempo, 1979, Monitoring in the Vadose Zone: A Review of Technical Elements and Methods: U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory.

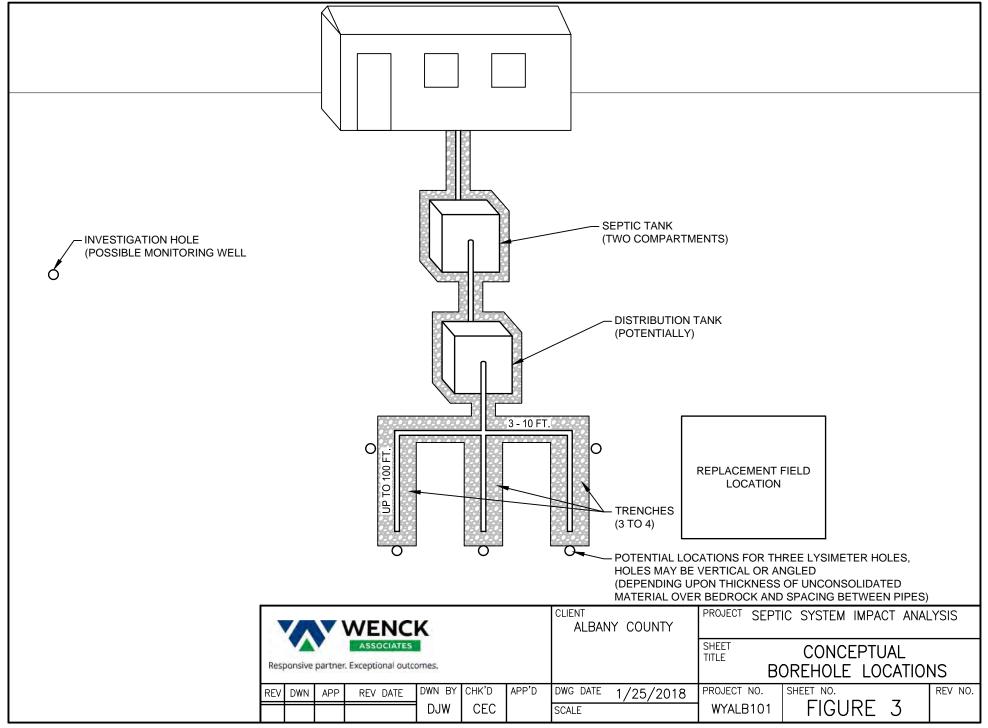
Western Water Consultant, Inc. (WWC), 2015, 2015 Laramie Water Master Plain, Level I, Report to Wyoming Water Development Commission, December 2015, Volume II.



- Geologic Map 1.
- Conceptual Lysimeter Installation Design Conceptual Borehole Locations 2.
- 3.
- Conceptual Well Diagram 4.

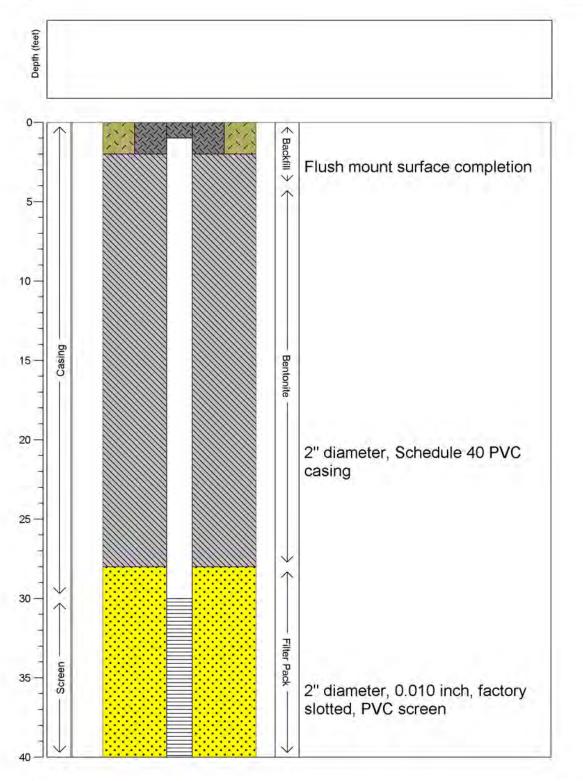








Project: Albany County Location: Albany County Drilled by: Date started. Date completed: Well Name: Drilling Method: Total depth: 40' Elev.:



Notes:	

Lysimeter Instructions



# OPERATING INSTRUCTIONS

#### 1920F1 Pressure-Vacuum Soil Water Samplers

March 2017





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# **HISTORY/GENERAL USES**

Soil Water Samplers had their origin back in 1961 when we cooperated with Dr. George H. Wagner at the University of Missouri to manufacture a porous ceramic cup for collecting soil water samples. The outgrowth of this work was our first commercial Soil Water Sampler, Model 1900 Soil Water Sampler. Since that time, these samplers have been generally accepted as an ideal tool for in situ collection of soil water samples for a great variety of soil moisture monitoring work.

The initial and most extensive use of these Samplers was made by Pennsylvania State University, largely under the direction of Dr. L. T. Kardos and others, on the Pennsylvania Waste Water Project. Modifications of the original 1900 Soil Water Sampler by Richard R. Parizek and Burke E. Lane at Pennsylvania State University, reported on in the Journal of Hydrology, produced a pressure-vacuum type unit. Since that time, we have made available commercially the Model 1920 Pressure-Vacuum Soil Water Sampler. Some of our Soil Water Samplers have been in continuous use for several years and still yield satisfactory soil moisture samples.

All of our ceramics are made from formulations which contain various proportions of kaolin, talc, alumina, ball clay, and other feldspathic materials, using proprietary formulas developed through research and experience accumulated over more than 4 decades.

Our samplers find applications not only in research work such as quantitative chemical analysis of soil water, but also for pollution control purposes in monitoring moisture under sanitary landfills, irrigated areas with wastewater, and areas where reclaimed or recycled water is used on a routine basis to assure compliance with government standards.

Soilmoisture's line of Soil Water Samplers has proven to be an excellent and reliable means for obtaining soil water samples from both saturated and unsaturated soils at depths ranging up to several hundred feet.

Soilmoisture's Soil Water Samplers, which are also referred to as



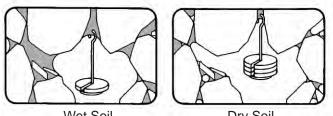
## **OPERATING PRINCIPLES**

"suction lysimeters" or "lysimeters", have been in general use around the world for many years.

Soil water is held largely under a state of tension (negative pressure) within the soil by capillary forces. The capillary force is the sum of the adhesive and cohesive forces. The adhesive force is characterized as the attraction of water for soil solids (soil and organic matter). Cohesive force is characterized as the attraction of water for itself. Adhesive force is far greater than the cohesive force.

Water is naturally attracted to soil particles (by its adhesive quality) and "sticks" to the surface of each particle and in the various sized "capillary" spaces or "pores" between the soil particles. When the soil is very wet, the large pores fill with water. This "excess" water has no direct surface contact with the soil and is held cohesively, one water molecule to another, and can move quite freely. As a soil dries out, the "excess" water first evaporates as it requires less energy to break the cohesive bonds. The remaining water, held tightly inside the capillary spaces by adhesive qualities, requires more energy to remove it from the soil.

The following illustration (see Figure 1) shows the increasing force required to remove water from the small-sized capillary pores compared to the large pores as the soil dries out. When the remaining water is held only in extremely small pore spaces, it requires more energy to remove the water from these pores. Even though there may be a considerable volume of water in the soil, the tension that holds the water determines how readily it can be removed.



Wet Soil

Dry Soil

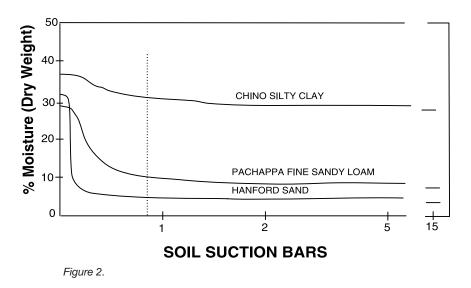
This tension that determines how moisture moves in the soil is referred to as "soil water tension", "negative pore pressure", or "soil suction". For simplicity's sake we refer to this tension as "soil suction" in these instructions, but keep in mind that negative pressure is the most descriptive term.

The following graph shows the relationship between the percent of moisture in a soil and the soil suction required to remove the moisture from three types of soil: clay, loam, and sand.

The graph (see Figure 2) illustrates that it is easier to remove water



from a sandy soil with 10% moisture, than it is to remove water from a clay soil with 30% moisture. This is because the water in the clay soil is held in very small capillary spaces within the soil particles under a higher soil suction, whereas the sandy soil holds water in large capillary spaces under a lower soil suction.



Soilmoisture's Soil Water Samplers allow water to be removed from the soil by creating a vacuum (negative pressure or suction) inside the sampler greater than the soil suction holding the water in the capillary spaces. This establishes a hydraulic gradient for the water to flow through the porous ceramic cup and into the sampler. Note: when evaluating soil suction ratings of a ceramic plate or cup, a positive pressure rating is used. Water can be held at tensions far greater than 1 atm (the limit for vacuum-type measurements). Positive pressure can force water out of capillary pores equivalently as negative pressures, and is the practical method for evaluation of soil suction.

In practice, a vacuum is drawn in the Soil Water Sampler that exceeds the soil water tension. Then liquid water will flow to the ceramic cup due to the potential gradient (i.e. water will move from less negative potential to more negative potential). The practical limit for water flow in soils is about 65 cb (centibar) (although in some soils, the value can approach 85 cb). When soil moisture tensions exceed 2 bars, the wetted meniscus in the ceramic pores will break and the Soil Water Sampler will appear to be unable to hold vacuum. The ceramic cup will have to be rewetted to hold a vacuum and soil moisture tensions will have to decrease to less than 85 cb before water can again be moved toward the ceramic cup.

Additional information on the advantages and disadvantages of Soil

Water Samplers in general can be found in Chapter 19, "Compendium of In Situ Pore-Liquid Samplers for Vadose Zone" (Dorrance et al.), of the ACS Symposium on Groundwater Residue Sampling Design (April 22-27, 1990) and the ASTM Designation D4696-92 "Standard Guide for Pore-Liquid Sampling from the Vadose Zone" (Vol. 04.08 Soil and Rock (I): D4696).

Remove all packing materials and check the Soil Water Sampler for



# YOUR NEW PRESSURE-VACUUM SOIL WATER SAMPLER

Unpacking	any damage that may have occurred during shipment.	
	If the Sampler is damaged, call the carrier immediately to report it. Keep the shipping container and all evidence to support your claim.	
Assembly	The standard 1920F1 Pressure-Vacuum Soil Water Sampler was assembled and testedprior to shipment.	

All other accessory items necessary for proper use are discussed later in these instructions and are listed on page 16. Please read all instructions thoroughly before installing the Sampler. To assure optimum cleanliness of the assembly, no grease or organic solvents have been used in its manufacture.

conditions in the applications intended for this equipment.

Not Liable for Improper Use Soilmoisture Equipment Corp. is not responsible for any damage, actual or inferred, for misuse or improper handling of this equipment. The Pressure-Vacuum Soil Water Samplers, Models 1920F1, are to be used solely as directed by a prudent individual under normal



# **ACQUAINT YOURSELF WITH THE PARTS**

The Pressure-Vacuum Soil Water Sampler (Model 1920F1) comes fully assembled. The Pressure-Vacuum Soil Water Sampler (see Figure 3) is constructed of a 1.9 inch O.D. PVC tube (made of FDAapproved material) with a 2 bar porous ceramic cup bonded to one end. The serviceable end of the Sampler is completely sealed and two 1/4inch tube connectors protrude from the top. The white tube connector indicates the "Pressure/Vacuum" side and is used exclusively for pressurizing and evacuating the Sampler. The green tube connector is used to recover the collected sample.

Two 1/4-inch O.D. polyethylene access tubes are used for pressurizing and recovering samples which are terminated in neoprene tubing. Clamping rings are used to clamp the neoprene to keep the Sampler

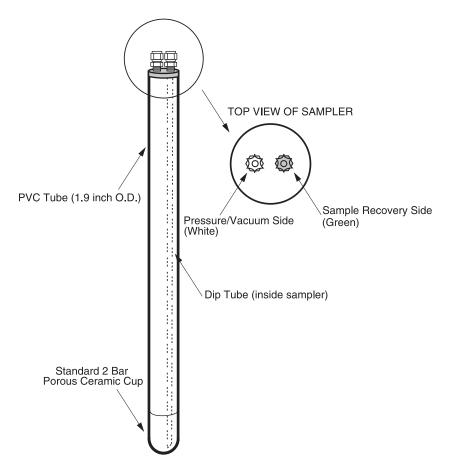
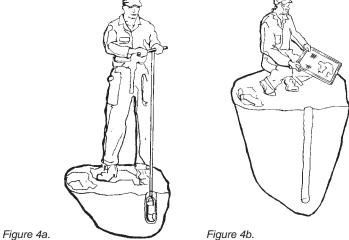


Figure 3. Pressure-Vacuum Soil Water Sampler



# **REQUIREMENTS PRIOR TO USE AND HOW TO OPERATE**

Attaching the Access Tubes	under negative pressure (not shown here). Once the depth and location for the Pressure-Vacuum Soil Water Sampler have been established, you must determine the required length for the access tubes before they are cut and attached to the Soil Water Sampler.
	The access tubes are generally made of 1/4-inch O.D. polyethylene, nylon tubing. Each access tube is inserted into the loosened top portion of the tube connector located on the serviceable end of the Soil Water Sampler. Tighten the fittings to finger tightness. We recommend using 2 different colors of tubing to differentiate between the two connectors in order to eliminate mistakes in identifying the access tubes once the Sampler is placed in the soil. Soilmoisture offers both black and green polyethylene tubing, models 1903L and 1904L respectively.
Pressure Testing Before Installa- tion	We highly recommend pressure testing the complete Sampler assembly prior to installation. Your prior testing will confirm the integrity of all joints and components.
	After allowing the ceramic portion of the Sampler to soak in water for approximately two hours, a sustained pressure of 20 psi can be applied to the submerged Sampler, associated tubing, and connectors. Continuous bubble formation indicates leakage and shows the exact location of any leak.
Coring the Hole	The Pressure-Vacuum Soil Water Sampler, Model 1920F1, may be installed at any depth up to a maximum of 50 feet.



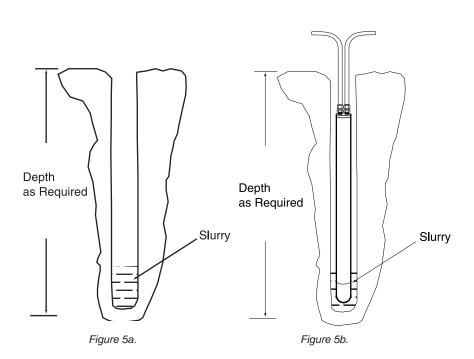
In rock-free, uniform soils at shallow depths, use a 2-inch screw or bucket auger for coring the hole (Figure 4a). If the soil is rocky, a 4-inch auger should be used. The soil is then sifted (Figure 4b) through a 2mm mesh screen or 2mm sieve to free it of pebbles and rocks.

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This will provide a reasonably uniform backfill soil for filling in around the Soil Water Sampler. Soilmoisture has suitable soil augers for this purpose (234 Series augers). There are other methods for installing the Soil Water Sampler to be used, largely dictated by the type of soil you are dealing with and the tools available. The primary concern in any method of installation is that the porous ceramic cup of the Sampler be in tight, intimate contact with the soil so that soil water can move readily from the pores of the soil through the pores in the ceramic cup and into the Soil Water Sampler.

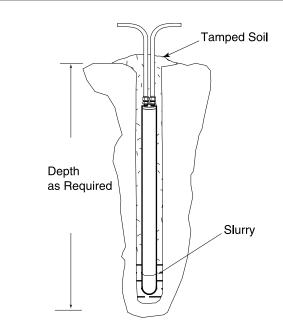
#### Preparing The Hole Using a Slurry and Backfilling The Hole

After the hole has been cored, mix sifted soil with water to make a slurry which has a consistency of cement mortar. This slurry is then poured down to the bottom of the cored hole to insure a good soil contact with the porous ceramic cup (see Figure 5a).



Immediately after the slurry has been poured, insert the Soil Water Sampler down into the hole so that the porous ceramic cup is completely embedded in the soil slurry (see Figure 5b).





Backfill the remaining area around the Sampler with sifted soil which is free of pebbles and rocks, a 2mm sieve is popular for this. Tamp the soil firmly to prevent surface water from running down the cored hole, or make a bentonite seal. (see Fig. 6)

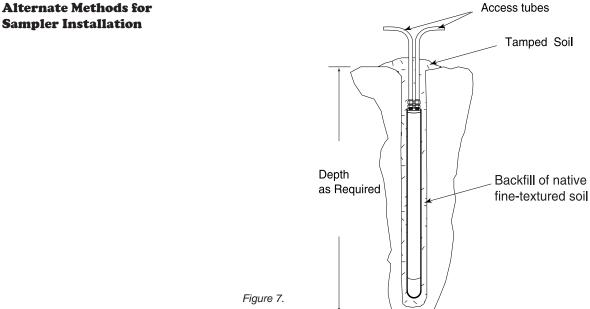


Figure 6.

If the soil into which the Sampler is being installed is fine-textured and free of rocks, a slurry may not be necessary. Core the hole to the desired depth, insert the Soil Water Sampler and backfill the hole with native soil, tamping continuously to insure good soil contact with the porous ceramic cup and complete sealing of the cored hole (see Figure 7).

**Sampler Installation** 



In a coarse-textured or rocky soil, it may be difficult to make a suitable slurry from the existing soil. A slurry can be made using silica flour, which is then used to establish good contact between the ceramic cup and the soil. For a 2-inch diameter hole, 1 lb. of silica flour is needed, while a 4-inch diameter hole will require 4 lbs. of silica. Mix the silica with water to produce a slurry with a consistency of cement mortar.

Core the hole to the desired depth, and pour in about 1/4 of the silica slurry. Insert the Soil Water Sampler and pour in the remainder of the slurry so that the slurry completely covers the ceramic cup. Backfill the hole with sifted soil (free of pebbles and rocks), tamping continuously with a metal rod to prevent surface water from channeling down between the soil and the body tube of the Sampler (see Figure 8).

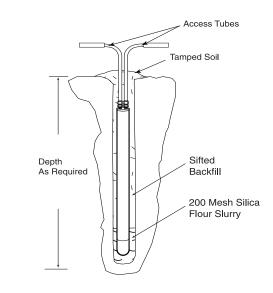
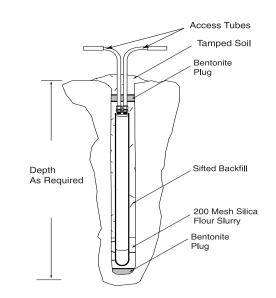


Figure 8.

To ensure that disturbed soil resulting from the installation of the Sampler does not affect the movement of water to the Sampler, Bentonite clay plugs can be installed. Core the hole a few inches deeper than the desired depth, and pour in several inches of wet Bentonite clay (see Fig. 9). This will isolate the Sampler from the soil below. Pour in 1/4 of the slurry, either of soil or of Silica, and insert the Soil Water Sampler. Pour the remainder of the slurry around the cup of the Soil Water Sampler. Backfill with native soil to a level just above the Soil Water Sampler and again add sufficient Bentonite as a plug to further isolate the Soil Water Sampler and guard against possible channeling of water down the hole. Backfill the remainder of the hole slowly, tamping continuously with a metal rod using native soil, free of pebbles and rocks.





#### **Protecting the Access Tubes**

After installation, the access tubes from the Sampler are terminated with a 6-inch length of neoprene tubing (MRT003)above the Sampler installation. Or, if conditions require, place the neoprene-terminated access tubes in a trench, terminating above the soil surface at a remote location. We recommend that the access tubes be protected inside a conduit tube running from the top of the Sampler to the termination at the surface. At the surface level, take care that the access tubes are safe from damage by mechanical equipment or animals. Do not cover the surface area directly above the Sampler in any manner that would interfere with the normal percolation of soil water down to the depth of the Sampler, otherwise the obstruction could have an adverse affect on your soil water sample.

**Collecting A Sample in the Sampler** clamping ring, and the vacuum port of the hand pump is connected to the Pressure-Vacuum access tube. The pump is then used to create a vacuum of about 60 cb inside the Sampler, which is indicated on the gauge connected to the pump (see Fig. 10).

Figure 9.

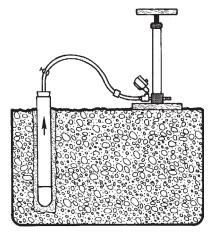


Figure 10. The vacuum within the Sampler causes the water to move from the soil,

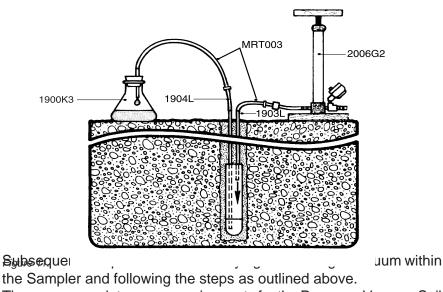
13



through the pores of the porous ceramic cup, and into the Sampler. The rate at which the soil solution will collect within the Sampler depends on the capillary conductivity of the soil, the soil suction value within the soil (as measured with tensiometers), and the amount of vacuum within the Sampler. In moist soils of good conductivity, at field capacity (10 to 30 cb of soil suction as read on a tensiometer) substantial soil water samples can be collected within a few hours. Under more difficult conditions it may require several days to collect an adequate sample.

In general, a vacuum of 50 to 85 cb is normally applied to the Soil Water Sampler. In very sandy soils, however, it has been noted that very high vacuums applied to the Soil Water Sampler seem to result in a lower rate of collection of the sample than a lower vacuum. It is our opinion that in these coarse, sandy soils, the high vacuum within the Sampler may deplete the moisture in the immediate vicinity of the porous ceramic cup reducing the capillary conductivity, which creates a barrier to the flow of water to the cup. In loams and gravelly clay loams, users have reported collection of 300 to 500 ml of solution over a period of a day with an applied vacuum of 50 cb, when soils are at field capacity. At waste water disposal sites, users have obtained 1500 ml of sample solution in 24 hours following cessation of irrigation with 1 to 2 inches of waste water on sandy or clay loam soil.

To recover a soil water sample, remove the Pressure-Vacuum tube from the vacuum port of the pump, and attach the tube to the pressure port. Place the discharge access tube in a small collection bottle and remove both clamping rings. Apply a few strokes on the hand pump to develop enough pressure within the Sampler to force the collected water out of the Sampler and into the collection bottle (see Fig. 11).



# There are no maintenance requirements for the Pressure-Vacuum Soil Water Sampler other than protecting the access tubes from damage.

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**Recovering a Sample from the Soil** 

Water Sampler

# **MAINTENANCE AND PRECAUTIONS**

Tube ends should be covered or plugged to prevent debris from entering the tubes and later contaminating the Sampler.

Freezing conditions will not damage the subsurface parts of the Samplers. The Samplers are normally left permanently in place all year round. Water may freeze in the sample line near the surface during saturated freezing conditions. Be sure all the water is removed from the sample line before clamping it for the next sample.

If the soil suction exceeds 2 bars, the ceramic cup may need to be rewetted to obtain a sample. This is accomplished by pouring approximately 250 ml of deionized water down the sample line (both the pressure-vacuum and the sample lines must be open). After waiting approximately one hour, pressurize the pressure-vacuum line to remove any excess water. A vacuum can be applied after the ceramic cup has been rewetted. If no sample is obtained after following the above rewetting procedure, the soil suction is probably in excess of 85 cb.

**Rewetting The Sampler** 



# SPARE PARTS AND ACCESSORIES LIST

0922W Bentonite (5 lb., 10 lb., or 50 lb. bag sizes) 0930W Silica Flour (5 lb., 10 lb., or 50 lb. bag sizes) 1900K4 Wide-mouth Sample Bottle, polypropylene - 1,000 ml (autoclavable) 1902K3 Centralizer with Centralizer Adapter Kit 1902K4 1-1/2" Stainless Steel Coupling Assembly 1903L Black Polyethylene Tubing (100 ft., 500 ft., or 1,000 ft. rolls) 1904L Green Polyethylene Tubing (100 ft., 500 ft., or 1,000 ft. rolls) 2006G2 Pressure-Vacuum Hand Pump (with gauge) 2031G2 Clamping Rings (per doz.) **MRT003** Neoprene Tubing, 3/16-inch I.D. x 1/16-inch wall (10ft, 25ft, or 50ft, rolls)

#### Note:

All Pressure-Vacuum Soil Water Samplers come in 6-inch, 12-inch, 24-inch or 36-inch lengths. They can also be special ordered with either a 1 Bar High Flow (30 ft. maximum depth range) or 1/2 Bar Standard (15 ft. maximum depth range) porous cup instead of the standard 2 Bar cup. Please contact our Sales Department for further details.

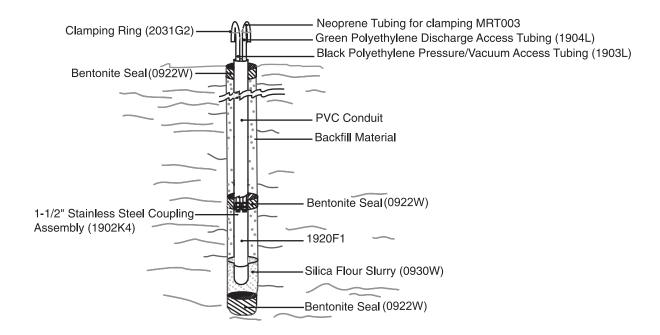


Figure 12. Complete sampler installation with accessories

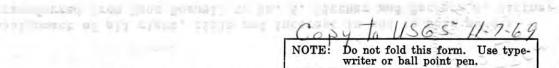
© Copyright 2007 All rights reserved 0898-1920F1K1.PM6 (7/07)



Site Leachfield Information

Form U.W. 7 \*\*Completed Prior to May 24, 1969

Х



**STATE OF WYOMING** 

OFFICE OF THE STATE ENGINEER

STATEMENT OF COMPLETION AND DESCRIPTION OF WELL

for Domestic or Stock Watering Use Only

a preferred water right is given to such use when the yield minute. Domestic use refers to household use and the wa		
3166	Temporary Filing No	
Permit No. U.W	Temporary Finng No	
Vater Division No		
J.W. District <u>LARAMIE</u>		
Name of Well Boswell No.		WELL LOCATION
IF WELL IS TO BE ABANDONED, SI	EE TTEM 21	<b>D</b> 11
		<u>Albany</u> County <u>W 1/4 of SE 1/4 of Sec. /</u>
1. Owner 2. Address Dills ( Sprate Laramie	na a. Bitthee	1
1. Owner Address MAN TAILS 1 & PTATE   Or angie	11,40, 82070	14 of SE 1/4 of Sec.
2. Address DEACTO LATANIE 3. Agent to receive correspondence <u>Same</u>	т.	15 N., R. 73 W.
4. Name & address of driller Mr B Drilling	01	N
4. Name & address of drifter Che yenne, W	Loming	
/		
5. Well is constructed on lands owned by <u>Ment</u> (Obtaining of easement or right of way is the respondence)	nsihility of the applicant's	NW1/4NE1/4
Include copy if land is privately owned and owner is		
6. Type of construction: Dug 🗆 Drilled 🖻		
	Type of Rig	E
Driven 🛛 Jet 🗆 Other		
7. Use of Water—Domestic 🖾 Stock 🗆		SW 1/4 SE 1/4
8. Means of conveyance, distance and direction to point o To house 25 N-by 1" up den	i use	
9. Date started Any April 21, 1969	round pipe	
0. Date completed <u><i>Roy</i></u> , 27, 1969	(including pump)	
1. Date after completion when water was used Ma		S
2. WELL DESCRIPTION		Scale: $2'' = 1$ mile
Total Depth 176 Depth to Static	Water Level_50 Ab	ove diagram represents one full
3. TEST DATA		tion. Locate well accurately in
Yield How Tested	Air sm	all square representing 40 ac. or
Drawdown Length of Test		the above does not apply fill in
4. PUMP DATA	the	following:
Type Submersible Power Source (Turbine, Centrifugal, etc.)	(Elec., Gas, etc.) Lo	t Block//
Horsepower 3/4 Yield 7-15		y, Town or Subdivision:
5. CASING RECORD		IIIELL
9/ Plain Casing	5	herman Hill Estates
Size <u>5</u> /16 Kind <u>57ee</u> from from	0_ft. to 126_ft. Al	bany County, 10 yoming
SizeKindfrom	ft. toft.	(Include filing or number)
Size Kind from Perforated Casing	ft. toft.	K+171 P= +305
Size Kind from	ft, toft.	- 11, 1g. 40 00
Size Kind from	ft. toft.	
CONSTRUCTION		
<ol> <li>CONSTRUCTION Was surface seal provided? Yes</li></ol>	t Depth Material used:	Cement plug
Was surface casing used? Yes 🗵 No 🗆 Was it co		
7. FLOWING WELL (Owner is responsible for installing		
Controlled by: Valve 🗆 Cap 🗆 Plug 🗆 Does well	i leak around casing : 1 es 🗌 No 🎽	

3166

Permit No. U.W.

THE MILLS COMPANY, SHERIDAN 124861

21. Book No. \_\_\_\_ Page No. \_ 11. 18. Ground Elevation, if known\_

19. LOG OF WELL-Clearly indicate first water bearing material and principal water bearing material.

From Feet	To Feet	Material Type, Texture, Color	REMARKS (Cementing, Shutoff, Packing, etc.)	Indicate Water Bearing Formation	Indicate Perforated Casing Location	
0	20.	Top soil & roch				
20	35	Sand + rock				
35	55	Hard Fink Limestope	cement plug	pt 40'		
55	25	Red Limestope	1.0			
75	95	Boot	A			
95	115	1/				
115	135	*				
135	150	4			and the second second	
150	170	Sandstone				
170	176	Red Limestone				
1			-	- 1970		
				1		
- minter	Distant .				in the second second	
			12		10 Million 10	
					and the second se	
		Diate II gran				
-	- The second second	L'INTER CONTRACTOR			1 1 2	
0.00	A Shares					
			and the second sec		1	

Was a chemical analysis made? Yes 🗆 No 🔂

If so, please include a copy of the analysis with this form.

If not, do you consider the water as: Good 🛛 Acceptable 🗆 Poor 🗆 Unusable 🗆

Was a bacteriological analysis made? Yes 🗆 No 🗖

If a domestic well, was the well disinfected by the driller? Yes 🛽 No 🗆

21. IF WELL IS TO BE ABANDONED, complete Items 1 through 6, Item 10 and Item 19 (Log of Well) and state reason for abandonment below.

It is the responsibility of the owner to properly plug or fill in the well in order to prevent contamination of ground water and to cover or cap the well at ground level.

REMARKS:

(Signed) (Owner) THE STATE OF WYOMING SS. County of Laramie I hereby certify that the foregoing statement was signed in my presence and sworn to before me by My Commission Expires. 19 C Notary Public 2 7 1969 May 16 Date of Receipt: October 69 Date of Priority: 19. Date of Approval: 194 mons M State Engineer November 13, 1972 - Assignment of all right, title and interest in and to this permit transferred from Kent Boswell to Wm. E. Bittner and Barbara A. Bittner MICRO-NOV 20'72

SCANNED OCT 2 0 2011

U.W. 3166

WSF 191 3-17-66 10000 len

RECORD OF WELL DRILLED

19<u>69</u> AC PROGRAM

FRANGE View}

<u>Imperial Homes, Inc.</u>		
(Name of Operator)	(Farm No.)	(County)
9	1761	5_9/16
(Location of Well)		
Cased: ft. to ft. Type	<i>I.D.</i> Size	Wt.Casing-Lbs./ft
Casedft. toft. Type	Size	Wt.Casing-Lbs./ft
Cased: ft. to ft. Type	Size	Wt.Casing-Lbs./ft
Perforated: ft toft	;; ftt	o ft.
Type of Perforation		
Artesian Well Flow GF	M; Was cut-off	device installed?
Pump Well XX Type pumping e	quipment provid	ed <u>Submersible pump</u>
Static Water Level <u>90</u> ; Pumping	or Bailing Wate:	r Level 1 <u>00</u> ft.at <u>15</u> GPM
How Tested Air	Length	of Test <u>2 hours</u>
Describe Quality of Water (taste, c	odor, color, fi	tness, etc.)good

<u>Driller's Statement</u>: I HEREBY CERTIFY, that the statements entered above concerning this well are true and correct, and that the well log on the reverse side of this form records accurately the depth of the well and the description of formations drilled. I authorize this record to be used to support the producer's claim for cost-sharing under the Agricultural Conservation Program

29-69

Signature of Driller)

<u>Producer's Statement</u>: I HEREBY CERTIFY, that I observed periodically the drilling operations of the above well and to the best of my knowledge I believe that the statements entered above by the driller are true and correct, and that the well log on the reverse side hereof records accurately the depth of the well and description of formations drilled I hereby submit this information to the County ASC Committee in support of my claim for cost-sharing for the above well under the Agricultural Conservation Program.

(Date)

(Signature of Producer) (Put formation log on reverse side) LOG OF WELL

\* •

(Meth	od of Dril	April 21, 1969 April 27, 1969 (Date Started) (Date Completed)
From Feet	To Feet	Description of Material Drilled; and Water Sources Encountered
0	20	Top soil and rock
20	35	Sand and rock
35	55	Hard pink limestone
55	75	Red limestone
75	95	Rock
95	115	Rock
115	135	Rock
135	150	Rock
150	170	Sandstone
170	176	Red limestone
<u></u>		
<u></u>		
		COMMENTS:
		176' 5 9/16 Casing
<u></u>		50' Water
<u></u>		Cement plug at 40'
<u> </u>		
		1
	-	

Preparation and distribution: It is required that the driller prepare this form in the original only and give same to the producer. Copies may be prepared as desired.

• • •

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т		F //					
, []	OWNER/INSTALLER INFORMATION	5/9					
	er: LANNY E, MARYANN GOYN						
	ling Address: 2225 RANGE VIEW LANE						
	ne: (Work) Maryann- (307) 742-2141 (Home) (307) 745	-3877					
<b> </b>	taller (if other than above): Martin Excavation Inc.						
₿	ling Address: 4285 Soldier Springs Rd.						
Pho	ne: (Work) 745-466/ (Home)	. <u></u>					
2.	TYPE OF CONSTRUCTION: New System Replacemen	t <u>X</u>					
3.	PROPERTY INFORMATION						
Loc	ation of system site by County address: 2225 Range View La. Sherman Hill Estates	7 <b>e</b>					
Loc	ation of system site by legal description: $Lats 3 and 4$ , $W^{V_2}B$						
	ensions: Lot 3 - 135.0' x 290.0'; Lot 4 - 135.0' x 290.						
	a of property: Total Lots 3 and $4 = 78,300 \text{ ft}^2$ (1.8 a						
If	rce of water supply: Well 🛛 ;Surface Water □ ;Cistern □ ;Ot a well, give State permit number and depth:U.W. 3166 - 176 f6. t 90 ft.s	her 🗆 otaldepth tatic water le					
J	surface water, give name of creek/stream/lake: N/A						
llf	"other", please describe: ephemeral drainages around Sher	man Hill Es					
5.	TOPOGRAPHY OF SITE						
Тор	ography of wastewater: Flat 🛛 ;Gently 🗆 ; Moderately 🗆 ;S 2-3% → Sloped Sloped Slo	teeply 🗌 oped					
	sloped, does facility lie above or below the site for the resve $\Box$ ; Below 🕱	idence?					
6.	LEACHFIELD SITE SOILS						
A. San	Soil size: Large Gravel $(+\frac{1}{2}")$ $\Box$ ; Small Gravel (Pea Gravel) d $\blacksquare$ ; Sandy Loam $\blacksquare$ ; Loamy Clay $\Box$ ; Clay $\Box$ $Upper 2' - sandy / sa$	□; Towel E, cobble					
в.	Depth to bedrock or highest impervious layer: <u>35 ft</u> How was depth to bedrock determined? (check one): Exploration Well driller's log ⊠; Geologic data □ Date depth to bedrock determined: <u>4</u> /27/69 - See attached of	on hole 🗆 ;					
с.	Depth to seasonal high groundwater: <b>90'</b> How was depth to groundwater determined? (check one): Explor						

Number of buildings to be	connected t	o septic system:	One	•
If there is to be more that engineer must design the s		for the units se	erved, a pi	cofessional
System is for (Check all t single family dwelling multiple family dwelling commercial business 🗆 #	X # of bedro	droom a.	 type of wa	House hold Sewage an ste: Greywate
8. PERCOLATION TEST INF and Construction Standard Perc rate in minutes/inch.	ls for Small	Wastewater Fac:	ilities."	ns see "Des
Hole #1 <b>2.75</b>	Hole #3	2.50	Hole #5	2.50
Hole #2 2.00	Hole #4	2.00	Hole #6	2.75
	<u> </u>			1.2.1.1.5
If three to five holes tea	sted, indica	te slowest rate	(largest :	#):
If three to five holes tes If six holes tested, indic			(largest	#):
· · · · · · · · · · · · · · · · · · ·	cate average rate: Use F c rate value ed curve lin find soil l	igure 7, in the on bottom of t e, then follow oading rate (fo	"Design an he graph, the horizon r example:	nd Construct follow the ontal line t
If six holes tested, indic To determine soil loading Standards," find your perc vertical line to the slope intersects to the left to	cate average rate: Use F c rate value ed curve lin find soil 1 rate of .52	: 2.42 Figure 7, in the on bottom of t he, then follow oading rate (fo gallons/sq ft/	"Design an he graph, the horizon r example:	nd Construct follow the ontal line t
If six holes tested, indic To determine soil loading Standards," find your perc vertical line to the slope intersects to the left to 15 min/inch has a loading	cate average rate: Use F c rate value ed curve lin find soil 1 rate of .52 gallons/ ield size: M	: 2.42 igure 7, in the on bottom of t ie, then follow oading rate (fo gallons/sq ft/ sq. ft./day Multiply the num	"Design an he graph, the horizon r example: day).	nd Construct follow the ontal line t a perc rate

• This is the minimum square footage of leachfield required for your system. Additional calculation is needed for an Infiltrator system.

#### 9. SEPTIC TANK INFORMATION

Manufacturer's name: Unknown - Existing tan	k installed	in 1969
Tank constructed of (Check one): concrete ⊠; polyethylene □ ; other (specify):	fiberglass [	□ ;
Tank liquid capacity: 1000 Gal.		
Tank dimensions: length: 10'; width: 4';	; height: 6'	
Type of baffles - Specify (tee, insert, etc.):		
• Inlet pipe size: <b>4</b> "; schedule:	40 ;	length: 5
• Outlet pipe size: 4" ; schedule: .	40 ;	length: 5'
• For minimums see "Design and Construction St	andards"	rannaidh na dh' na
Access to surface from tank to be provided by ( Manways 🕱 ; 2-6" cleanouts 🗆	(Check one):	

## 

A.'	Type of system (Check one):
	Trench
	Bed Complete Section C
	Infiltrator 🕱 Complete Section D
	Mound 🔲 Additional application required
	Holding tank 🛛 Additional application required Other 🔋 🗖
	ecify:
If	system requires a pump for pressure - additional application required.
в.	TRENCH
	a. Minimum sq ft of leachfield required (as determined in #8):
	b. Width of trench:
	c. Total linear feet of trench:
	d. Depth of stone below perforated pipe (minimum 6"):
	<pre>e. Total square footage of drainfield: sq ft To compute: (2d + b) x c = square feet (b, c &amp; d measured in feet)</pre>
	f. Depth of stone above perforated pipe (minimum 2"):
	g. Depth of trench below surface (minimum 1 ft cover):
	h. Size of leachfield stone diameter (1/2" - 21/2")
	i. Type of material placed over stone (Specify: hay, straw, untreated building paper, filter cloth, etc.):
с.	BED
	a. Minimum sq ft of leachfield required (as determined in #8):
	b. Width of bed:
	c. Length of bed:
	d. Depth of stone below perforated pipe (minimum 6"):
	e. Bottom Surface area (b x c) = sq ft
	f. Sidewall area (b + b + c + c) x d = sq ft
	g. Total square footage of leachfield (e + f) = sq ft
	h. Distance between perforated pipe laterals:
	i. Depth of stone above perforated pipe (minimum 2"):
<u> </u>	j. Size of leachfield stone diameter (½" - 2½"):
, ,	k. Type of material placed over stone (Specify: hay, straw, untreated building paper, filter cloth, etc.):

D.	INFILTRATOR
Ľ.	
	a. Minimum sq ft of leachfield required (from #8): 562.5
	b. Minimum sq ft of Infiltrator required (a x .6): 337.5
	c. Minimum linear feet of Infiltrator required (b $\div$ 3): //2.5
	d. Minimum number of Infiltrator sections (c ÷ 6.25): 18
	e. Depth of trench below the surface: 3 ft. to 3.5 ft.
INF	<ul> <li>TILTRATOR GUIDELINES <ul> <li>Infiltrators may be used in a trench, bed or mound system.</li> <li>When using an Infiltrator you may reduce the required square footage for a standard system by 40% (minimum sq ft x .6 = minimum sq ft) of infiltration required.</li> <li>Any Infiltrator system which is under pressure must be equipped with a distribution box (d-box).</li> <li>The D-box must be installed at the head of the leachfield to assure equal distribution of effluent. A distance of at least 10 feet between the D-box and the head of each Infiltrator trench must be maintained to avoid saturating the soil immediately around the D-box. Saturation of the soil around theD-box could lead to settling.</li> <li>A minimum of 3 feet of undisturbed soil must be maintained between Infiltrator trenches must be level and scarified prior to installation.</li> <li>The Infiltrators must have splash &amp; end plates.</li> <li>The backfill must be a minimum of 12" of soil.</li> </ul></li></ul>

#### 11. ISOLATION DISTANCES

Listed below are minimum distances with spaces to provide the distances for your system. Fill in completely and transfer all distances for your system to the blank site plan provided.

## Note: Wells must be 50 feet from all property lines.

FROM	TO SEPTIC Minimum	TANK OR EQUIV Your System	TO ABSORPTION SYSTEM Minimum Your System		
Wells (includes neighboring wells)	50	106	100	140	
Property Lines	50	62	50	50	
Building Foundation w/out foundation drain	5	14	10	48	
Building Foundation with foundation drains	5	N/A	25	NIA	
Potable Water Pipes	25	87-From water well line @ NE corn of house	er 25	115	
Septic Tank	N/A	of house N/A	10	26	
Stream or Surface Body of Water including seasonal & intermittent (ditches, sloughs, etc)	50	70	50	68	

#### , 12. SITE PLAN REQUIREMENTS

This permit requires a site plan. An example is provided for your assistance. Refer to "General Notes" on blank site plan provided. Be sure to include all isolation distances for your system as listed above.

#### 13. INSTALLATION

Expected	Date	of	Installation:	7-2-99	
				(Month/Day/Year)	<u>,</u>

#### 14. RIGHT OF INGRESS/APPLICANT CERTIFICATION

I hereby grant authorized personnel the right of ingress and egress from said lands for any and all inspection purposes necessary to the exercise of this permit. I certify that, to the best of my knowledge, that the aforementioned information and material is true and correct, and I understand that authorization of this permit does not guarantee successful operation.
<pre>201 IGA Warning: If your property is located within "Planning Area Boundary"     as shown on Exhibit 1 of the Intergovernmental Agreement for Laramie     Wastewater Treatment Facilities and Collections System, you may be     required to abandon this system and connect to a collector/interceptor     line if one is installed contiguous to your property.     APPLICANT'S SIGNATURE: Lary Hoy May May May     DATE: 6/28/99 CONSENT OF OWNER OF RECORD (if different from applicant)     OWNER'S SIGNATURE:</pre>
OWNER'S SIGNATURE:
DATE:

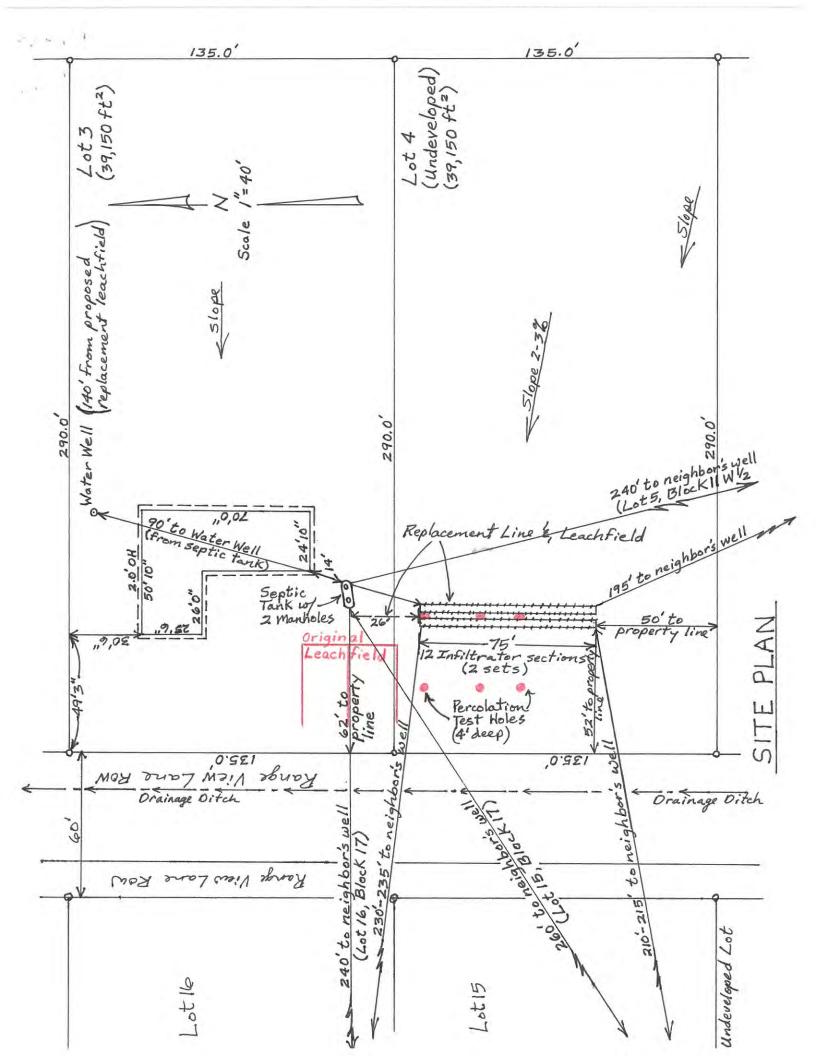
NOTE :

A LETTER OF CERTIFICATION OF COMPLIANCE WHICH STATES THAT THE SYSTEM WAS INSTALLED WITH NO CHANGES TO THE APPROVED DESIGN MUST BE FILED WITH THE REVIEWER AFTER BACKFILL

-OR-

AS BUILT DRAWINGS SHOWING ANY CHANGES MADE DURING INSTALLATION OF THE SYSTEM FROM THE DESIGN APPROVED IN THE PERMIT APPLICATION.

EXPIRATION DATE OF THIS PERMIT IS TWO (2) YEARS FROM THE DATE OF APPROVAL BY THE REVIEWER.



Test Hole Logs



Project: Albany County Septic System Impact Location: N41.296264°, W105.524537° NAD83 Drilled by: Authentic Drilling Date started: February 12, 2018 Date completed: February 12, 2018 Well Name: B-1 Drilling Method: Solid Stem Auger Logged by: M. Stacy Total depth: 34 Ft. Elevation: 7,459 Ft.

Depth (feet)	Borehole	Construction		Lithology	Remarks
	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	0-34 Ft.: Drill cuttings used to plug and abandon borehole	Casper Formation       Alluvium	0-1 Ft. SANDY SILT (ML): topsoil; fine to coarse grained quartz sand intermixed; dry; very loose; light reddish brown         1-28 Ft. SAND With GRAVEL (SW): fine to coarse grained, poorly sorted quartz sand; some gravel and cobles composed of limestone and sandstone; loose and unconsolidated; less gravel below 12 feet; dry to slightly moist; good porosity and permeability; pinkish brown to light reddish brown         28-34 Ft. SANDSTONE: well sorted fine grained quartz sand; dense; calcite cemented; slightly moist to dry; light tan to yellowish brown	No groundwater encountered in this borehole.

Notes: This figure presents the completion details for the BH-1 test hole. The borehole was drilled east of the septic system at 2225 Range View Lane in Laramie, Wyoming. This hole was drilled to initially investigate soil thickness, depth to bedrock, and saturation conditions adjacent to the septic system. Authentic Drilling drilled the test hole utilizing hollow stem auger methods. Upon completion of drilling, the borehole was backfilled with drill cuttings and abandoned.



Project: Albany County Septic System Impact Location: N41.296267°, W105.524574° NAD83 Drilled by: Authentic Drilling Date started: February 12, 2018 Date completed: February 12, 2018 Well Name: B-2 Drilling Method: Solid Stem Auger Logged by: M. Stacy Total depth: 46.5 Ft. Elevation: 7,459 Ft.

Depth (feet)	Borehole	Construction		Lithology	Remarks
-		0-46.5 Ft.: Drill cuttings used to plug and abandon borehole	Casper Formation	0-1 Ft: SANDY SILT (ML): topsoil; fine to medium grained quartz sand intermixed; dry; very loose; reddish brown         1-25 Ft. SAND (SW); fine to coarse grained, poorly sorted quartz sand; calcareous; loose and unconsolidated; dry to slightly moist; pinkish brown to light reddish brown         25-46.5 Ft. SANDSTONE: well sorted fine grained quartz sand; poorly cemented; permeable and porous; oxidized; calcite cemented at depth; friable; moist to dry; well cemented and hard at 46 foot depth; yellowish brown to reddish brown	No groundwater encountered in this borehole. Tested with water level tape to verify.

Notes: This figure presents the completion details for the BH-2 test hole. The borehole was drilled east of the septic system at 2225 Range View Lane in Laramie, Wyoming. Located closer to the septic system than BH-1, this hole was drilled to further investigate soil thickness, depth to bedrock, and saturation conditions adjacent to the septic system. Authentic Drilling drilled the test hole utilizing hollow stem auger methods. Upon completion of drilling, the borehole was backfilled with drill cuttings and abandoned.

## Appendix D

Lysimeter As-Builts



Project: Albany County Septic System Impact Location: N41.29633, W105.52477 NAD83 Drilled by: Authentic Drilling Date started: February 14, 2018 Date completed: February 14, 2018 Well Name: L-1 Drilling Method: Hollow Stem Auger Logged by: M. Stacy Total depth: 17 Ft. Elevation: 7,457 Ft.

Depth (feet)	Lysimet	er Construction		Lithology	Remarks
5		0-2.5 Ft.: Backfilled drill cuttings 2.5-3.5 Ft.: Bentonite pellets 3.5-4.5 Ft.: 10X20 Silica Sand 4.5-7.5 Ft.: 200 Mesh Silica Flour 5-7 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing 7.5-13 Ft.: 10X20 Silica Sand 13-14 Ft.: Bentonite pellets 14-15.5 Ft.: 10X20 Silica Sand 15.5-17 Ft.: 200 Mesh Silica Flour 15-17 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing		0-1 Ft: SILTY SAND (SM): poorly sorted fine to medium grained sand with silt and gravel; calcareous; topsoil; oxidized; dark brown 1-17 Ft: SAND (SW): poorly sorted, very fine to medium grained sand; slightly moist; moist at 10 foot depth; oxidized; loose; porous and permeable; light reddish brown	All sample and vacuum         polyethylene tubing for both         lysimeters was brought to land         surface, clamped, and placed         inside flush mounted well         covers set into soil. The covers         protected the tubing and         provided access for sampling.         Groundwater was not         encountered in the borehole.         Borehole was drilled at a 45         degree angle from the west         side of the septic system to         install lysimeters at a shallow         depth below the leachfield.         Hollow stem augers used in         this project were new and had         not been previously used.         All lysimeter components and         annular materials were placed         into the borehole without fluids.         The augers were gradually         retracted from the borehole         during placement of all         materials.

Notes: This figure presents the as-built details for the L-1 lysimeter completed west of the septic system at 2225 Range View Lane in Laramie, Wyoming. This borehole was drilled at a 45 degree angle from vertical to install two, two foot long lysimeters in this one borehole at two different depths below the septic system.



Project: Albany County Septic System Impact Location: N41.29633, W105.52476 NAD83 Drilled by: Authentic Drilling Date started: February 13, 2018 Date completed: February 13, 2018 Well Name: L-2 Drilling Method: Hollow Stem Auger Logged by: M. Stacy Total depth: 29 Ft. Elevation: 7,457 Ft.

Depth (feet)	Lysimet	er Construction		Lithology	Remarks
0     - <td></td> <td>0-17 Ft.: Backfilled drill cuttings 17-18 Ft.: Bentonite pellets 18-20.5 Ft.: 10X20 Silica Sand 20.5-22 Ft.: 200 Mesh Silica Flour 20-22 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing 22-23 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 27.5-29 Ft.: 200 Mesh Silica Flour 27-29 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing</td> <td></td> <td>0-1 Ft: SANDY SILT (ML): fine grained well sorted sand in silt; topsol; dark brown 1-29 Ft: SAND With GRAVEL (SW): poorly sorted, fine to medium grained quartz sand; slightly moist; oxidized; loose; porous and permeable; calcareous in some beds; gravel typically 1/4-1 1/2 inch diamter; reddish brown to pinkish brown</td> <td>All sample and vacuum         polyethylene tubing for both         lysimeters was brought to land         surface, clamped, and placed         inside flush mounted well         covers set into soil. The covers         provided access for sampling.         Groundwater was not         encountered in the borehole.         Hollow stem augers used in         this project were new and had         not been previously used.         Borehole was drilled at a 30         degree angle from the west         side of the septic system to         install lysimeters at an         intermediate depth in the         alluvium overlying the Casper         Formation below the leachfield.         All lysimeter components and         annular materials were glaced         into the borehole without fluids.         The augers were gradually         retracted from the borehole         during placement of all         materials.</td>		0-17 Ft.: Backfilled drill cuttings 17-18 Ft.: Bentonite pellets 18-20.5 Ft.: 10X20 Silica Sand 20.5-22 Ft.: 200 Mesh Silica Flour 20-22 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing 22-23 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 23-24 Ft.: Bentonite pellets 24-27.5 Ft.: 10X20 Silica Sand 27.5-29 Ft.: 200 Mesh Silica Flour 27-29 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing		0-1 Ft: SANDY SILT (ML): fine grained well sorted sand in silt; topsol; dark brown 1-29 Ft: SAND With GRAVEL (SW): poorly sorted, fine to medium grained quartz sand; slightly moist; oxidized; loose; porous and permeable; calcareous in some beds; gravel typically 1/4-1 1/2 inch diamter; reddish brown to pinkish brown	All sample and vacuum         polyethylene tubing for both         lysimeters was brought to land         surface, clamped, and placed         inside flush mounted well         covers set into soil. The covers         provided access for sampling.         Groundwater was not         encountered in the borehole.         Hollow stem augers used in         this project were new and had         not been previously used.         Borehole was drilled at a 30         degree angle from the west         side of the septic system to         install lysimeters at an         intermediate depth in the         alluvium overlying the Casper         Formation below the leachfield.         All lysimeter components and         annular materials were glaced         into the borehole without fluids.         The augers were gradually         retracted from the borehole         during placement of all         materials.
30 —	_			L	n

Notes: This figure presents the as-built details for the L-2 lysimeter completed west of the septic system at 2225 Range View Lane in Laramie, Wyoming. This borehole was drilled at a 30 degree angle from vertical to install two, two foot long lysimeters in this one borehole at two different depths below the septic system.



Project: Albany County Septic System Impact Location: N41.29633, W105.52483 NAD83 Drilled by: Authentic Drilling Date started: February 13, 2018 Date completed: February 13, 2018 Well Name: L-3 Drilling Method: Hollow Stem Auger Logged by: M. Stacy Total depth: 40 Ft. Elevation: 7,457 Ft.

Depth (feet)	Lysimeter Construction		ysimeter Construction Lithology		Remarks
5 - 5 - - -		0-30 Ft.: Backfilled drill cuttings		0-1 Ft.: SANDY SILT (ML): fine grained sand in silt; loose; some gravel; dry; topsoil; dark brown 1-12 Ft.: SAND (SW): poorly sorted, fine to medium grained quartz sand; oxidized; loose; calcareous; some gravel intermixed; reddish brown to orangy brown	All sample and vacuum polyethylene tubing for both lysimeters was brought to land surface, clamped, and placed inside flush mounted well covers set into soil. The covers protected the tubing and provided access for sampling.
- 10 - - - - 15 -				12-33 Ft.: SAND With GRAVEL (SW): fine to coarse grained, poorly sorted quartz sand; porous and permeable; gravel typically 1/2 to 1" diameter; calcareous; moist around 15 feet	Groundwater was not encountered in the borehole.
					this project were new and had not been previously used.
- - 25 — - - -		30-31 Ft.: Bentonite pellets 31-34 Ft.: 10X20 Silica Sand 33-35 Ft.: 2 bar cup Lysimeter, placed with			Borehole was drilled at a 30 degree angle from the west side of the septic system to install lysimeters into the Casper Formation below the leachfield.
- 30		vacuum and sampling tubing 34-35 Ft.: 200 Mesh Silica Flour 35-36 Ft.: 10X20 Silica Sand 36-37 Ft.: Bentonite pellets		33-40 Ft.: SANDSTONE: calcareously cemented, well sorted fine grained quartz sand; porous and permeable; slightly moist;	All lysimeter components and annular materials were placed
35		37-39 Ft.: 10X20 Silica Sand 38-40 Ft.: 2 bar cup Lysimeter, placed with vacuum and sampling tubing 39-40 Ft.: 200 Mesh Silica Flour	<ul> <li>Casper Formation</li> </ul>	friable; buff to yellowish brown	into the borehole without fluids. The augers were gradually retracted from the borehole during placement of all materials.

Notes: This figure presents the as-built details for the L-3 lysimeter completed west of the septic system at 2225 Range View Lane in Laramie, Wyoming. This borehole was drilled at a 30 degree angle from vertical to install two, two foot long lysimeters in this one borehole at two different depths below the septic system.



Project: Albany County Septic System Impact Location: N41.29638, W105.52474 NAD83 Drilled by: Authentic Drilling Date started: February 13, 2018 Date completed: February 13, 2018 Well Name: L-4 Drilling Method: Hollow Stem Auger Logged by: M. Stacy Total depth: 15.5 Ft. Elevation: 7,457 Ft.

Depth (feet)	Lysimeter Construction	ysimeter Construction Lithology		
	0   0 <td>0-3 Ft: SANDY SILT (ML): fine to medium grained quartz sand silt; loose; dry; dark reddish brown         3-15.5 Ft: SAND (SW): poorly sorted, fine to medium grained quartz sand; oxidized; porous and permeable; reddish brown         0.00000000000000000000000000000000000</td> <td>in       Hollow stem augers used in this project were new and had not been previously used.         Groundwater mass not encountered in the borehole.       Groundwater was not encountered in the borehole.         Borehole was drilled at a 45 degree angle from the west side of the septic system to install lysimeters at a shallow depth below the leachfield.         After Authentic drilled through the western infiltrator, All In One septic was repaired the damaged infiltrator and reburied the infiltrator. The drill hole was excavated as part of this repair and backfilled with the excavation.</td>	0-3 Ft: SANDY SILT (ML): fine to medium grained quartz sand silt; loose; dry; dark reddish brown         3-15.5 Ft: SAND (SW): poorly sorted, fine to medium grained quartz sand; oxidized; porous and permeable; reddish brown         0.00000000000000000000000000000000000	in       Hollow stem augers used in this project were new and had not been previously used.         Groundwater mass not encountered in the borehole.       Groundwater was not encountered in the borehole.         Borehole was drilled at a 45 degree angle from the west side of the septic system to install lysimeters at a shallow depth below the leachfield.         After Authentic drilled through the western infiltrator, All In One septic was repaired the damaged infiltrator and reburied the infiltrator. The drill hole was excavated as part of this repair and backfilled with the excavation.	

Notes: This figure presents the as-built details for the L-4 lysimeter hole that was drilled north of the L-1 through L-3 lysimeters and west of the septic system at 2225 Range View Lane in Laramie, Wyoming. This hole was drilled before L-1 through L-3. This borehole was drilled at a 45 degree angle from vertical to install two, two foot long lysimeters in this one borehole. However, no lysimeters were installed in this hole after the western infiltrator was drilled through from the west side. All In One was called to the site, excavated down to and around the infiltrator, and repaired and reburied the damaged infiltrator.

SALES ORDER

## SOILMOISTURE EQUIPMENT CORP.

R

instruments for the extraction and measurement of soil moisture PLANT AND OFFICE LOCATION: 801 SOUTH KELLOGG AVE., GOLETA. CA. 93117

> Bill-To WENCK01 WENCK 4025 Automation Way, Bldg. E Fort Collins, CO 80525 USA

Order Number: 18S0602A Page 1 Order Date: 02/02/18 Print Date: 02/05/18

Ship-To WENCK01S AUTHENTIC DRILLING 33555 COUNTY RD 37 KIOWA, CO 80117 USA

TEL:970.691.3259 ATTN:Mark Stacy TEL: 720-465-1450

Order Number:	18S0602A	Ship Date:
Order Date:	02/02/18	Purchase Order:
Credit Terms:	CC	Ship Via: UPS GROUND
	CREDIT CARD	INCO Terms: FOB SANTA BARBARA

Remarks: ATTN: SHERRI MEIKLEJOHN

FIN: 95-2454953

SHIPMENT SCHEDULED FOR FEBRUARY 5, 2018 : THANK YOU FOR YOUR ORDER SOILMOISTURE EQUIPMENT CORP

:

:

NOTE: FOB SANTA BARBARA - ALL FREIGHT CHARGES WILL BE PREPAID AND ADDED TO THE INVOICE. THE PACKING & HANDLING CHARGE IS BASED ON 3% OF TOTAL PRICE OF THE GOODS, WITH A \$5.00 MINIMUM FEE.

Ln Item Number	UM	Quantity Tax	Unit Price	Net Price
1 1920F1L24-B02M2 PRESS/VAC SOIL WATER	EA Sampi.er	6 no 24" 2 BAR CUP	\$212.00	\$1,272.00
2 2006G3	EA	1 no	\$680.00	\$680.00
PRESSURE VACUUM HAND 3 0930W050	EA EA	H P + V GAUGES 6 no	\$92.00	\$552.00
SILICA FLOUR, 200 M 4 0922W010	ESH, 50 L EA	B. BAG 2 no	\$40.00	\$80.00
BENTONITE, 10 LB. B	AG 30-50	MESH		



SALES ORDER

## SOILMOISTURE EQUIPMENT CORP.

R

instruments for the extraction and measurement of soil moisture PLANT AND OFFICE LOCATION: 801 SOUTH KELLOGG AVE., GOLETA. CA., 93117

> Bill-To WENCK01 WENCK 4025 Automation Way, Bldg. E Fort Collins, CO 80525 USA

Order Number: 18S0602A Page 2 Order Date: 02/02/18 Print Date: 02/05/18

Ship-To WENCK01S AUTHENTIC DRILLING 33555 COUNTY RD 37 KIOWA, CO 80117 USA

TEL:970.691.3259 ATTN:Mark Stacy TEL: 720-465-1450

Order Number:18S0602AShip Date:Order Date:02/02/18Purchase Order:Credit Terms:CCShip Via: UPS GROUNDCREDIT CARDINCO Terms: FOB SANTA BARBARA

Remarks: ATTN: SHERRI MEIKLEJOHN

Ln Item Number	UM	Quantity Tax	Unit Price	Net Price
5 2031G2	EA	2 no	\$14.00	\$28.00
CLAMPING RING, ONE D 6 MRT003L10	EA	1 no	\$32.00	\$32.00
EPDM TUBING, 3/16"I.		•		to 70, 00
8 1901PECGL0100 GREEN POLYETHYLENE I	EA TIBING 1	2 no /4" O.D., 100 F	\$135.00	\$270.00
9 1901PECNL0100	EA	2 no	\$135.00	\$270.00
BLACK POLYETHYLENE I	'UBING, 1	./4" O.D., 100 F		

Line Total:	\$3,184.00
Order Discount:	\$0.00
UPS GROUND:	\$0.00
PACKING & HANDLING:	\$95.52
SPECIAL:	\$0.00
Total Tax:	\$0.00
Total (USD):	\$3,279.52



Soil Testing Results

# Ammonium-N and nitrate-nitrite N adsorption and desorption characteristics for subsoils (University of Wisconsin-Stout Laboratory)

### Methods

Subsoils representing layers L1, L2, L3, B2-1, B2-2, and B2-3 were analyzed for the variables listed in Table 1. A known volume of sediment was dried at 105 °C for determination of dry bulk density and burned at 550 °C for determination of losson-ignition organic matter content (Avnimelech et al. 2001, Håkanson and Jansson 2002). Additional sediment was dried and shipped to Pace Analytical Laboratory (1800 Elm St. SE, Minneapolis, MN) for analysis of total Kjeldahl nitrogen (TKN) and sediment nitrate-nitrite N.

Table 1. Variable list	
Variable	Units
Dry bulk density	g/cm <sup>3</sup>
Organic content	(%)
Sediment Total Kjeldahl Nitrogen	%
Sediment Nitrate-Nitrite N	mg/kg
Ammunium-N maximum adsorption	mg/kg
Nitrate-nitrite N maximum adsorption	mg/kg

Additional wet subsoils were subjected to a range of ammonium-N and nitrate-nitrite N concentrations to examine Langmuir-type adsorption isotherms and potential maximum adsorption capacity using a modification of Pierzynski (2000, Phosphorus sorption isotherm determination, Graetz and Nair, p 35). Ammonium-N and nitrate-nitrite N concentrations ranging between 0 and 500 mg/L (0 mg/L, 50 mg/L, 100 mg/L, 250 mg/L, and 500 mg/L) were prepared using a 0.01 M CaCl<sub>2</sub> solution to preserve ionic integrity. Ten g of subsoil and 100 mL of standard solution were added to 125 mL glass assay tubes to create a soil:solution ratio of 10:1. Assay tubes were gently shaken for 24 hours, centrifuged, decanted, and filtered through a type A/E glass fiber filter (Pall). Samples were preserved with sulfuric acid to a pH < 2 and shipped to Pace Analytical for analysis of ammonium-N and nitrate-nitrite N. Additional standards were also shipped for analysis.

The linear Langmuir equation is,

$$\frac{C}{S} = \frac{1}{kS_{max}} + \frac{C}{S_{max}}$$

where:

S = Dissolved inorganic nitrogen species adsorbed (mg/kg)

C = Dissolved inorganic nitrogen species concentration after 24 h shaking

S<sub>max</sub> = N sorption capacity (mg/kg)

K = Bonding energy constant (L/mg)

An example Langmuir isotherm is shown in Figure 1 for ammonium-N adsorption onto L2 subsoil. In this

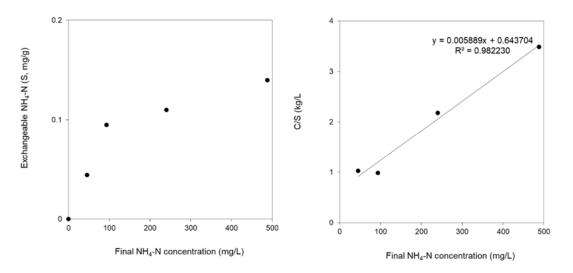


Figure 1. Changes in adsorbed ammonium-N (i.e., exchangeable NH<sub>4</sub>-N, left panel) and C/S versus final equilibrium NH<sub>4</sub>-N concentration (right panel). The inverse of the C/S:S slope approximates  $S_{max}$  (1/0.005889 = ~ 170 mg/kg).

example, ammonium-N adsorption reached an asymptote at an equilibrium concentration of ~ 500 mg/L and the sorption capacity was ~ 170 mg/kg (i.e.,  $S_{max}$ ).

## **Summary of Results**

Dry bulk densities were relatively high, ranging between 2.3 g/cm<sup>2</sup> and 2.6 g/cm<sup>3</sup>. Organic matter contents were very low, ranging between 0.40 % and 1.1 %. Sediment TKN concentrations were below detection limits in all subsoils except L1 (Table 2). Sediment nitrate-nitrite N concentrations were also low to undetected in all subsoil samples.

Stations	Depth	Dry bulk Density	Organic content	TKN	NO3NO2-N	Smax NH4-N	Smax NO3NO2-N
	(ft)	(g/cm3)	(%)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
L1	7-10.5	2.44	1.07	209	3.2	645	ND
L2	23-28	2.46	0.50	ND	1.9	170	ND
L3	33-38	2.41	0.52	ND	2	171	ND
B2-1	4-10.5	2.60	0.39	ND	ND	158	ND
B2-2	14-20.5	2.55	0.41	ND	ND	458	ND
B2-3	>29	2.32	0.49	ND	ND	329	ND

Overall, subsoils tended to adsorb some ammonium-N over the range of concentrations and exhibited Langmuir isotherm sorption characteristics (Figure 3). However, ammonium-N adsorption was relatively low; typically < 15% of the initial standard was adsorbed by subsoils. Ammonium-N sorption maxima (S<sub>max</sub>) ranged between 158 mg/kg and 645 mg/kg (Table 2). In contrast, adsorption of nitrate-nitrite N by subsoils was negligible (Figure 3). Subsoils adsorbed < 6% of the initial standard and did not follow Langmuir sorption patterns (Figure 3). Thus, a distinct S<sub>max</sub> was not observed for nitrate-nitrite N because very little, if any, nitrate-nitrite was adsorbed by subsoils. Because nitrate-nitrite N is an anion, it does not typically adsorb to negatively-charged soil sites or sands, and instead, remains soluble and leaches into groundwater (Gaines & Gaines 1994).

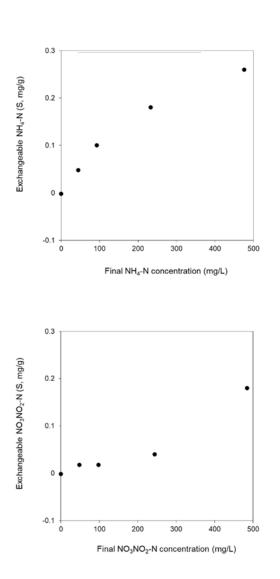


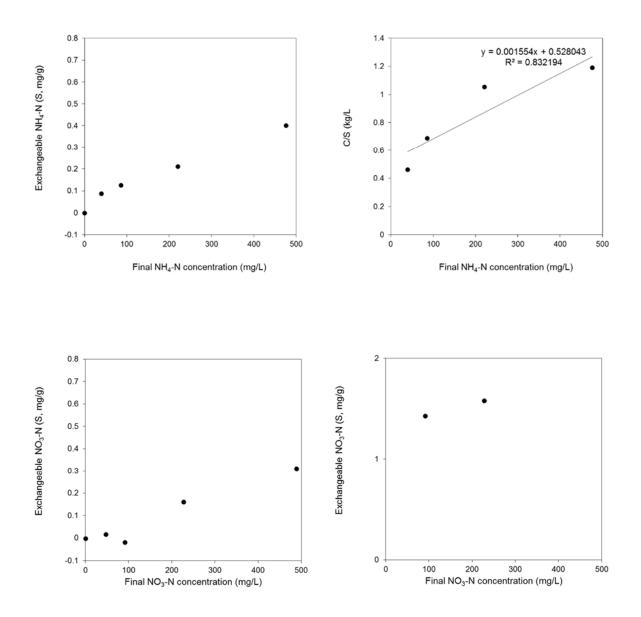
Figure 2. An example of changes in adsorbed ammonium-N (i.e., exchangeable NH<sub>4</sub>-N, upper panel) and adsorbed nitrate-nitrite N (i.e., exchangeable NO<sub>2</sub>NO<sub>3</sub>-N) for B2-2 subsoil.

## References

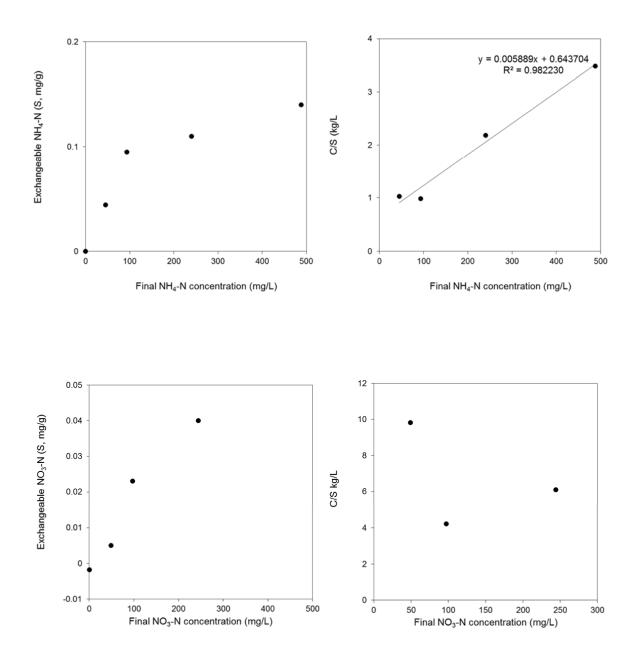
Gaines TP & Gaines ST. 1994. Soil texture effect on nitrate leaching in soil percolates. Commu Soil Sci Plant Anal 25:2561-2570.

Pierzynski GM (Editor). 2000. Methods of phosphorus analysis for soils, sediment, residuals, and waters. Southern Cooperative Series Bulletin No. 396. June 2000.

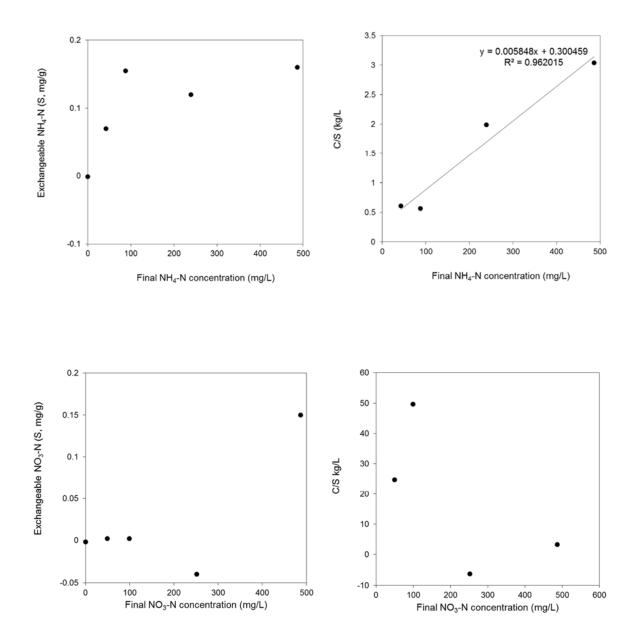
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.454.4558&rep=rep1&type=pdf



## L1 Ammonium and Nitrate+Nitrite Plots Used for Langmuir Calculations

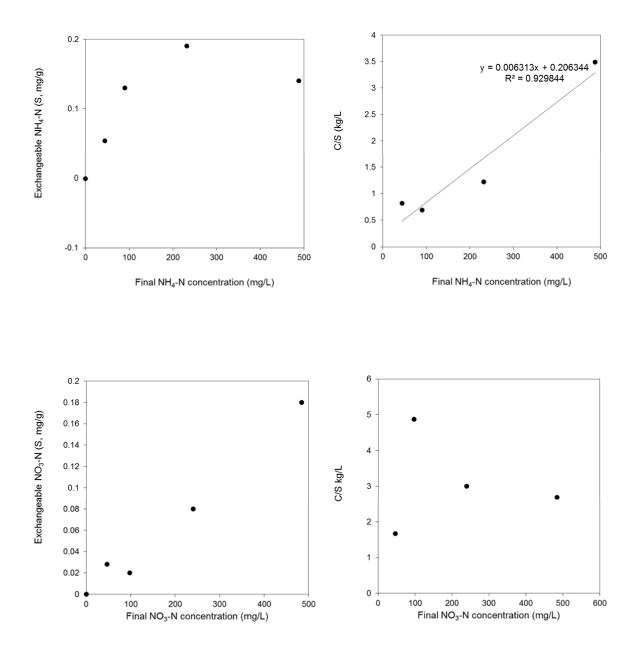


## L2 Ammonium and Nitrate+Nitrite Plots Used for Langmuir Calculations

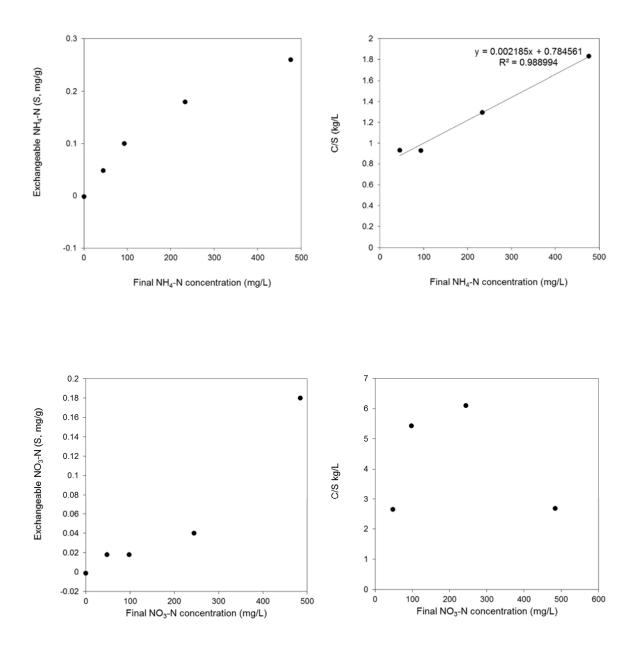


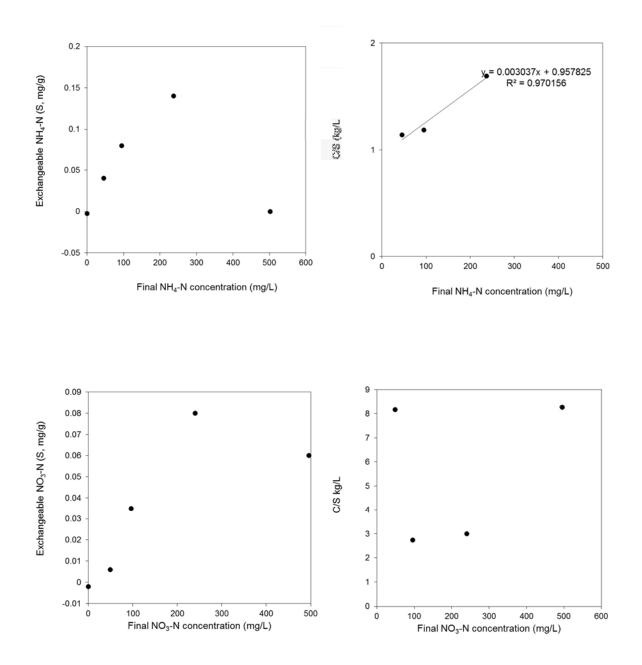
## L3 Ammonium and Nitrate+Nitrite Plots Used for Langmuir Calculations











**B2-3** Ammonium and Nitrate+Nitrite Plots Used for Langmuir Calculations



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

November 29, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: Sediment N colorado Pace Project No.: 10456152

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on November 20, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures





Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

#### CERTIFICATIONS

Project: Sediment N colorado Pace Project No.: 10456152

#### Virginia Minnesota Certification ID's

315 Chestnut Street, Virginia, MN 55792 Montana Certificate #CERT0103 Alaska Certification UST-107 Minnesota Dept of Health Certification #: 027-137-445 North Dakota Certification: # R-203 Wisconsin DNR Certification # : 998027470 WA Department of Ecology Lab ID# C1007



#### SAMPLE SUMMARY

Project: Sediment N colorado

Pace Project No.: 10456152

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10456152001	1	Solid	11/19/18 11:00	11/20/18 09:00
10456152002	2	Solid	11/19/18 11:00	11/20/18 09:00
10456152003	3	Solid	11/19/18 11:00	11/20/18 09:00
10456152004	4	Solid	11/19/18 11:00	11/20/18 09:00
10456152005	5	Solid	11/19/18 11:00	11/20/18 09:00
10456152006	6	Solid	11/19/18 11:00	11/20/18 09:00



#### SAMPLE ANALYTE COUNT

Project: Sediment N colorado

Pace Project No.: 10456152

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10456152001	1	ASTM D 2974-13 (2013)		1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V
10456152002	2	ASTM D 2974-13 (2013)	JK1	1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V
10456152003	3	ASTM D 2974-13 (2013)	JK1	1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V
10456152004	4	ASTM D 2974-13 (2013)	JK1	1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V
10456152005	5	ASTM D 2974-13 (2013)	JK1	1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V
10456152006	6	ASTM D 2974-13 (2013)	JK1	1	PASI-V
		EPA 351.2	DMB	1	PASI-V
		EPA 353.2	DMB	1	PASI-V



#### ANALYTICAL RESULTS

Project: Sediment N colorado

Pace Project No.: 10456152

Sample: 1		10456152001		d: 11/19/18				atrix: Solid	
Results reported on a "dry weigh	nt" basis and are	adjusted for		oisture, sa	mple si	ize and any dilut	ions.		
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight	Analytical	Method: ASTN	D 2974-13	(2013)			-		
Percent Moisture	2.5	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen		Method: EPA 3				A 351.2			
Nitrogen, Kjeldahl, Total	209	mg/kg	103	44.9	1		11/27/18 08:09	7727-37-9	M1
353.2 Nitrogen, NO2/NO3		Method: EPA 3		-	hod: FP				
Nitrogen, NO2 plus NO3	3.2	mg/kg	0.51	0.12	1		11/27/18 12:09		N3
Sample: 2 Results reported on a "dry weigh		10456152002 adjusted for		d: 11/19/18				atrix: Solid	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qua
Dry Weight	Analytical	Method: ASTM	I D 2974-13	(2013)				-	
Percent Moisture	31.0	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen	Analytical	Method: EPA 3	351.2 Prepa	aration Met	hod: EP	A 351.2			
Nitrogen, Kjeldahl, Total	ND	mg/kg	132	57.7	1	11/26/18 08:17	11/27/18 08:12	7727-37-9	
353.2 Nitrogen, NO2/NO3	Analytical	Method: EPA 3	353.2 Prepa	aration Met	hod: EP	A 353.2			
Nitrogen, NO2 plus NO3	1.9	mg/kg	0.72	0.17	1	11/26/18 10:15	11/27/18 12:10		N3
Sample: 3		10456152003		d: 11/19/18				atrix: Solid	
Results reported on a "dry weigh Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight	Analytical	Method: ASTN	I D 2974-13	(2013)					
Percent Moisture	3.4	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen	Analytical	Method: EPA 3	351.2 Prepa	aration Metl	hod: EP	A 351.2			
Nitrogen, Kjeldahl, Total	ND	mg/kg	103	45.3	1	11/26/18 08:17	11/27/18 08:14	7727-37-9	
353.2 Nitrogen, NO2/NO3	Analytical	Method: EPA 3	353.2 Prepa	aration Met	hod: EP	A 353.2			
-									

**REPORT OF LABORATORY ANALYSIS** 

0.51

0.12

1

11/26/18 10:15 11/27/18 12:12

Nitrogen, NO2 plus NO3

2.0

mg/kg

N3



#### ANALYTICAL RESULTS

Project: Sediment N colorado

Pace Project No.: 10456152

Sample: 4		10456152004		1: 11/19/18		Received: 11/		atrix: Solid	
Results reported on a "dry weigh	nt" basis and are	e adjusted for		isture, sa	mple si	ze and any dilut	ions.		
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight	Analytical	Method: ASTM	1 D 2974-13	(2013)					
Percent Moisture	0.52	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen	Analytical	Method: EPA 3	351.2 Prepa	ration Metl	hod: EP	A 351.2			
Nitrogen, Kjeldahl, Total	ND	mg/kg	101	44.0	1	11/26/18 08:17	11/27/18 08:15	7727-37-9	
353.2 Nitrogen, NO2/NO3	Analytical	Method: EPA 3	353.2 Prepa	ration Metl	hod: EP	A 353.2			
Nitrogen, NO2 plus NO3	ND	mg/kg	0.50	0.12	1	11/26/18 10:15	11/27/18 12:13		N3
Sample: 5	Lab ID:	10456152005	Collected	1: 11/19/18	8 11:00	Received: 11/	20/18 09:00 Ma	atrix: Solid	
Results reported on a "dry weigh	nt" basis and are	e adjusted for	percent mo Report	isture, sa	mple si	ze and any dilut	ions.		
Parameters	Results	Units	Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight	Analytical	Method: ASTN	1 D 2974-13	(2013)					
Percent Moisture	5.1	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen	Analytical	Method: EPA 3	351.2 Prepa	ration Meth	hod: EP	A 351.2			
Nitrogen, Kjeldahl, Total	ND	mg/kg	111	48.6	1	11/26/18 08:17	11/27/18 08:16	7727-37-9	
353.2 Nitrogen, NO2/NO3	Analytical	Method: EPA 3	353.2 Prepa	ration Meth	hod: EP	A 353.2			
Nitrogen, NO2 plus NO3	ND	mg/kg	0.53	0.13	1	11/26/18 10:15	11/27/18 12:20		N3
Sample: 6	Lab ID:	10456152006	Collected	d: 11/19/18	8 11:00	Received: 11/	20/18 09:00 Ma	atrix: Solid	
Results reported on a "dry weigh	nt" basis and are	e adjusted for	percent mo Report	isture, sa	mple si	ze and any dilut	ions.		
Parameters	Results	Units	Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Dry Weight	Analytical	Method: ASTN	1 D 2974-13	(2013)					
Percent Moisture	4.9	%	0.10	0.10	1		11/29/18 13:47		
351.2 Total Kjeldahl Nitrogen	Analytical	Method: EPA 3	351.2 Prepa	ration Met	hod: EP	A 351.2			
Nitrogen, Kjeldahl, Total	ND	mg/kg	95.6	41.9	1	11/26/18 08:17	11/27/18 08:17	7727-37-9	
353.2 Nitrogen, NO2/NO3	Analytical	Method: EPA 3	353.2 Prepa	ration Metl	hod: EP	A 353.2			
Nitrogen, NO2 plus NO3	ND	mg/kg	0.52	0.12	1	11/26/18 10:15	11/27/18 12:22		N3



#### **QUALITY CONTROL DATA**

Project: Sediment N colorado
Pace Project No : 10456152

Pace Project No.:	10456152

QC Batch:	157523	Analysis Method:	ASTM D 2974-13 (2013)
QC Batch Method:	ASTM D 2974-13 (20	Analysis Description:	Dry Weight/Percent Moisture
Associated Lab Sam	ples: 10456152001,	456152002, 10456152003, 10456152004	4, 10456152005, 10456152006

	DUPLICATE:	623915
SAIVIPLE	DUPLICATE:	023915

		12119172002	Dup		Max		
Parameter	Units	Result	Result	RPD	RPD	Qualifiers	
Percent Moisture	%	9.3	9.3	0	5		

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### **QUALITY CONTROL DATA**

Project:	Sedimer	nt N colorado											
Pace Project No .:	1045615	52											
QC Batch:	157302	2		Analys	sis Method:	[	EPA 351.2						
QC Batch Method:	EPA 35	51.2		Analys	sis Descript	ion: 3	351.2 TKN						
Associated Lab San	nples:	10456152001,	10456152002	, 10456152	2003, 10456	6152004,	1045615200	5, 104561	52006				
METHOD BLANK:	622627			٦	Matrix: Soli	d							
Associated Lab San	nples:	10456152001,	10456152002	, 10456152	2003, 10456	6152004,	1045615200	5, 104561	52006				
				Blank	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Kjeldahl, T	otal		mg/kg		ND	10	0	43.8 11	/27/18 08:07	,			
LABORATORY COM	NTROL S	AMPLE: 622	2626										
5				Spike	LCS		LCS	% Re					
Paran	neter		Units	Conc.	Resu	llt	% Rec	Limit	s Qi	alifiers	-		
Nitrogen, Kjeldahl, T	otal		mg/kg	1050	)	979	93	9	0-110				
MATRIX SPIKE & M			ATE: 622628	3		622629							
				MS	MSD	022020							
		1	0456152001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	r	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Kjeldahl, T	otal	mg/kg	209	1030	976	1120	1050	89	87	90-110	6	15	M1
MATRIX SPIKE & M	IATRIX S		ATE: 622630	)		622631							
				MS	MSD								
			2119020003	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	r	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Kjeldahl, T	otal	mg/kg	4410	1020	1020	5610	5500	118	107	90-110	2	15	P6

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### **QUALITY CONTROL DATA**

Project:	Sedime	nt N colorado											
Pace Project No .:	104561	52											
QC Batch:	15731	5		Analys	sis Method:	l	EPA 353.2						
QC Batch Method:	EPA 3	53.2		Analys	sis Descript	ion: 3	353.2 Nitrate	+ Nitrite					
Associated Lab San	nples:	10456152001	10456152002	, 10456152	003, 1045	6152004,	1045615200	5, 10456 <sup>,</sup>	152006				
METHOD BLANK:	622653			Ν	Matrix: Soli	id							
Associated Lab San	nples:	10456152001	10456152002	, 10456152	003, 1045	6152004,	1045615200	5, 10456 <sup>,</sup>	152006				
				Blank	k R	eporting							
Paran	neter		Units	Resu	t	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3		mg/kg		ND	0.4	9	0.12 1	1/27/18 12:01	N3			
LABORATORY COM	NTROL S	AMPLE: 622	2652										
				Spike	LCS		LCS	% R					
Paran	neter		Units	Conc.	Resu	llt	% Rec	Lim	its Qu	alifiers	_		
Nitrogen, NO2 plus	NO3		mg/kg	9.8	ł	9.7	98		90-110 N3				
MATRIX SPIKE & M	IATRIX S		ATE: 622654	4		622655							
				MS	MSD								
			10455920001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus l	NO3	mg/kg	1.0	11.5	11.4	12.8	3 12.6	10	2 102	90-110	1	10	N3
MATRIX SPIKE & M	IATRIX S		ATE: 622650	6		622657							
				MS	MSD								
			10455920005	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus I	NO3	mg/kg	1.2	9.9	9.8	11.0	0 10.8	9	9 97	90-110	2	10	N3

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### QUALIFIERS

#### Project: Sediment N colorado

Pace Project No.: 10456152

#### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

#### LABORATORIES

PASI-V Pace Analytical Services - Virginia

#### ANALYTE QUALIFIERS

- M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
- N3 Accreditation is not offered by the relevant laboratory accrediting body for this parameter.
- P6 Matrix spike recovery was outside laboratory control limits due to a parent sample concentration notably higher than the spike level.



#### QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	Sediment N colorado
Pace Project No .:	10456152

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10456152001	1	ASTM D 2974-13 (2013)	157523		
10456152002	2	ASTM D 2974-13 (2013)	157523		
10456152003	3	ASTM D 2974-13 (2013)	157523		
10456152004	4	ASTM D 2974-13 (2013)	157523		
10456152005	5	ASTM D 2974-13 (2013)	157523		
10456152006	6	ASTM D 2974-13 (2013)	157523		
10456152001	1	EPA 351.2	157302	EPA 351.2	157311
10456152002	2	EPA 351.2	157302	EPA 351.2	157311
10456152003	3	EPA 351.2	157302	EPA 351.2	157311
10456152004	4	EPA 351.2	157302	EPA 351.2	157311
10456152005	5	EPA 351.2	157302	EPA 351.2	157311
10456152006	6	EPA 351.2	157302	EPA 351.2	157311
10456152001	1	EPA 353.2	157315	EPA 353.2	157331
10456152002	2	EPA 353.2	157315	EPA 353.2	157331
10456152003	3	EPA 353.2	157315	EPA 353.2	157331
10456152004	4	EPA 353.2	157315	EPA 353.2	157331
10456152005	5	EPA 353.2	157315	EPA 353.2	157331
10456152006	6	EPA 353.2	157315	EPA 353.2	157331

-	C	CHAIN-	AIN-OF-CUSTODY / Analytical Request Docur	MO#:10456152
.1	Pace Analytical"	The Chain-of-	hain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accur	
Sectio Require	Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:	10456152
Company:	w: Wenck Associates Jeff Strom	Report To: same	Attention: Jeff Strom	
Address;	7500 Olson Memorial Hwy	Copy To:	Company Name: Wenck Associates	REGULATORY AGENCY
	Suite 300, Golden Valley, MN 55427		Address: same	L NPDES L GROUND WATER L DRINKING WATER
Email To:	s: jstrom@wenck.com	Purchase Order No.:	Pace Quote Reference	L
Phone:	763-252-6833 Fax:	Project Name: Sediment N colorado	Pace Project Oyeyemi Odijole	ation
Seques	Requested Due Date/TAT: std TAT	Project Numbér:	Pace Profile #:	STATE
			Requested	Requested Analysis Filtered (YIN)
	Section D Valid Matrix Codes Recruited Client Information MATRIX Codes	й (Ле)	zsevitiernes Z	
-	SAMPLE ID WIPE (A-Z, 0-9 / .) OTHER Sample IDS MUST BE UNIQUE TISSUE	s) ∃⊡OC	ιί TKN sis Test i ned	Chlorine
# MЭTI		АУРИРЦЕТ Т В РОРСКЕТ ПТАВ ТАМА ТАМА ТАМА ТАМА ТАМА ТАМА	Cedimen Cedimen Cother Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> Mathano Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> H <sub>2</sub> SO <sub>4</sub> H <sub>2</sub> SO <sub>4</sub> H <sub>2</sub> SO <sub>4</sub> H <sub>2</sub> SO <sub>4</sub>	
-		G 11/79118 11:00 11/19118	20 1 X	
2	2	G 11/19118 11:00 11/19118	11:00 20 1 X X X	200
e	3	SL G 11/19118 11:00 11/19118 1	11:00 20 1 X X X	003
4	4	SL G 11/19118 11:00 11/19118 1	11:00 20 1 X X X X	400
'n	5	SL G 11/19118 11:00 11/19118 1	11:00 20 1 X X X X	00 Ż
9	G	SL G 11/19118 11:00 11/19118 1	11:00 20 1 X	000
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Pag		SAMPLER NAME AND SIGNATURE	SIGNATURE	וענשכן ססופו עא) ארא) ארא)
ge 12		PRINT Name of		eemp ii construction Custo Custo Custo Custo (Υ/Ν
2 of		SIGNATURE of SAMPLER:	WWW / / / / / / / / / / / / / / / / / /	995 ) 98
15	*Important Note: By signing this form you are accepting F	"Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paidweigh 30 days.	per month for any invoices not paidwith a 30 days.	F-ALL-Q-020rev.08, 12-Oct-2007

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 310ct2018 Page 1 of 2
/A aut Anaiyuudi	Document No.:	Issuing Authority:
	F-MN-L-213-rev.24	Pace Minnesota Quality Office

Sample Condition Client Name: Upon Receipt Wench			Project	# WO#:10456152
	USPS		lient	PM: OEO Due Date: 11/29/18
Commercial Pace SpeeDee	 Other:			CLIENT: WENCK
Tracking Number: 1257503203 SE	347 18	25		
Custody Seal on Cooler/Box Present? Yes	:	Sèals Int	act?	Yes No Optional: Proj. Due Date: Proj. Name:
Packing Material: 🛛 Bubble Wrap 🗌 Bubble Bags	None	e 🔲 (	Other:	Temp Blank? Yes
Thermometer         G87A9170600254           Used:         Ø	Туре	of Ice:	<b>Z</b> we	— <b>—</b>
Cooler Temp Read (°C): <u>3.5</u> Cooler Temp Corre	ected (°C)	3.	5	Biological Tissue Frozen? Yes No ZN/A
Temp should be above freezing to 6°C Correction Factor	r:c	2.0		e and Initials of Person Examining Contents: $11/201/8$
USDA Regulated Soil ( [] N/A, water sample)				
Did samples originate in a quarantine zone within the United St. NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)?	ates: AL, A	ιr, ca, fl □γ		
If Yes to either question, fill out a Regu	lated Soil			(INO including Hawaii and Puerto Rico)? [Yes ]NO -Q-338) and include with SCUR/COC paperwork.
				COMMENTS:
Chain of Custody Present?	<b>Z</b> Yes	[No		1.
Chain of Custody Filled Out?	Z Yes	No		2.
Chain of Custody Relinguished?	Yes			3.
Sampler Name and/or Signature on COC?	. Z Yes	∏No	□n/a	4.
Samples Arrived within Hold Time?	<b>V</b> Yes	No		5.
Short Hold Time Analysis (<72 hr)?	Yes`			6.
Rush Turn Around Time Requested?	Yes			7.
Sufficient Volume?	<u>Z</u> Yes	No		8.
Correct Containers Used?	Yes	⊡No		9.
-Pace Containers Used?	<b>V</b> Yes	No		
Containers Intact?	<b>Z</b>  Yes	<u>□</u> No		10.
Filtered Volume Received for Dissolved Tests?	Yes	ΠNο	<b>⊠</b> N/A	11. Note if sediment is visible in the dissolved container
Is sufficient information available to reconcile the samples to the COC? Matrix: <u>SL</u>	<b>⊠</b> Yes	□No		12.
All containers needing acid/base preservation have been checked?	Yes	,	<b>.</b>	13. HNO3 H <sub>2</sub> SO4 NaOH Positive for Res.
All containers needing preservation are found to be in	L res	∐No	ZIN/A	Sample #
compliance with EPA recommendation? (HNO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)		<b>—</b> .,	<b></b> .	
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease,	Yes	No	<b>∏</b> n/a	Initial when Lot # of added
DRO/8015 (water) and Dioxin/PFAS	Yes	No	ZN/A	completed: preservative:
Headspace in VOA Vials ( >6mm)?	Yes	∏No	ZN/A	14.
Trip Blank Present?	Yes	No	ŹN/A	15.
Trip Blank Custody Seals Present? Pace Trip Blank Lot # (if purchased): NA	Yes	ΠNο	<b>⊠</b> N/A	
CLIENT NOTIFICATION/RESOLUTION Person Contacted: Jeff Strom				Field Data Required? Yes
		·		Date/Time: 11/20/18
Comments/Resolution: Samples collected in MN.		<u> </u>		
	3.7.3			
Project Wanager Review:	/ <i>aug</i> oliance/sar	notes, a c	opy of this	Date: 11/20/18

Note: Whenever there is a discrepancy affecting warting arolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of noid, incorrect preservative, out of temp, incorrect containers).

Labeled by: <u>CS</u>

Tain of Custody       State Of Origin: MN Cert. Necide: 10456152       State Of Origin: MN Cert. Necide: X Yes Cert. Necide: X Yes Subcontract To Subcontract To Subcon	Samples Intact Por N	Y or N	Ice (	Received on	Z	Ø or	Custody Seal	Cust	.) °C	Receipt 3	Cooler Temperature on Receipt 3.	ooler Te	0
Pain of Custody     Price       Samples were sent directly to the Subcontracting Laboratory.     State Of Origin: MN Cert. Needed: X Yes     CILENT: PRCE IN CLENT: PRCE IN Presented Street Provided Date: 11/202018 Results Require Provided Date: 11/202018 Results Require	N												wN
Pain of Custody       Preserved Containers       Preserved Containers       Preserved Containers         Sample Were Sent directly to the Subcontracting Laboratory       State of Origin: MN       CLENT: PRCE M         oritro       Subcontracting       Subcontracting       Curtext: Proce M         oritro       Subcontracting       Subcontracting       Owner Received Date:       11/20/2018         oritro       Subcontracting       Tread Analytical Virginia MN       315 Chestinut Streag       Owner Received Date:       11/20/2018         oritro       Subcontracting       115 Chestinut Streag       Virginia MN       315 Chestinut Streag       None (218)742-1042       Results Requires         origin:       Nn 5541       Sample Collecti       Sample Collecti       Lab ID       Matrix       Freeserved Containers       2       2       Preserved Containers       2 <td< th=""><th></th><th></th><th>S</th><th>1</th><th>11/2</th><th>May</th><th>23 CM</th><th>11/20/18/10</th><th></th><th>Alle</th><th>1 Olt</th><th></th><th><u>د</u> د</th></td<>			S	1	11/2	May	23 CM	11/20/18/10		Alle	1 Olt		<u>د</u> د
Pain of Custody       Preserved Cuitalners       Pres	Drv weight in VM		ïme	Date/T		By	Received	Date/Time			Released By	ansfers	ㅋ
Ph: CLJ         Samples were sent directly to the Subcontracting Laboratory.       CLIENT: PRCE MP         Contract To         Owner Received Date: 11/20/2018 Results Requested Analysis         Preserved Containers         Preserved C	Comments												
Pain of Custody       Ph: cLy       Ph: cLy       CLENT: PACE MP         Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN       Cert. Needed: X Yes       Custory: Custory: Norver Received Date: 1120/2018 Results Required Virginia MN         arTo       Subcontracting Laboratory:       State Of Origin: MN       Cert. Needed: X Yes       Encontracting Laboratory:       Cert. Needed: X Yes       Encontracting Laboratory:       Encontracting Laboratory:       State Of Origin: MN       Encontracting Laboratory:		^	and bearing		1	Solid	10456152006		-	PS		თ	σ
Pain of Custody       Pain Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN Cert. Needed: X Yes       CLENT: PRCE MP Cert. Needed: X Yes       CLENT: PRCE MP Cert. Needed: X Yes         vortio       Subcontract       Owner Received Date:       11/20/2018 Results Requested Analysis         orito       Subcontract       Pace Analytical Virginia MN Street       Owner Received Date:       11/20/2018 Results Requested Analysis         versionalis, MN 55414       Pace Analytical Virginia MN Street       Street       Versionalistical Virginia MN Street       Street       Versionalistical Virginia MN Street       Versionalis		~	-		1	Solid	10456152005			PS		G	U
Pain of Custody       Pain Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN Cert. Needed: X Yes       CLENT: PRCE MP CERT. Needed: X Yes         kronder: 10456152       Workorder Name: Sediment N colorado       Owner Received Date:       11/20/2018 Results Reque Needed: X Yes       11/20/2018 Results Reque Requested Analysis         ort To       Subcontract To       Pace Analytical Virginia MN S15 Interest To       Prese Analytical Virginia MN S514       Yes       11/20/2018 Results Reque         ort To       Sample ID       Sample Collect       Pace Analytical Virginia MN S5742-1042       Yes       11/20/2018 Results Reque         e 200       Pace Analytical Virginia MN S5742       Sample ID       Sample Collect       Natrix       Yes       Yes         e (612)607-6402       Sample Collect       Trype       Lab ID       Matrix       Yes       Yes       Yes         sample ID       Ps       11/19/2018 11:00       10456152001       Solid       1       X		^	-			Solid	10456152004			PS		4	4
Pain of Custody       Ph: cLj clienting Laboratory.       State of Origin: MN Cert. Needed: X Yes Subcontracting Laboratory.       CLIENT: PRCE MP CLIENT: PRCE MP Control       PRCE MP CLIENT: PRCE MP Cert. Needed: X Yes Cert. Needed: X Yes Noner Received Date: 11/20/2018 Results Reque Requested Analysis Phone (218)742-1042         2 2000 Street 2000 DEIm Street 2000 Collect 1       Pace Analytical Virginia MN 315 Chestnut Street Virginia, MN 55792 Phone (218)742-1042       K       K       Requested Analysis Requested Analysis         2 2000 2 Eim Street 2 2000 Collect 1       Sample Collect 2 11/19/2018 11:00       Imatrix       Preserved Containers X X       X		^	free		-	Solid	10456152003			PS		ω	ω
Pain of Custody       PM: CLJ       PM: CLJ       PM: CLJ       CLIEWT: PRCE W         Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN       Cert. Needed: X Yes       Curevre received Date: 11/20/2018 Results Reque         Norder: 10456152       Workorder Name: Sediment N colorado       Owner Received Date: 11/20/2018 Results Reque       11/20/2018 Results Reque         entropy:       Subcontract To       State Of Origin: MN       Cert. Needed: X Yes       Entropy:         entropy:       Pace Analytical Virginia MN       State Of Origin: MN       Cert. Needed: X Yes       Entropy:         enapplical Dimesota       Street       Street Virginia, MN 55792       Pace Analysis       Phone (218)742-1042         e 200       Phone (218)742-1042       Phone (218)742-1042       Phone (218)742-1042       Phone (218)742-1042         e (612)607-6402       Sample       Collect       Preserved Containers       Preserved Containers         e (612)607-6402       Bate/Time       Lab ID       Matrix       Preserved Containers       Preserved Containers         e 1       PS       11/19/2018 11:00       10456152001       Solid       1       X       X		^			-	Solid	10456152002	here		PS		N	N
Pain of Custody       PM: CLJ       PM: CLJ       PM: CLJ       PM: CLIENT: PACE M         Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN       State Of Origin: MN       Cert. Needed: X Yes       CLIENT: PACE M         ktorder: 10456152       Workorder Name: Sediment N colorado       Owner Received Date: 11/20/2018 Results Reque       Tubcontract To       Dem Subcontract To       Dem Subcontract To       Results Reque         ort To       Subcontract To       Subcontract To       Dem Subcontract To       Results Reque         ort To       Subcontract To       Pace Analytical Virginia MN       315 Chestnut Street       Requested Analysis       Requested Analysis         e 200       Pace Analytical Virginia, MN 55792       Phone (218)742-1042       Requested Analysis       Requested Analysis         reapolis, MN 55414       Sample Collect       NM 55792       Sample Collect       Sample Lab ID       Matrix       Preserved Containers       X		^				Solid	10456152001	-		PS		4	
ody       PM: CJ         sent directly to the Subcontracting Laboratory.       State Of Origin: MN       CLIENT: PRCE MP         Workorder Name: Sediment N colorado       Owner Received Date:       11/20/2018 Results Reque         Subcontract To       Owner Received Date:       11/20/2018 Results Reque         Subcontract To       Requested Analysis         Pace Analytical Virginia MN       55792         Phone (218)742-1042       Preserved Containers         Preserved Containers       Z	LAB USE ON				Other	Matrix	_ab ID	me	oie	Sa	le D	1.1.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	Item
ody       Pf: CLJ         sent directly to the Subcontracting Laboratory.       State Of Origin: MN       CLIENT: PACE MP         Workorder Name: Sediment N colorado       Owner Received Date:       11/20/2018 Results Reque         Subcontract To       Pace Analytical Virginia MN       315 Chestnut Street       Requested Analysis         Virginia, MN 55792       Phone (218)742-1042       Phone (218)742-1042       Provide (218)742-1042         X       X       X       X         X       Yes       Yes       Yes         X       Yes       Yes       Yes         Yirginia, MN 55792       Yes       Yes       Yes         X       Yes       Yes       Yes       Yes         X       Yes       Yes       Yes       Yes         Yirginia, MN 55792       Yes       Yes       Yes       Yes         X       Yes       Yes       Yes       Yes       Yes         Yes       Yes       Yes       Yes       Yes       Yes			1	rved Containers	Prese	1			_	1		1	1
A of Custody       PM: CLJ         Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN       CLIENT: PACE MP         Ser: 10456152       Workorder Name: Sediment N colorado       Owner Received Date:       11/20/2018 Results Requested Analysis         Subcontract To       Subcontract To       Requested Analysis						2 2	aayucar virgii sstnut Street MN 55792 218)742-104	315 Che Virginia, Phone (			tical Minnesota Street s, MN 55414 2)607-6402	ace Analy 700 Elm \$ 100 Inneapoli 1000 (611)	Ph Su Pa
A of Custody       PM: CLJ         Samples were sent directly to the Subcontracting Laboratory.       State Of Origin: MN       CLIENT: PACE MP         Serr: 10456152       Workorder Name: Sediment N colorado       Owner Received Date: 11/20/2018 Results Reque	rednested Highlysis		-				10	Subcontract				sport To	Re
directly to the Subcontracting Laboratory. State Of Origin: MN CLIENT: PACE MP	Results Requested By:	5	Ved	Owner Rec			N colorado		ler Nam	Workord		orkorde	S
PM: CLJ	CLIENT: PACE MPLS	2	n.	State Of Or			Laboratory	ubcontracting	to the S	ent directly	Samples were s		
										de l	of Custo	2	0

Tuesday, November 20, 2018 12:38 13 PM

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Page 1 mil

Pace Analytical		ondition Docum	ent Name: Upon Reco nent No.: 001-Rev.10	Issuing Authority:
Sample Condition Upon Receipt Courier: Fed Ex UPS Commercial Pace	USPS Øther		Project : Client	#: WO#:12119087
Custody Seal on Cooler/Box Present? Yes	No	Seals	Intact?	Yes No Optional: Proj. Due Date: Proj. Name:
Packing Material: Bubble Wrap			Other:	Temp Blank? Yes No
hermometer Used: 2 140792808	Type of		-	Blue None Samples on ice, cooling process has be
Cooler Temp Read °C: 2.6 Cooler Temp emp should be above freezing to 6°C Correction Fi	Corrected °	c: 3.	1	Biological Tissue Frozen? Yes No.
Chain of Custody Present?	Yes	Nc	□N/A	1.
Chain of Custody Filled Out?	Yes	No		2.
Chain of Custody Relinquished?	Yes	No	□N/A	3.
Sample Name and Signature on COC?	Yes	No	□N/A.	4.
Samples Arrived within Hold Time?	<b>V</b> Yes	No	□n/a	5. If Fecal: <pre>_&lt;8 hours</pre> >8, <24 hours>24 hours
Short Hold Time Analysis (<72 hr)?	Yes	No	□N/A	6.
Rush Turn Around Time Requested?	☐ Yes	No	N/A	7.
Sufficient Volume?	Yes	No	∐N/A	8.
Correct Containers Used?	Yes	No	□N/A	9.
-Pace Containers Used?	Yes	No		
Containers Intact? Filtered Volume Received for Dissolved Tests?	Yes			10.
Sample Labels Match COC?	Yes			11. Note if sediment is visible in the dissolved containers.
-Includes Date/Time/ID/Analysis Matrix:	SL			12.
All containers needing acid/base preservation will be checked and documented in the pH logbook.	Yes	No		See pH log for results and additional preservation documentation
Headspace in Methyl Mercury Container	Yes	Nc	N/A	13.
Headspace in VOA Vials ( >6mm)?	Yes	No	N/A	14.
Trip Blank Present?	Yes	No	2N/A	15.
Trip Blank Custody Seals Present? Pace Trip Blank Lot # (if purchased):	Yes	<b>No</b>		
LIENT NOTIFICATION/RESOLUTION Person Contacted: Comments/Resolution:				Field Data Required? Yes No Date/Time:
ECAL WAIVER ON FILE Y N	Lin			IRE WAIVER ON FILE Y NDate:11/21/18 his form will be sent to the North Carolina DEHNR Certification Office ( i.e



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

October 30, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: Colorado Pace Project No.: 10452713

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on October 23, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures





Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

#### CERTIFICATIONS

Project:	Colorado
Pace Project No.:	10452713

#### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



#### SAMPLE SUMMARY

Project:ColoradoPace Project No.:10452713

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10452713001	CONTROL 0mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452713002	CONTROL 50mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452713003	CONTROL 100mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452713004	CONTROL 250mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452713005	CONTROL 500mg/L	Water	10/19/18 11:00	10/23/18 09:30



# SAMPLE ANALYTE COUNT

Project: Colorado Pace Project No.: 10452713

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10452713001	CONTROL 0mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452713002	CONTROL 50mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452713003	CONTROL 100mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452713004	CONTROL 250mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452713005	CONTROL 500mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M



#### ANALYTICAL RESULTS

Project: Colorado Pace Project No.: 10452713									
Sample: CONTROL 0mg/L	Lab ID:	10452713001	Collected	d: 10/19/1	3 11:00	Received: 10	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	ND	mg/L	0.10	0.030	1		10/26/18 11:11	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	ND	mg/L	0.036	0.011	1		10/30/18 07:30		
Sample: CONTROL 50mg/L	Lab ID:	10452713002	Collected	d: 10/19/1	3 11:00	Received: 10	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	48.2	mg/L	2.0	0.60	20		10/26/18 11:12	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	49.1	mg/L	1.8	0.54	50		10/30/18 07:31		
Sample: CONTROL 100mg/L	Lab ID:	10452713003	Collected	d: 10/19/1	3 11:00	Received: 10	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	98.5	mg/L	5.0	1.5	50		10/26/18 11:14	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	89.6	mg/L	3.6	1.1	100		10/30/18 07:32		
Sample: CONTROL 250mg/L	Lab ID:	10452713004	Collected	d: 10/19/18	3 11:00	Received: 10	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	242	mg/L	10.1	3.0	100		10/26/18 11:15	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	244	mg/L	7.1	2.1	200		10/30/18 07:33		



#### ANALYTICAL RESULTS

Project: Pace Project No.:	Colorado 10452713									
Sample: CONTRO	0L 500mg/L	Lab ID:	10452713005	Collected	1: 10/19/18	8 11:00	Received: 10/	/23/18 09:30 M	latrix: Water	
Parame	eters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia		Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia		516	mg/L	20.1	6.0	200		10/26/18 11:16	7664-41-7	
353.2 Nitrate + Nit	rite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus	NO3	520	mg/L	17.8	5.4	500		10/30/18 07:35	i	



#### **QUALITY CONTROL DATA**

Project:	Colorad	0											
Pace Project No .:	1045271	13											
QC Batch:	57146	5		Analys	sis Method:	E	EPA 350.1						
QC Batch Method:	EPA 3	50.1		Analys	sis Descript	tion: 3	350.1 Ammor	nia					
Associated Lab San	nples:	1045271300	01, 10452713002	, 10452713	3003, 1045	2713004, ^	1045271300	5					
METHOD BLANK:	3100336	6		I	Matrix: Wa	ter							
Associated Lab San	nples:	1045271300	1, 10452713002	, 10452713	3003, 1045	2713004, <sup>2</sup>	1045271300	5					
				Blanl	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	Analyz	ed	Qualifiers				
Nitrogen, Ammonia			mg/L		ND	0.10	0 10/26/18	11:08					
LABORATORY CON	NTROL S	AMPLE: 3	3100337										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Ree Limits	-	ualifiers			
Nitrogen, Ammonia			mg/L	2.5	5	2.5	100	90	0-110		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31003	38		3100339							
	-	-		MS	MSD								
Paramete	er	Units	10452832002 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia		mg/L	14.6	25	25	40.6	40.2	104	102	90-110	1	20	
MATRIX SPIKE & M	1ATRIX S	PIKE DUPLI	CATE: 31003	40		3100341							
				MS	MSD								
			10452836001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.4	2.5	97	99	90-110	2	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### **QUALITY CONTROL DATA**

Project:	Colorad	lo											
Pace Project No.:	104527	13											
QC Batch:	57208	0		Analys	sis Method	: 6	EPA 353.2						
QC Batch Method:	EPA 3	53.2		Analys	sis Descrip	tion:	353.2 Nitrate	+ Nitrite, p	oreserved				
Associated Lab San	nples:	10452713001	1, 10452713002	, 10452713	3003, 1045	2713004,	1045271300	5					
METHOD BLANK:	310408	6		ſ	Matrix: Wa	ter							
Associated Lab San	nples:	10452713001	I, 10452713002	, 10452713	3003, 1045	2713004,	1045271300	5					
				Blank		eporting							
Paran	neter		Units	Resu	lt	Limit	Analyz	zed	Qualifiers				
Nitrogen, NO2 plus	NO3		mg/L		ND	0.03	6 10/30/18	07:58					
LABORATORY COM	NTROL S	AMPLE: 31	04087										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		ualifiers			
Nitrogen, NO2 plus	NO3		mg/L	1		0.97	97	9	0-110		-		
MATRIX SPIKE & M	IATRIX S		CATE: 310408	88		3104089	1						
				MS	MSD								
Paramete	er	Units	10452260001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	0.96	0.96	95	94	90-110	0	20	
MATRIX SPIKE & M	IATRIX S		CATE: 310409	90		3104091							
				MS	MSD								
			10452260003	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	I 1.1	99	99	90-110	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### QUALIFIERS

Project:	Colorado
Pace Project No.:	10452713

#### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

J - Estimated concentration at or above the LOD and below the LOQ.

LOD - Limit of Detection adjusted for dilution factor and percent moisture.

LOQ - Limit of Quantitation adjusted for dilution factor and percent moisture.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

#### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis



#### QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	Colorado
Pace Project No .:	10452713

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10452713001	CONTROL 0mg/L	EPA 350.1	571465		
10452713002	CONTROL 50mg/L	EPA 350.1	571465		
10452713003	CONTROL 100mg/L	EPA 350.1	571465		
10452713004	CONTROL 250mg/L	EPA 350.1	571465		
10452713005	CONTROL 500mg/L	EPA 350.1	571465		
10452713001	CONTROL 0mg/L	EPA 353.2	572080		
10452713002	CONTROL 50mg/L	EPA 353.2	572080		
10452713003	CONTROL 100mg/L	EPA 353.2	572080		
10452713004	CONTROL 250mg/L	EPA 353.2	572080		
10452713005	CONTROL 500mg/L	EPA 353.2	572080		

W0# : 10452713

CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of	REGULATORY AGENCY	NPDES T GROUND WATER T DRINKING WATER	FUST FRCRA FOTHER	SITE CALLE IN MILLIO	LOCATION I OH I SC IN I OTHER	Filtered (YIN) Age / / / / / /	Requested 25	////		Co	5-xc	mo							2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	6	N/ <b></b> , N/ <b>,</b> N/ <b>,</b>	N/J.	N/A	es Intect stody p in °C	Cura Sealed Sealed
Section C Inverse Information	Attention: Jef 6 Strom	Company Name: WCW ASSOCA STOVE 1		Pace Quote Reference:	Pace Project Manager: Due way with Odri CL	0	COLLECTED COLLECTED	SARG COMPOSITE EXTRET COMPOSITE ENDOCENE C 4 10 00 00 00 00 00 00 00 00 00 00 00 00												Dava - PAUS				SAMPLER NAME AND SIGNATURE	SIGNATURE of SAMPLER. (A) MAN A WILLIAM AND LATE SIGNED (MM / DD LYN)
Section A Section B Section B Section B	nc. Jeft Stan	IN MASHUT		AND WILL BAM	Phylic 252-6573 Fax	sted Due Date/TAT:	Section D Required Client Information Valid Matrix Codes SAMPLE 1D WATEN CODE Cone Character per box. Water With Water Codes Cone Character per box. Water W	ART 01 ART 01 01HER 05 115SULE 15	CONTROL & mg/L	2 CONTROL 50 mg/L	s CONTROL 100 mg/L	CONTROL	CONTROL	9		9	.0		Additional Comments:		L	L	Į	Page	e 11 o

11 of 12

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E-File,(ALLQ020rev.3,31Mar05), 13Jun 2005

Price Analytical         Semple Confliction Upon Receipt Form         Page 1 4/2           Document No:         Testing AutorAry:         Pace Minispose Guality Office           Sample Confliction         Upon Receipt Form         Project #           Upon Receipt Form         Project #         ULO# : 10/36/18           Counter:         Counter:         Project #           Presing Material:         Project #         Tree Blank ?           Presing Material:         Scient:         Project #           Thermoniter         Scient:         Doce Counter:         Treemp Blank ?           Description of the 10/18/00 Freemant?         Cooler Temp Corrected ?         US         Biological Tissue Freeze ?           Description of the 10/18/00 Freezemant?         Cooler Temp Corrected ?         US         Biological Tissue Freezemant ?           Thermoniter is science contracted in Controls         Contracted Recemant ?         Decemant ?         Decemant ?           Cooler Te		<b>1</b>		ocument		Document Revised: 02May2018
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Counter: Geouriser: Counter: Coun					Project	WO#:10452713
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Custody Seal on Cooler/Box Present?       Types       Mon       Seals Intact?       Types			$l = []Other:_$	126	6	
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Temp should be above freezing to StC       Correction Factor:       1       Date and initials of Person Examining Contents:       1       1       2.8715       1         UDS A Regulated Soil [[] (J/V, water sample)       Did samples originate in a foreign source (inspirationally, inspirate in a foreign source (inspirationally, inspirate			mp Corrected (°C)	. Ч,	S	Biological Tissue Frozen? Yes No ZN/A
DId samples originate inf aquarantine zone within the United States AL, AR, CA, EL, GA, ID, LA, MS, Did samples originate from 8 forgins source (inspirationally, CN, NM, NY, OK, OK, SK, TN, TAY VA (check map)?			n Factor:	t/)	2 Dat	
N.C. NM, NY, OK, OR, S.C. TM, TX or VA (check maps)?	Did samples o	ated Soil ( MNA, water sample)	Inited States Al			
If Yes to afther question, fill out a Regulated Soil Cifecklist (F-MN-Q-338) and include with SCUR/COC paperwork.         COMMENTS:         Control Time Requested?         Containers:         Containers:         Sufficient volume?         Containers:         Containers:         Sufficient information available to reconcile the samplet to preservation have been checked?         Cress:         No         List with a Preservation are found to be in compliance with PA recommendation?         Containers: needing add/base preservation have been checked?         Mark:         Containers: needing add/base preservation have been che	NC, NM, NY, (	OK, OR, SC, TN, TX or VA (check maps)?			es 🗆	No including Hawaii and Puerto Rico)?
Chain of Custody Filed Out?       Image: Bio Custody Filed Out?       Image: Custody Filed Out?         Chain of Custody Relinquished?       Image: Custody Relinquished?       Image: Custody Relinquished?         Sampler Name and/or Signature on COC?       Image: Relinquished?       Image: Relinquished?         Sampler Name and/or Signature on COC?       Image: Relinquished?       Image: Relinquished?         Sampler Name and/or Signature on COC?       Image: Relinquished?       Image: Relinquished?         Sufficient Volume?       Image: Relinquished?       Image: Relinquished?         Sufficient Volume?       Image: Relinquished?       Image: Relinquished?         Correct Containers Used?       Image: Relinquished?       Image: Relinquished?         Is sufficient Volume?       Image: Relinquished for Disolved Tests?       Image: Relinquished for Disolved Tests?       Image: Relinquished for Disolved Tests?         Is sufficient Information available to reconcile the samplex to Image: Relinquished State Containers       Is Sufficient Information available to reconcile the samplex to Image: Relinquished State Containers       Is Sufficient Information available to reconcile the samplex to Image: Relinquished State Containers       Is Sufficient Information available to reconcile the samplex to Image: Relinquished State Containers       Is Sufficient Information available to reconcile the samplex to Image: Relinquished State Containers       Is Sufficient Information available to reconcile the samplex to Image: Relinquished State Containere		If Yes to either question, fill ou	t a Regulated Soi	l Checkli	st (F-MN-	-Q-338) and include with SCUR/COC paperwork.
Chain of Custody Filled Out?       Image: Stress of Custody Relinquished?       Image: Stress of Custody Relinquished?         Sampler Name and/or Signature on COC?       Image: Stress of Custody Relinquished?       Image: Stress of Custody Relinquished?         Sampler Name and/or Signature on COC?       Image: Stress of Custody Relinquished?       Image: Stress of Custody Relinquished?         Sampler Name and/or Signature on COC?       Image: Stress of Custody Relinquished?       Image: Stress of Custody Relinquished?         Short Hold Time Analysis (<22 hr)?		,				COMMENTS:
Chain of Custody Relinquished?       The       We       Contained Status         Sampler Name and/or Signature on COC?       Thes       IN0       INA         Samples Arrived within Hold Time?       Thes       IN0       INA         Short Hold Time Analysis (472 hr)?       IVes       IN0       6.         Rush Turn Around Time Requested?       IVes       IN0       6.         Sufficient Volume?       IXes       IN0       8.         Correct Containers Used?       IYes       IN0       10.         Filtered Volume Received for Dissolved Tests?       IYes       IN0       10.         Filtered Volume Received for Dissolved Tests?       IYes       IN0       11.       Note if sediment is visible in the dissolved container         Is sufficient Yolume Received for Dissolved Tests?       IYes       IN0       12.       IVI or if word for more Society for Market for Presention have been checked?         All containers needing acid/base preservation have been checked?       IVes       IN0       IVes       IN0         Initial when       Lot # of added       Initial when       Lot # of added       Choirne? Y IN         Sample #       IV-Si/I       INA       Initial when       Lot # of added         Roo/2015 (water) and Dixin/PFAS       IVes       IN0       <	Chain of Cust	tody Present?	<u> Yes</u>	No		1.
Sampler Name and/or Signature on COC?       Ytes       No       N/A       4.         Samples Arrived within Hold Time?       Ytes       No       5.         Short Hold Time Analysis (r2z ht)?       Ytes       No       6.         Rush Turn Around Time Requested?       Ytes       No       8.         Correct Containers Used?       Ytes       No       9.         -Pace Containers Used?       Ytes       No       9.         -Pace Containers Used?       Ytes       No       10.         Filtered Volume Received for Dissolved Tests?       Ytes       No       11.       Note if sediment is visible in the dissolved container         Is sufficient information available to reconcile the samples to the COC?       Matrix, Mathematical Wes       10.       Positive for Res. Chlorine? Y N         All containers needing acid/base preservation have been checked?       Matrix, Mathematical Yres       No       13.       HNOs       Sample #       I-Stiff (-Stiff)       Positive for Res. Chlorine? Y N         All containers needing acid/base preservation are found to be in complance with EPA recommendation?       If Nos       If Nos       Sample #       I-Stiff (-Stiff)       Positive for Res. Chlorine? Y N         Sample with EPA recommendation?       If Nos, HSQs, 2Ph, Nod UPS Stiffde, NoStH>12 Cyanide       If Nos	Chain of Cust	ody Filled Out?	Z Yes			
Samples Arrived within Hold Time?       Yes       No       5.         Short Hold Time Analysis (<72 hr)?	Chain of Cust	ody Relinguished?	Ves	Ø	6~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	22.34.5
Short Hold Time Analysis (<2 hr)?	Sampler Nam	ne and/or Signature on COC?		No	□n/a	4.
Rush Turn Around Time Requested?       IYes       No       7.         Sufficient Volume?       IYes       No       8.         Correct Containers Used?       IYes       No       9.         -Pace Containers Used?       IYes       No       10.         Filtered Volume Received for Dissolved Tests?       IYes       No       10.         Filtered Volume Received for Dissolved Tests?       IYes       No       10.         Filtered Volume Received for Dissolved Tests?       IYes       No       10.         Is sufficient information available to reconcile the sampler to the COC?       Matrix       IYes       No         All containers needing acid/base preservation have been checked?       INo       II.       Note if sediment is visible in the dissolved container         All containers needing preservation are found to be in compliance with EPA recommendation?       IVes       No       N/A         All containers needing preservation are found to be in compliance with EPA recommendation?       IVes       No       N/A         Compliance with EPA recommendation?       IVes       No       IN/A       Initial when initial wh	Samples Arriv	ved within Hold Time?	Yes			5.
Sufficient Volume?       Ves       No       8.         Correct Containers Used?       Ves       No       9.         -Pace Containers Used?       Ves       No       10.         Filtered Volume Received for Dissolved Tests?       Ves       No       10.         Filtered Volume Received for Dissolved Tests?       Ves       No       11.       Note if sediment is visible in the dissolved container         Is sufficient information available to reconcile the samplex to the COC?       Matrix:       Ves       No       12. // // // // // // // // // // // // //	Short Hold Ti	me Analysis (<72 hr)?	Yes	<b>Z</b> No		6.
Correct Containers Used?       Dive	Rush Turn Ar	ound Time Requested?	Yes			7.
	Sufficient Vol	ume?	<b>⊠</b> Yes	[]No		8.
Pace Containers Used?       Øres       №         Containers intact?       Øres       №       10.         Filtered Volume Received for Dissolved Tests?       Øres       №       10.         Is sufficient information available to reconcile the samples to the COC?       Matrix:       Øres       №       12. NO film on COV (n mpus)         All containers needing acid/base preservation have been checked?       Matrix:       Øres       №       13.       □HNO3       ØH2SO4       Positive for Res. Chlorine? Y N         All containers needing preservation are found to be in compliance with EPA recommendation?       Øres       №       N/A       Sample #       1-Si/II       Positive for Res. Chlorine? Y N         BRO/8015 (water) and Dioxin/PFAS       Øres       №       N/A       Initial when Lot # of added preservative:       Chlorine? Y N         Headspace in VOA Vials (>5mm)?       □Yes       №       Ør/A       14.       Trip Blank Present?       □Yes       №       Ør/A         Pripet Manager Review:	Correct Conta	ainers Used?	<b>V</b> Yes	No		9.
Containers Intact?       IVes       INo       10.         Filtered Volume Received for Dissolved Tests?       IVes       INo       II. Note if sediment is visible in the dissolved container         Is sufficient information available to reconcile the samplex to the COC?       Matrix:       IVes       INo       12VU       frime on CW/(s a matule)         All containers needing acid/base preservation have been checked?       INo       II.       IAHNO3       IHNO3       IHSO4,       INO       No         All containers needing preservation are found to be in compliance with EPA recommendation?       INVA       III.       III.       INO       IHNO3       IHSO4,       III.       NoOH       Positive for Res.         Charge and Dioxin/PFAS       IVes       INO       IN/A       IIIIIII When       I.ot # of added       Completed:       preservative:       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	-Pace Cont	ainers Used?		 ∏No		
Filtered Volume Received for Dissolved Tests?       IVes       No       II. Note if sediment is visible in the dissolved container         Is sufficient information available to reconcile the samples to the COC?       Matrix:       IVes       No       II. Note if sediment is visible in the dissolved container         All containers needing acid/base preservation have been concleaters needing preservation are found to be in compliance with EPA recommendation?       IVes       No       II.       III. Note if sediment is visible in the dissolved container         All containers needing preservation are found to be in compliance with EPA recommendation?       IVes       No       IV.A       III.       III. Note if sediment is visible in the dissolved container         All containers needing preservation are found to be in compliance with EPA recommendation?       IVes       No       IV.A       III.       III. Note if sediment is visible in the dissolved container         (HNOa, H_2SOa,        QPA       ON       N/A       III.       Sample #       IVes       INO       N/A         Sample #       IVEs       No       IV/A       III.       III.       III.       III.       III.       Positive for Res.         Checked?       No       IVA       III.       III.       III.       IIII.       IIII.       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Containers In	tact?				10.
Is sufficient information available to reconcile the samples to the COC?       Matrix:	Filtered Volur	ne Received for Dissolved Tests?			TAN/A	
the COC?       Matrix:       Att         All containers needing acid/base preservation have been checked?       Image: State in the image: Sta	Is sufficient in	formation available to reconcile the same		···· —· .	<u></u>	
checked?       Image: Second Sec	the COC?	Matrix: h	4 -			
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO3, H <sub>2</sub> SO4, <2PH, NaOH >9 Sulfide, NaOH >12 Cyanide) Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS PRO/8015 (water) and Dioxin/PFAS Project Manager Review: Project Manager Review: Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of Note: Whenever there is a discrepancy affecting North Carolina Demonstrance samples, a copy of this form		needing acid/base preservation have bee			_	
compliance with EPA recommendation?       (HNO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)       Ives       No       N/A         Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS       Ives       No       Ivitial when       Lot # of added         Headspace in VOA Vials ( >6mm)?       Ives       No       Ivitial when       Lot # of added         Headspace in VOA Vials ( >6mm)?       Ives       No       Ivitial when       Lot # of added         Trip Blank Present?       Ives       No       Ivitial       Ivitial when       Lot # of added         CliENT NOTIFICATION/RESOLUTION       Ives       Ives       No       Ivitial       Ives       No         Person Contacted:       Jeff (email)       Jeff (email)       Date/Time:       10/23/18       No         Project Manager Review:       Math       Date:       10/23/18       Date:       10/23/18         Note:       Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of the out of the cordina DEHNR Certification Office ( i.e. out of the out of the North Carolina DEHNR Certification Office ( i.e. out of the North Carolina DEHNR Certification Office ( i.e. out of the North Carolina DEHNR Certification Office ( i.e. out of the North Carolina DEHNR Certification Office ( i.e. out of the North Carolina DEHNR Certification Office ( i.e. out of the North C		needing preservation are found to be in	<b>L</b> Yes	<u>No</u>	∐N/A	Chloriner Y N
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	compliance w	ith EPA recommendation?	/			
DRO/8015 (water) and Dioxin/PFAS       Yes       No       ØN/A       completed:       preservative:         Headspace in VOA Vials (>6mm)?       Yes       No       ØN/A       14.         Trip Blank Present?       Yes       No       ØN/A       15.         Trip Blank Custody Seals Present?       Yes       No       ØN/A       15.         CLIENT NOTIFICATION/RESOLUTION       Field Data Required?       Yes       No         Person Contacted:       Jeff (email)       Date/Time:       10/23/18         Comments/Resolution:       Samples collected at 11:00 am per the client.       Date:       10/23/18         Project Manager Review:       Muthuk       Date:       10/23/18         Note:       Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of this form will be sent to the North Carolina DEHNR Certification Office (i.e. o			de) 🖉 Yes	ΠNο	□n/a	
Headspace in VOA Vials (>6mm)?       IVes       No       IN/A       14.         Trip Blank Present?       IVes       No       IN/A       15.         Trip Blank Custody Seals Present?       IVes       No       IN/A         Pace Trip Blank Lot # (if purchased):       IVes       No       IN/A         Field Data Required?       IVes         Outer/Time:         Outer:         Outer:         Outer:         Outer:         Outer:         Outer:         Outer:         Outer:			Yes	□No	⊠ÎN/A	
Trip Blank Present?   Trip Blank Custody Seals Present?   Pace Trip Blank Lot # (if purchased):     CLIENT NOTIFICATION/RESOLUTION   Person Contacted:   Jeff (email)   Comments/Resolution:   Samples collected at 11:00 am per the client.     Project Manager Review:     Motion:     Date:   10/23/18     Date:   10/23/18        Note:   Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (Le out of the North Carolina DEHNR Certification DEHNR Certification DEHNR Certification DEHNR Certification DEHNR C	Headspace in	VOA Vials ( >6mm)?			1	
Trip Blank Custody Seals Present?       IYes       No       An/A         Pace Trip Blank Lot # (if purchased):	Trip Blank Pre	sent?	Yes	No		15.
CLIENT NOTIFICATION/RESOLUTION       Field Data Required?       Yes       No         Person Contacted:       Jeff (email)       Date/Time:       10/23/18         Comments/Resolution:       Samples collected at 11:00 am per the client.       Date/Time:       10/23/18         Project Manager Review:         Project Manager Review:       Date:       10/23/18         Note:       Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of	⊤rip Blank Cus	tody Seals Present?	[] Yes	ΠNο	71	
Person Contacted: Jeff (email) Date/Time: 10/23/18 Comments/Resolution: Samples collected at 11:00 am per the client. Project Manager Review: Advance Date: 10/23/18 Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of	Pace Trip Blan	k Lot # (if purchased):		·		
Person Contacted:       Jeff (email)       Date/Time:       10/23/18         Comments/Resolution:       Samples collected at 11:00 am per the client.       Image: 10/23/18         Project Manager Review:       Image: 10/23/18       Date: 10/23/18         Note:       Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of the North Carolina DEHNR Certification DEHNR Ce	С					
Project Manager Review: Date: 10/23/18 Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of	Person Contac	cted: Jeff (email)				Date/Time:10/23/18
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of	Comments/Re	esolution: Samples collected a	at 11:00 am per	the clie	ent.	
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of	<u> </u>	A				
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of		/ and it	AL.T.	1 -		and to be a second a
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of hold, incorrect preservative, out of temp, incorrect containers)			- Manage			Date: 10/23/18
	Note: Wheneve hold, incorrect of	r there is a discrepancy affecting North Caro preservative, out of temp, incorrect contained	olina compliance sar	mples, a c	opy of this	s form will be sent to the North Carolina DEHNR Certification Office ( i.e. out of

LBIN



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

October 30, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: Colorado Pace Project No.: 10452717

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on October 23, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures





Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

#### CERTIFICATIONS

Project:	Colorado
Pace Project No.:	10452717

#### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



#### SAMPLE SUMMARY

Project:ColoradoPace Project No.:10452717

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10452717001	L1 WET 0mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452717002	L1 WET 50mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452717003	L1 WET 100mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452717004	L1 WET 250mg/L	Water	10/19/18 11:00	10/23/18 09:30
10452717005	L1 WET 500mg/L	Water	10/19/18 11:00	10/23/18 09:30



#### SAMPLE ANALYTE COUNT

Project:	Colorado
Pace Project No.:	10452717

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10452717001	L1 WET 0mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452717002	L1 WET 50mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452717003	L1 WET 100mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452717004	L1 WET 250mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M
10452717005	L1 WET 500mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	KEO	1	PASI-M



#### ANALYTICAL RESULTS

Project: Colorado Pace Project No.: 10452717									
Sample: L1 WET 0mg/L	Lab ID:	10452717001	Collecte	d: 10/19/1	8 11:00	Received: 10/	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	0.10	mg/L	0.10	0.030	1		10/26/18 12:34	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	0.35	mg/L	0.036	0.011	1		10/30/18 07:44		
Sample: L1 WET 50mg/L	Lab ID:	10452717002	Collecte	d: 10/19/1	8 11:00	Received: 10/	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	39.6	mg/L	2.0	0.60	20		10/26/18 12:36	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	47.6	mg/L	1.8	0.54	50		10/30/18 07:45		
Sample: L1 WET 100mg/L	Lab ID:	10452717003	Collecte	d: 10/19/1	8 11:00	Received: 10/	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	86.0	mg/L	5.0	1.5	50		10/26/18 12:37	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	91.7	mg/L	3.6	1.1	100		10/30/18 07:46		
Sample: L1 WET 250mg/L	Lab ID:	10452717004	Collecte	d: 10/19/1	8 11:00	Received: 10/	/23/18 09:30 Ma	atrix: Water	
Parameters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	221	mg/L	10.1	3.0	100		10/26/18 12:38	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	228	mg/L	7.1	2.1	200		10/30/18 07:47		



### ANALYTICAL RESULTS

Project: Pace Project No.:	Colorado 10452717									
Sample: L1 WET 5	600mg/L	Lab ID:	10452717005	Collected	d: 10/19/18	8 11:00	Received: 10/	23/18 09:30 N	latrix: Water	
Parame	ters	Results	Units	LOQ	LOD	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia		Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia		476	mg/L	20.1	6.0	200		10/26/18 12:40	7664-41-7	
353.2 Nitrate + Nitr	ite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus	NO3	489	mg/L	17.8	5.4	500		10/30/18 07:48	3	



#### **QUALITY CONTROL DATA**

Project:	Colorad	ło											
Pace Project No.:	104527	17											
QC Batch:	57146	5		Analys	sis Method:	E	PA 350.1						
QC Batch Method:	EPA 3	50.1		Analys	sis Descript	ion: 3	50.1 Ammor	nia					
Associated Lab San	nples:	1045271700	1, 10452717002	, 10452717	7003, 10452	2717004, 1	045271700	5					
METHOD BLANK:	310033	6		1	Matrix: Wa	ter							
Associated Lab San	nples:	1045271700	1, 10452717002	, 10452717	7003, 10452	2717004, 1	045271700	5					
				Blanl	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	Analyz	ed	Qualifiers				
Nitrogen, Ammonia			mg/L		ND	0.10	) 10/26/18	11:08					
LABORATORY COM	NTROLS	SAMPLE: 3	100337										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Red Limits		ualifiers			
Nitrogen, Ammonia			mg/L	2.5	5	2.5	100	90	)-110		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31003	38		3100339							
				MS	MSD								
Paramete	er	Units	10452832002 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia		mg/L	14.6	25	25	40.6	40.2	104	102	90-110		20	
MATRIX SPIKE & M			CATE: 31003	40		3100341							
			C	MS	MSD	0100041							
			10452836001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.4	2.5	97	99	90-110	2	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### **QUALITY CONTROL DATA**

Project:	Colorado	)											
Pace Project No .:	1045271	7											
QC Batch:	572080	)		Analys	sis Method	: E	EPA 353.2						
QC Batch Method:	EPA 35	3.2		Analys	sis Descrip	tion: 3	353.2 Nitrate	+ Nitrite, p	reserved				
Associated Lab San	nples: 1	0452717001	, 10452717002	, 10452717	7003, 1045	2717004,	1045271700	5					
METHOD BLANK:	3104086			ſ	Matrix: Wa	ter							
Associated Lab San	nples: 1	0452717001	, 10452717002	, 10452717	7003, 1045	2717004,	1045271700	5					
				Blank		eporting							
Paran	neter		Units	Resu	lt	Limit	Analyz	zed	Qualifiers	_			
Nitrogen, NO2 plus	NO3		mg/L		ND	0.03	6 10/30/18	07:58					
LABORATORY CON	NTROL SA	AMPLE: 31	04087										
Paran	neter		Units	Spike Conc.	LCS Resi		LCS % Rec	% Ree Limits		ualifiers			
Nitrogen, NO2 plus	NO3		mg/L	1		0.97	97	90	0-110		-		
MATRIX SPIKE & M	IATRIX SF		ATE: 31040	88		3104089	)						
				MS	MSD								
Damasala			10452260001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	0
Paramete		Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD		Qual
Nitrogen, NO2 plus l	NO3	mg/L	ND	1	1	0.96	6 0.96	95	94	90-110	0	20	
MATRIX SPIKE & M	IATRIX SF		ATE: 31040	90		3104091							
				MS	MSD								
_			10452260003	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	_
Paramete	r	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus I	NO3	mg/L	ND	1	1	1.1	I 1.1	99	99	90-110	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



#### QUALIFIERS

Project: Colorado Pace Project No.: 10452717

#### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above LOD.

J - Estimated concentration at or above the LOD and below the LOQ.

LOD - Limit of Detection adjusted for dilution factor and percent moisture.

LOQ - Limit of Quantitation adjusted for dilution factor and percent moisture.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected at or above the adjusted LOD.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

#### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis



#### QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	Colorado
Pace Project No .:	10452717

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10452717001	L1 WET 0mg/L	EPA 350.1	571465		
10452717002	L1 WET 50mg/L	EPA 350.1	571465		
10452717003	L1 WET 100mg/L	EPA 350.1	571465		
10452717004	L1 WET 250mg/L	EPA 350.1	571465		
10452717005	L1 WET 500mg/L	EPA 350.1	571465		
10452717001	L1 WET 0mg/L	EPA 353.2	572080		
10452717002	L1 WET 50mg/L	EPA 353.2	572080		
10452717003	L1 WET 100mg/L	EPA 353.2	572080		
10452717004	L1 WET 250mg/L	EPA 353.2	572080		
10452717005	L1 WET 500mg/L	EPA 353.2	572080		

# WO#:10452717

# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

	Page: of	REGULATORY AGENCY	- NPDES I GROUND WATER I DRINKING WATER	UST L'RCRA L'OTHER	SITE T GA IT IL I IN I MI I NC			Requested B	Pace Project	68/			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		,					DATE TIME SAMPLE CONDITIONS		N/A N/A N/A	 N/A	Teceived on Custody Icee Ice Ice	1 IF   00
	Section C Invoice Information:	5	Name: WONKK	Address:	Pace Quote Reference	Pace Project Manager: Or O, AP, MA A O. A. 19		LION COLLED EMP AT TYNERS COLLED EMP AT TYNERS COMP	µзиој 2 <sup>8</sup> 0 <sup>2</sup> 0H 02 <sup>3</sup> 2 <sup>3</sup> 5 <sup>3</sup> tesestored correc. correc. correc. correc. correc. tesestored correc. corre	DATE TIME DATE TIME 5 22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2										RELINQUISHED BY / AFFILIATION DATE TIME ACCEPTED BY / AFFILIATION	there a photo			SAMPLER NAME AND SIGNATURE PRINT Name of SAMPLER: 1011 AULT JOWES SIGNATURE of SAMPLER: 1011 AULT JONES SIGNATURE	21/-zlat (Minn
10452717	Section A Section B Required Client Information	1 JeffStrow	OLSON WWW. MWN	First Front Colcien Mailin Min N	WenterCon	Project Name: Colong	Project Number:	Valid Matrix Codes 1.attion <u>MATRIX</u> DRINGING WATER WATER WATER	The character per box. The monor of the character per box. The monor of the character per box. The monor of the character of	LI WET DM9/1	LI WET	LI WET	4 L1 WET 260 mg/L	5 LI WET 500 mg/L			6	01	12	Additional Comments:				Page 11	of 12

E-File, (ALLQ020rev.3,31Mar05), 13Jun2005

	Star and	Do Sample Cone	cument		Document Revised: 02May2018 pt Form Page 1 of 2	
	Pace Analytical		ocument		Issuing Authority:	
		F-N	/IN-L-213	-rev.23	Pace Minnesota Quality Office	
Sample Co Upon Re				Project	# WO#:10452717	
Courier:			C	lient	PM: 0E0 Due Date: 10/30/1	8
Commerc	cial 🔤 Pace 🔄 Speel	Dee Other:_			CLIENT: WENCK	
Tracking N	lumber: <u>2 575 032</u>	035410	136	6	· · · · · · · · · · · · · · · · · · ·	
Custody Se	al on Cooler/Box Present? Yes		Seals Inta	nct?	Yes No Optional: Proj. Due Date: Proj. Nar	ne:
Packing Ma	aterial: 🗖 Bubble Wrap 🗍 Bubb	le Bags 🗌 None	e ∐c	ther:	Temp Blank?	±2116
Thermome Used:	G87A9155100842		e of Ice:	<b>W</b> et		行 フ
Cooler Tem		mp Corrected (°C)	: <u> </u>	<u> </u>	Biological Tissue Frozen? Yes	
	d be above freezing to 6°C Correcti ated Soii ( 🔽 N/A, water sample)	ion Factor:	-0 ~	<u>í</u> Date	e and Initials of Person Examining Contents: $10/237$	18 []
Did samples (	originate in a quarantine zone within the	United States: AL, A	.R, CA <u>, F</u> L,	GA, ID, L	A. MS, Did samples originate from a foreign source (international states)	onaliy,
NC, NM, NY,	OK, OR, SC, TN, TX or VA (check maps)? If Yes to either question fill o	ut a Regulated Soli			No including Hawaii and Puerto Rico)?	No
			CHECKIIS	L (L-14114-	COMMENTS:	
Chain of Cus	tody Present?	Yes	No		1.	
	tody Filled Out?	Yes			2.	
	tody Relinguished?				3.	
Sampler Nar	ne and/or Signature on COC?		No	□n/a	4.	
Samples Arri	ved within Hold Time?	Yes	No		5.	
Short Hold T	ïme Analysis (<72 hr)?	Yes	ZNo		6	
Rush Turn A	round Time Requested?	Yes	D/No		7.	
Sufficient Vo	lume?	<b>⊉</b> Yes	No		8	
Correct Cont	ainers Used?	<b>Ø</b> Yes	ΠNο		9.	
-Pace Con	tainers Used?	Ves_	No			
Containers Ir	ntact?	Z Yes	No		10.	
Filtered Volu	me Received for Dissolved Tests?	Yes	No		11. Note if sediment is visible in the dissolved container	
ls sufficient i the COC?	nformation available to reconcile the sam Matrix:	nples to Ves	∏No		12.	
All container checked?	s needing acid/base preservation have be					e for Res.
	s needing preservation are found to be ir	∭ Yes	∐No	∐n/a	Sample # 1-5:1/1 Chlorin	e?YN
	vith EPA recommendation? 4, <2pH, NaOH >9 Sulfide, NaOH>12 Cvar		<b>—</b>	<b>—</b>		
	4, <2pH, NaOH >9 Suffice, NaOH>12 Cyar /OA, Coliform, TOC/DOC Oil and Grease,	nide) 🗾 Yes	∐No	□N/A	Initial when Lot # of added	
	vater) and Dioxin/PFAS	Yes	No		completed:preservative:	
	vOA Vials ( >6mm)?	☐Yes	No	ZN/A	14.	
Trip Blank Pro		☐ Yes	∐No		15.	
	stody Seals Present? nk Lot # (if purchased):	Yes	□No	<b>Ç⊉∕</b> N/A		
		-		,		
Person Conta	CLIENT NOTIFICATION/RESOLUTION acted: Jeff (email)				Field Data Required? Yes	0
Comments/F	······································	ed at 11:00 am pe	er the cli	ient	Date/Time: 10/23/18	
connictits/r						
	1	11 -	-			<u></u>
Pr	oject Manager Review:	to Alunch			Date: 10/23/18	
Note: Whenev	ver there is a discrepancy affecting North Ca	rolina compliance sa	mples, a co	opy of this	form will be sent to the North Carolina DEHNR Certification Office	(i.e out of
hold, incorrect	preservative, out of temp, incorrect contain	ners).				

UB:W



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 10, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457424

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457424

'ace Analytica

www.pacelabs.com

#### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

#### CERTIFICATIONS

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



#### SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457424

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457424001	STD 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457424002	STD 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457424003	STD 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457424004	STD 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457424005	STD 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



## SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457424

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10457424001	STD 0 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457424002	STD 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457424003	STD 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457424004	STD 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457424005	STD 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



#### ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457424

Lab ID:	10457424001	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Analytical	Method: EPA 3	50.1						
ND	mg/L	0.10	0.030	1		12/07/18 17:13	7664-41-7	
Analytical	Method: EPA 3	53.2						
ND	mg/L	0.10	0.018	1		12/08/18 15:51		
Lab ID:	10457424002	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Analytical	Method: EPA 3	50.1						
49.6	mg/L	2.0	0.60	20		12/07/18 17:17	7664-41-7	
Analytical	Method: EPA 3	53.2						
49.6	mg/L	5.0	0.88	50		12/08/18 15:54		
Lab ID:	10457424003	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Analytical	Method: EPA 3	50.1						
103	mg/L	5.0	1.5	50		12/07/18 17:19	7664-41-7	
Analytical	Method: EPA 3	53.2						
99.5	mg/L	10.0	1.8	100		12/08/18 15:55		
Lab ID:	10457424004	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
Analytical	Method: EPA 3	50.1						
Analytical 251	Method: EPA 3 mg/L	50.1 10.0	3.0	100		12/07/18 17:23	7664-41-7	
251		10.0	3.0	100		12/07/18 17:23	7664-41-7	
· · ·	Results Analytical ND Analytical ND Analytical ND Lab ID: Results Analytical 49.6 Analytical 49.6 CLab ID: Results Analytical 99.5	Analytical Method: EPA 3 ND mg/L Analytical Method: EPA 3 ND mg/L Lab ID: 10457424002 Results Units Analytical Method: EPA 3 49.6 mg/L Analytical Method: EPA 3 49.6 mg/L Lab ID: 10457424003 Results Units Analytical Method: EPA 3 103 mg/L Analytical Method: EPA 3 99.5 mg/L	ResultsUnitsReport LimitAnalyticalmg/L0.10NDmg/L0.10AnalyticalMethod: EPA 353.2NDNDmg/L0.10Analyticalmg/L0.10ResultsUnitsReport LimitAnalyticalUnitsReport LimitAnalyticalMethod: EPA 350.1AnalyticalAnalyticalMethod: EPA 350.149.6mg/LAnalyticalMethod: EPA 350.1AnalyticalAnalyticalMethod: EPA 350.1Collected Report LimitAnalyticalUnitsCollected Report LimitAnalyticalUnitsS.0AnalyticalMg/L5.0Analyticalmg/L5.0Analyticalmg/L5.0Analyticalmg/L10.0Mg/LJo.010.0Mg/LLimit10.0	ResultsUnitsReport LimitMDLAnalytical Wethod: EPA 350.1ND0.030Analytical Wethod: EPA 350.2ND0.010NDmg/L0.100.018Analytical Wethod: EPA 350.1Collected: 12/03/1 ReportReport LimitAnalytical Wethod: EPA 350.1MDLAnalytical Wethod: EPA 350.1Analytical Wethod: EPA 350.1Analytical Wethod: EPA 350.10.688Analytical Wethod: EPA 350.1NDAnalytical Wethod	Results         Units         Report Limit         MDL         DF           Analytical Wethod: EPA 350.1         ND         0.030         1           ND         mg/L         0.10         0.030         1           Analytical Wethod: EPA 353.2         ND         0.010         0.018         1           Analytical Wethod: EPA 353.2         ND         mg/L         0.10         0.018         1           Lab ID:         10457424002         Collected:         12/03/18         11:00           Results         Units         Limit         MDL         DF           Analytical Wethod: EPA 350.1         Keport         MDL         DF           Analytical Wethod: EPA 350.1         0.600         20         20           Analytical Wethod: EPA 350.2         0.600         20         20           Analytical Wethod: EPA 350.2         0.88         50           Results         Units         Collected:         12/03/18         100           Results         Units         Emport         MDL         DF           Analytical Wethod: EPA 350.1         S0.0         1.5         50           Analytical Wethod: EPA 350.2         99.5         mg/L         5.0         1.5 <t< td=""><td>Results         Units         Report Limit         MDL         DF         Prepared           Analytical         wethod: EPA 350.1        </td><td>Results         Units         Limit         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         ND         mg/L         0.10         0.030         1         12/07/18 17:13           Analytical Method: EPA 353.2         ND         mg/L         0.10         0.018         1         12/07/18 17:13           Analytical Method: EPA 353.2         ND         mg/L         0.10         0.018         1         12/08/18 15:51           Lab ID:         10457424002         Collected:         12/03/18 11:00         Received:         12/04/18 09:45         M           Results         Units         Limit         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         Report         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         49.6         mg/L         2.0         0.60         20         12/07/18 17:17           Analytical Method: EPA 353.2         49.6         mg/L         5.0         0.88         50         12/08/18 15:54           Analytical Method: EPA 350.1         Report         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         Imit         &lt;</td><td>Results         Units         Report Limit         MDL         DF         Prepared         Analyzed         CAS No.           Analytical         Method:         EPA 350.1         12/07/18 17:13         7664-41-7           ND         mg/L         0.10         0.030         1         12/08/18 17:13         7664-41-7           Analytical         Method:         EPA 353.2         ND         mg/L         0.10         0.018         1         12/08/18 15:51           Lab ID:         10457424002         Collected:         12/03/18         11:00         Received:         12/04/18 09:45         Matrix: Water           Results         Units         Limit         MDL         DF         Prepared         Analyzed         CAS No.           Analytical         Method:         EPA 350.1           12/07/18 17:17         7664-41-7           Analytical         Method:         EPA 353.2           12/08/18 15:54            49.6         mg/L         5.0         0.68         50         12/08/18 15:54            Lab ID:         10457424003         Collected:         12/03/18         I:00         12/07/18 17:19         7664-41-7           Analytical</td></t<>	Results         Units         Report Limit         MDL         DF         Prepared           Analytical         wethod: EPA 350.1	Results         Units         Limit         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         ND         mg/L         0.10         0.030         1         12/07/18 17:13           Analytical Method: EPA 353.2         ND         mg/L         0.10         0.018         1         12/07/18 17:13           Analytical Method: EPA 353.2         ND         mg/L         0.10         0.018         1         12/08/18 15:51           Lab ID:         10457424002         Collected:         12/03/18 11:00         Received:         12/04/18 09:45         M           Results         Units         Limit         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         Report         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         49.6         mg/L         2.0         0.60         20         12/07/18 17:17           Analytical Method: EPA 353.2         49.6         mg/L         5.0         0.88         50         12/08/18 15:54           Analytical Method: EPA 350.1         Report         MDL         DF         Prepared         Analyzed           Analytical Method: EPA 350.1         Imit         <	Results         Units         Report Limit         MDL         DF         Prepared         Analyzed         CAS No.           Analytical         Method:         EPA 350.1         12/07/18 17:13         7664-41-7           ND         mg/L         0.10         0.030         1         12/08/18 17:13         7664-41-7           Analytical         Method:         EPA 353.2         ND         mg/L         0.10         0.018         1         12/08/18 15:51           Lab ID:         10457424002         Collected:         12/03/18         11:00         Received:         12/04/18 09:45         Matrix: Water           Results         Units         Limit         MDL         DF         Prepared         Analyzed         CAS No.           Analytical         Method:         EPA 350.1           12/07/18 17:17         7664-41-7           Analytical         Method:         EPA 353.2           12/08/18 15:54            49.6         mg/L         5.0         0.68         50         12/08/18 15:54            Lab ID:         10457424003         Collected:         12/03/18         I:00         12/07/18 17:19         7664-41-7           Analytical



### ANALYTICAL RESULTS

Project:N adsorption 3Pace Project No.:10457424

Sample: STD 500 mg/L	Lab ID:	10457424005	Collected	: 12/03/18	8 11:00	Received: 12/	04/18 09:45 Ma	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	Method: EPA 3	50.1						
Nitrogen, Ammonia	502	mg/L	20.0	6.0	200		12/07/18 17:25	7664-41-7	
353.2 Nitrate + Nitrite	Analytical N	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	402	mg/L	50.0	8.8	500		12/08/18 15:58		



# **QUALITY CONTROL DATA**

Project:	N adso	ption 3											
Pace Project No .:	104574	24											
QC Batch:	57960	1		Analys	sis Method:	E	EPA 350.1						
QC Batch Method:	EPA 3	50.1		Analys	sis Descript	ion: 3	350.1 Ammor	nia					
Associated Lab San	nples:	1045742400	01, 10457424002	, 10457424	003, 1045	7424004, 1	1045742400	5					
METHOD BLANK:	314366	9			Matrix: Wa	ter							
Associated Lab San	nples:	1045742400	01, 10457424002	, 10457424	003, 1045	7424004, 1	1045742400	5					
				Blanl	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	0 0	0.030 12/	07/18 16:57				
LABORATORY COM	NTROLS	AMPLE: 3	3143670										
Paran	notor		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limits		alifiers			
	neter									amers	-		
Nitrogen, Ammonia			mg/L	2.5	)	2.5	99	90	0-110				
MATRIX SPIKE & N	ATRIX S		CATE: 31436	71		3143672							
				MS	MSD								
			10457424001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	ər	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.5	2.5	100	100	90-110	0	20	
MATRIX SPIKE & M	ATRIX S		ICATE: 31436	73		3143674							
				MS	MSD								
			10457588001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
_			_	-	-	_							
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adsorption 3	3											
Pace Project No.:	10457424												
QC Batch:	579733			Analys	is Method	1:	EPA 353.2						
QC Batch Method:	EPA 353.2			Analys	is Descrip	otion:	353.2 Nitrate	e + Nitrite	e, preserved				
Associated Lab Sar	nples: 10457	424001,	10457424002	, 10457424	003, 1045	57424004,	1045742400	05					
METHOD BLANK:	3144848			Ν	Aatrix: Wa	ater							
Associated Lab Sar	nples: 10457	424001,	10457424002	, 10457424	003, 1045	57424004,	1045742400	05					
				Blank	c F	Reporting							
Parar	neter		Units	Resul	t	Limit	MDL	-	Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3		mg/L		ND	0.1	0	0.018	12/08/18 16:0 <sup>-</sup>	1 FS			
LABORATORY COI	NTROL SAMPL	E: 314	4849										
				Spike	LC	S	LCS	%	Rec				
Parar	neter		Units	Conc.	Res	ult	% Rec	Lir	nits Q	ualifiers			
Nitrogen, NO2 plus	NO3		mg/L	1		0.99	99	9	90-110 FS		-		
MATRIX SPIKE & M	IATRIX SPIKE	DUPLICA	ATE: 31448	50		3144851							
				MS	MSD								
		1	0457424001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Red	c % Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	1 1.1	1	06 107	90-110	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457424

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No .:	10457424

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457424001	STD 0 mg/L	EPA 350.1	579601		
10457424002	STD 50 mg/L	EPA 350.1	579601		
10457424003	STD 100 mg/L	EPA 350.1	579601		
10457424004	STD 250 mg/L	EPA 350.1	579601		
10457424005	STD 500 mg/L	EPA 350.1	579601		
10457424001	STD 0 mg/L	EPA 353.2	579733		
10457424002	STD 50 mg/L	EPA 353.2	579733		
10457424003	STD 100 mg/L	EPA 353.2	579733		
10457424004	STD 250 mg/L	EPA 353.2	579733		
10457424005	STD 500 mg/L	EPA 353.2	579733		



# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

f Section A Required C	Section A Required Client Information:	Section B Required Project Information:	oject In	lformat	tion:				ά	Section C Invoire Info	Section C woice Information	È									Page:		٩			Γ
Company:	ny: Wenck Associates Brian Beck	Report To: same	ame						×	Attention:	ľ	Jeff Strom	Ĕ				Γ									]
Address:	7500 Olson Memorial Hwy	Copy To:							Ŭ	упрапу	Company Name:		Wenck Associates	sociate	ş			REGUI	ATOF	REGULATORY AGENCY	NCY					
	Suite 300, Golden Valley, MN 55427								¥	Address:	×	same							NPDES		ROUND	GROUND WATER		DRINKING WATER	MATER	T
Email To:	o: jstrom@wenck.com	Purchase Order No.:	der No.	2					d d	ce Quote								⊓ UST	F	ž L	RCRA		i 5 . L		1	
Phone:	763-252-6833 Fax	Project Name:		l ads.	N adsorption 3				Z Å	Pace Project Manager	1	yeyem	Oyeyemi Odijole	le		1		Site L	Site Location							
Reque	Requested Due Date/TAT: std TAT	Project Number,	Jer.							Pace Profile #	:# e								STATE:							
															ſ	Reque	sted A	Requested Analysis Filtered (Y/N)	s Filte	red (Y	Î					
	Section D Valid Matrix Codes Required Client Information <u>MATRIX</u> <u>COI</u>	odes CODE	-	(HMC)		COLLECTED	CTED				Чd	Preservatives	tives		<b>1</b> N /λ				<u> </u>							
	DRINKING WATER WATER WASTE WATER PRODUCT SOIL/SOLID OIL	o, ≌ ™ M⊤ W	seboo bilev ses	))=) EARD=	COMPOSITE START	Ľ	COMPOSITE END/GRAB	۳a							l An tu ta <b>t</b> i			- #	#	⊢ॅ	44		10457424			
11EW #	SAMPLE ID WIFE (A-2, 0-9 /) OTHER Sample IDs MUST BE UNIQUE TISSUE	<del></del>			н Ц		Here and the second sec			A OF CONTAINER	INO <sup>3</sup> I <sup>5</sup> SO⁵	190 <u>4</u> 101	195S2O3	Vethanol Viher	tsəT sisylsnA N-muinomm	N-əfitin-əfatt		10457424	7424				· · · ·			
-	STD 0 mg/L		1 5		12/3/18	_	12/3/18	11:00	_	-	H ×	4	١	)		_			+-			Ы	Pace Pr	Pace Project No./ Lab I.D.	/Lab I.D	
2	STD 50 mg/L		۲. ۲		12/3/18	⊢	12/3/18	11:00	_	+	×	╞	<u> </u>	Į-	:   ×	+		-	-					27		Ţ
n	STD 100 mg/L	>	wT∮ o	 ن	12/3/18	11:00	12/3/18	11:00		1	×			Ē	×	×			-					1.</td <td></td> <td></td>		
4	STD 250 mg/L	2	_ ₩	- ت	12/3/18	11:00	12/3/18	11:00	20	1	X				×	-			-					H(0)		
 £С	STD 500 mg/L	>	ž	- 0	12/3/18	11:00	12/3/18	11:00	20	-	×	⊢		Ĥ	×	×								Ś		<u> </u>
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age 1						Чd	PRINT Name of SAMPLER:	of SAMPL	۲. ۲.			5										pəniə:	N/Y) e (boteu	(N/Y)	ni aeic (N\Y)	
11 of					]	ō	SIGNATURE	of SAMPLER			F	4		ノ	15 	DATE Signed (MM/DD/YY):		12/3	5				001	Seale		
12	"Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 38 days.	ace's NET 30 d	ау рауп	TIENT EE	rms and agre	eing to late .	charges of 1.4	5% per mont	h for any	v invoices	not paid	within 3	Ì days.						-		F-1	ALL-0-02	Drev.08, 1	F-ALL-O-020rev.08, 12-Oct-2007	~	

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67			t Name:			Docu	ment Revi	sed: 310ct20	18	-
Pace Analytical®	Sample Con			eipt Form			Page 1	. of 2		
		Docume MN-L-21	nt No.: <b>3-rev.2</b> 4		ľ		Issuing Au	uthority: Quality Off	<u>.</u>	
Sample Condition Client Name:			Project	+ #++ [						
Upon Receipt			FIUIEC		10#	::10	<u>045</u>	<u>742</u>	4	
Courier: Fed Ex Sups			Client	PM	I: 0E	0	Due	Date:	12/11/	/18
Commercial Pace SpeeDe			enerre	CL	IENT	: WENC				
Tracking Number: 17 575 032 03 559			<u> </u>							
<b>b.c</b>	_	Seals Ini	tact? 🖗	Yes [	No	Optiona	l: Proj.	Due Date:	Proj. 1	Name:
Packing Material:		_	Other:				Temp	Blank? Ø	Yes	No
Thermometer,G87A9170600254 Used:G87A9155100842	Тур	e of Ice:		et 🗌 Blu	e [	None	Dry	_ Meite	 1.	
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JSDA Regulated Soil (🔀 N/A, water sample)									12~17	
Did samples originate in a quarantine zone within the Un NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? If Yes to either question, fill out		- TN	∕es [	No	includ	ng Hawaii a	and Puerto	foreign sour Rico)? Daparwork		
		ι					COMME	· · · · · · · · · · · · · · · · · · ·		
Chain of Custody Present?	Yes			1.	<u></u>		CONTINE	.1613.		
Chain of Custody Filled Out?	<b>K</b> Yes	No		2.				· · · · ·		
hain of Custody Relinquíshed?	☐Yes			3.			·			
ampler Name and/or Signature on COC?	Ves Ves		N/A	4.						
amples Arrived within Hold Time?	X Yes			5.			-			
hort Hold Time Analysis (<72 hr)?	Yes			6.		· · · · ·	, <u> </u>			
ush Turn Around Time Requested?	 ☐Yes	KIN0		7.	· · ·					
ufficient Volume?	<b>Da</b> lyes		·	8:		<u></u>				· · · · · · · · · · · · · · · · · · ·
Correct Containers Used?	fv fyres			9.				i		<u> </u>
-Pace Containers Used?	T Styres	 ПN0							÷	
ontainers intact?	<b>√</b> ¥es			10.				·		
Itered Volume Received for Dissolved Tests?	Yes				e if sed	ment is vie	ible in the	dissolved co		
sufficient information available to reconcile the sample		□ No		12.		inche is vis	ADIE IN LITE	uissoiveu co	mamer	
he COC? Matrix:										
II containers needing acid/base preservation have beer hecked?	ı <b>d</b> ⊈ÎYes	□No		13.	D٢	NO <sub>3</sub>	∭ H₂SO4	ПиаОн		ive for Res
Il containers needing preservation are found to be in	( <u>R</u> ) ies		□n/a	Sample #				<b></b>	Chior	ine? Y N
ompliance with EPA recommendation? INO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide	e) (Xyes	<b></b> ,	<b></b>			<b>6</b> .	1			
ceptions: VOA, Coliform, TOC/DOC Oil and Grease,	-/ Martes	No	□n/A	Initial whe	en		lot#r	of added		
RO/8015 (water) and Dioxin/PFAS	Yes	No	KÎN/A	completed				rvative:	<u> </u>	
eadspace in VOA Vials ( >6mm)?	Yes	No		14.						
rip Blank Present? rip Blank Custody Seals Present?	☐ Yes		₽N/A	15.						
ace Trip Blank Lot # (if purchased):	Yes	□No	D/N/A							
		····.			<u> </u>				<u> </u>	
CLIENT NOTIFICATION/RESOLUTION rson Contacted:				_		Field	l Data Rec	uired?	Yes 🗌	No
			·····	Date/Tim	ne:	- <u> </u>	1 <u>2/4/</u> 1	8		···
omments/Resolution: <u>Samples collect</u>		,								
								<u> </u>		<b></b> .
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Project Manager Review:		LIYOL			Date:					

Labeled by: V



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 10, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457416

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457416

'ace Analytica

www.pacelabs.com

### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

### CERTIFICATIONS

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



# SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457416

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457416001	L2 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457416002	L2 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457416003	L2 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457416004	L2 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457416005	L2 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



# SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457416

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10457416001	 L2 0 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457416002	L2 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457416003	L2 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457416004	L2 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457416005	L2 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



# ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457416

Sample: L2 0 mg/L	Lab ID:	10457416001	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	ND	mg/L	0.10	0.030	1		12/07/18 16:17	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	0.18	mg/L	0.10	0.018	1		12/08/18 15:09	)	FS
Sample: L2 50 mg/L	Lab ID:	10457416002	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	45.2	mg/L	2.0	0.60	20		12/07/18 16:21	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	49.1	mg/L	5.0	0.88	50		12/08/18 15:10	)	
Sample: L2 100 mg/L	Lab ID:	10457416003	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	93.5	mg/L	5.0	1.5	50		12/07/18 16:22	2 7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	97.2	mg/L	10.0	1.8	100		12/08/18 15:11		
Sample: L2 250 mg/L	Lab ID:	10457416004	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	240	mg/L	10.0	3.0	100		12/07/18 16:24	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	244	mg/L	20.0	3.5	200		12/08/18 15:13	3	



# ANALYTICAL RESULTS

Project: N adsorption 3

Sample: L2 500 mg/L	Lab ID:	10457416005	Collected	1: 12/03/18	8 11:00	Received: 12/	/04/18 09:45 Ma	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	488	mg/L	20.0	6.0	200		12/07/18 16:25	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	505	mg/L	50.0	8.8	500		12/08/18 15:14		



# **QUALITY CONTROL DATA**

Project:	N adsor	rption 3											
Pace Project No .:	104574	16											
QC Batch:	57960	0		Analys	sis Method:	E	PA 350.1						
QC Batch Method:	EPA 3	50.1		Analys	sis Descript	tion: 3	50.1 Ammor	nia					
Associated Lab San	nples:	1045741600	1, 10457416002	, 10457416	5003, 1045 <sup>-</sup>	7416004, 1	045741600	5					
METHOD BLANK:	314366	2			Matrix: Wa	ter							
Associated Lab San	nples:	1045741600	1, 10457416002	, 10457416	5003, 1045 <sup>-</sup>	7416004, 1	045741600	5					
				Blan	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	) (	0.030 12	/07/18 16:14	Ļ			
LABORATORY COM	NTROL S	SAMPLE: 3	143663										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		alifiers			
Nitrogen, Ammonia			mg/L	2.5	5	2.3	94	9	0-110		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31436	64		3143665							
				MS	MSD								
Paramete	er	Units	10457416001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.6	2.7	100	104	90-110	3	20	
MATRIX SPIKE & M	IATRIX S		CATE: 31436	66		3143667							
				MS	MSD								
			10457417001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	0.11	2.5	2.5	2.6	2.6	98	101	90-110	3	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adso	rption 3											
Pace Project No.:	104574	116											
QC Batch:	57973	32		Analys	sis Method:	: E	PA 353.2						
QC Batch Method:	EPA 3	353.2		Analys	sis Descript	tion: 3	53.2 Nitrate	+ Nitrite,	preserved				
Associated Lab Sar	nples:	1045741600	1, 10457416002	, 10457416	6003, 1045 <sup>-</sup>	7416004, 1	045741600	5					
METHOD BLANK:	314484	12		٢	Matrix: Wa	ter							
Associated Lab Sar	nples:	1045741600	1, 10457416002	, 10457416	6003, 1045 <sup>-</sup>	7416004, 1	045741600	5					
				Blank		eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3		mg/L		ND	0.10	) (	).018 12	/08/18 15:41	FS			
LABORATORY CO	NTROLS	SAMPLE: 3 <sup>°</sup>	144843										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		alifiers			
Nitrogen, NO2 plus	NO3		mg/L	1		1.0	100	ç	0-110 FS		-		
MATRIX SPIKE & M	ATRIX :		CATE: 31448	44		3144845							
				MS	MSD								
Paramete	er	Units	10457419001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	1.0	100	97	90-110	3	20	FS
MATRIX SPIKE & M	ATRIX :		CATE: 31448	46		3144847							
				MS	MSD								
_			10457422001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	<b>.</b> .
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	0.12	1	1	1.1	1.1	94	101	90-110	6	20	FS

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457416

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No.:	10457416

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457416001	L2 0 mg/L	EPA 350.1	579600		
10457416002	L2 50 mg/L	EPA 350.1	579600		
10457416003	L2 100 mg/L	EPA 350.1	579600		
10457416004	L2 250 mg/L	EPA 350.1	579600		
10457416005	L2 500 mg/L	EPA 350.1	579600		
10457416001	L2 0 mg/L	EPA 353.2	579732		
10457416002	L2 50 mg/L	EPA 353.2	579732		
10457416003	L2 100 mg/L	EPA 353.2	579732		
10457416004	L2 250 mg/L	EPA 353.2	579732		
10457416005	L2 500 mg/L	EPA 353.2	579732		

Pace Analytical

# CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: of				GROUND WATER I DRINKING WATER	ZA L OTHER						0457416		- Toises	race r	C C C	27	2 m J								SAMPLE CONDITIONS			ntact ooler M)	Temp ir Receiver Custor Sealed C (Y/N) Samples I (Y/N)
	-		Υ Υ Υ	I NPDES T GR	L UST L RCRA	Site Location		STATE:	Requested Analysis Filtered (Y/N)		MO#:104		10457416												12 Julie - Jur	•			12/3/19
DIMS	ion: Jeff Strom	Company Name: Wenck Associates	232		Juote nce:	raject Oyeyemi Odijole	Manager. Pace Profile #			Preservatives		الاتانية Bes Test N-mr N-mr	inomi∧ litrate-n																
Invoice Info	Attention:	Comp	Address:		Referen	Pace Project	Pace P				S COMPOSITE COMP	TEMP AT C	L JJGMAS	⊢	11:00	11:00	11:00 20 1	11:00											THE OF SAMPLER:
						e				COLLECTED		· · · · ·	TIME	Ļ	11:00 12/3/18	11:00 12/3/18	11:00 12/3/18	11:00 12/3/18				_		AFFILIATION				SAMPLER NAME	PKINI NAME SIGNATURE
Required Project Information:	same		r F	Judar No -		me: N adsorption 3	nber:				Sebeo valid codes		XIATAM SAMPLE . Aft The The The The The The The The The The	WT G 12/3/18	WT G 12/3/18	WT G 12/3/18	WT G 12/3/18	WT G 12/3/18						RELINQUISHED BY / AFFILIATION					
Client Information:		7500 Olson Memorial Hwy Copy To:	Suite 300, Golden Valley, MN 55427			763-252-6833 Fax: Project Name:	Requested Due Date/TAT: std TAT Project Number:			Section D Valid Matrix Codes Required Client Information MATRIX CODE		SAMPLE IU WP WP WP AR		L2 0 mg/L				L2 500 mg/L						ADDITIONAL COMMENTS					
Required	Company:	Address:		Email To:		Phone; 7	tequested		ľ	<u>v) K</u>			# MBTI		2		4	2	<u>ہ</u>	~	 an i	10	<del>2</del> <del>2</del>	: 			Í	Pa	ge 11 of

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	Pace Analytica	v° ⊢	Sample Con	dition U Documer		ipt For	rm			1 of 2		_
	f			MN-L-21				Pac	Issuing A e Minnesota	•	ffice	
i												l
Sample Condition Upon Receipt					Project	#:	MO	#:1	.045	741	6	
Courier:	minuc	<u></u>					PM: (	DE0	Due	Date:	12/11	/18
	Fed Ex	<b>⊠ú</b> µs		_	lient		• • •	NT: WEI				
Commercial Tracking Numbe		SpeeDee	Other:									
Hacking Numbe	- J-t SIS 03	2035536	042									
Custody Seal on	Cooler/Box Present?	🕅 Yes 🗌 N	lo	Seals Int	act? 🖉	Yes	□No	Optic	o <b>nal:</b> Proj.	Due Date:	Proj.	Name:
Packing Material	: 🕅 Bubble Wrap	Bubble Bag	5 🗋 Non	ie 🗋	Other:				Temp	Blank?	<b>A</b> Yes	ΠNo
Thermometer Used:	G87A9170600254		Тур	e of Ice:		t [	Biue	None	Dry	Melt	ed:	. —
Cooler Temp Rea	d (°C): <u>5- 4</u>	Cooler Temp Co	orrected (°C)	): 5.6	•		Bic	ological Ti	ssue Frozen	? 🗆 Yes	ΠNo	N/A
	ove freezing to 6°C	Correction Fac	tor: <u>h</u>	ne		e and l			xamining C		10~1°	
	oil ( 🗹 N/A, water san									-		
NC, NM, NY, OK, OP	te in a quarantine zone R, SC, TN, TX or VA (cheo	within the United :k maps)?	States: AL, A	AR, CA, FL □Y		a. ms, Tno		samples of uding Haw	riginate from ali and Puerto	a foreign so Ricol2	urce (interr Ye:	
	If Yes to either que		egulated Soi				s) and inc	lude with	SCUR/COC	paperwor	ריים עויים k.	s 📙No
						T	-		сомм			
Chain of Custody Pr	resent?		Yes	No		1.						
Chain of Custody Fi	lled Out?		(K)Yes			2.						
Chain of Custody R	elinquished?		- <u></u> Yes	No		3.				<u> </u>		
Sampler Name and	/or Signature on COC?		₩ Yes			4.			<u></u>		<u></u> .	
Samples Arrived wi	thin Hold Time?		ر کار کار کار کار کار کار کار کار کار کار			5.						
Short Hold Time Ar						6.			<u></u>		·	
Rush Turn Around			Yes	KIN₀	<u> </u>	7.						-
Sufficient Volume?			<b>X</b> Yes			8.						
Correct Containers	Used?		<b>∑</b> Z <sup>Y</sup> es			9.	<del>.</del>				·	
-Pace Containers	Used?		<b>™</b> <b>™</b> Yes									
Containers Intact?						10.						
Filtered Volume Rei	ceived for Dissolved Tes	its?	Yes			11.	Note if s	ediment is	visible in th	e dissolved		
ls sufficient informa	ition available to recon	cile the samples to				12.			, visible in th	C 013301720	container	
the COC?	Mati	rix: <u>v</u> t	•				_					
All containers needi checked?	ing acid/base preservat	ion have been		<b>—</b>		13.	- 		H₂SO₄	NaC	н	itive for Res.
	ing preservation are fou	ind to be in	Yes	No	∐n/a	Samp	_		<i>,</i> ,		Chic	orine? Y N
	A recommendation?								-51			
	, NaOH >9 Sulfide, NaC bliform, TOC/DOC Oil an		<b>V</b> SYes	ΠNο	□n/a	1						
DRO/8015 (water) a		iu Grease,	Yes	ΠNο	<b>Æ</b> ÎN∕A		l when pleted:			of ad <b>ded</b> ervative:		
Headspace in VOA V	/ials ( >6mm)?		Yes			14.			pres			<u> </u>
Trip Blank Present?		<b>1</b>	Yes			15.						
Trip Blank Custody S	Seals Present?		∐ Yes		GN/A							
Pace Trip Blank Lot 4	# (if purchased):	NA		_	7							
CLIENT	NOTIFICATION/RESO								ield Data Ro	auirod 3	Yes [	
Person Contacted:	-	Strom				Date	e/Time:	ſ	12/4/18	-		סאוך
Comments/Resolut		oles taken in	 MN					·				<b>.</b>
,												
<u>.</u>		<u>.</u>										
Project A	Anager Review:	0		inin D.					40/4/40			
Note: Whenever there	e is a discrepancy affecti	ng North Carolina c	ompliance sa	robles, a c	opy of this	s form v	Dat vill be sen	e: t to the No	12/4/18 rth Carolina I	EHNR Carth	fication Off	ice/ic out of
hold, incorrect preserv	vative, out of temp, incor	rect containers).			F, 500					a ann an a	leadon OII	the the out of
							Lat	peled by	:V	/		



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 10, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457417

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457417

'ace Analytica

www.pacelabs.com

### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

### CERTIFICATIONS

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# SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457417

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457417001	L3 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457417002	L3 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457417003	L3 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457417004	L3 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457417005	L3 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



# SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457417

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
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		EPA 353.2	JFP	1	PASI-M
10457417002	L3 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457417003	L3 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457417004	L3 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457417005	L3 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



# ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457417

Sample: L3 0 mg/L	Lab ID:	10457417001	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						_
Nitrogen, Ammonia	0.11	mg/L	0.10	0.030	1		12/07/18 16:27	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	0.18	mg/L	0.10	0.018	1		12/08/18 15:15	5	FS
Sample: L3 50 mg/L	Lab ID:	10457417002		d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	42.6	mg/L	2.0	0.60	20		12/07/18 16:34	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	49.4	mg/L	5.0	0.88	50		12/08/18 15:16	3	
Sample: L3 100 mg/L	Lab ID:	10457417003	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	87.5	mg/L	5.0	1.5	50		12/07/18 16:35	5 7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	99.3	mg/L	10.0	1.8	100		12/08/18 15:17	,	
Sample: L3 250 mg/L	Lab ID:	10457417004	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	239	mg/L	10.0	3.0	100		12/07/18 16:37	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	252	mg/L	20.0	3.5	200		12/08/18 15:20	)	



# ANALYTICAL RESULTS

Project: N adsorption 3

Pace Project No.: 10457417

Sample: L3 500 mg/L	Lab ID:	10457417005	Collecte	d: 12/03/1	8 11:00	Received: 12/	04/18 09:45 Ma	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	486	mg/L	20.0	6.0	200		12/07/18 16:38	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	487	mg/L	50.0	8.8	500		12/08/18 15:22		



# **QUALITY CONTROL DATA**

Project:	N adso	rption 3											
Pace Project No.:	104574	117											
QC Batch:	57960	00		Analys	sis Method:	E	PA 350.1						
QC Batch Method:	EPA 3	350.1		Analys	sis Descript	tion: 3	50.1 Ammoi	nia					
Associated Lab San	nples:	1045741700	01, 10457417002	, 10457417	7003, 1045	7417004, 1	045741700	5					
METHOD BLANK:	314366	62		I	Matrix: Wa	ter							
Associated Lab San	nples:	1045741700	01, 10457417002	, 10457417	7003, 1045	7417004, 1	045741700	5					
				Blan	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	) (	0.030 12	2/07/18 16:14	Ļ			
LABORATORY COM	NTROLS	SAMPLE:	3143663										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		alifiers			
Nitrogen, Ammonia			mg/L	2.5		2.3	94		0-110		-		
						2.0	0.						
MATRIX SPIKE & M	IATRIX S	SPIKE DUPL	ICATE: 31436	64		3143665							
				MS	MSD								
			10457416001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	<b>•</b> •
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.6	2.7	100	) 104	90-110	3	20	
MATRIX SPIKE & M	IATRIX S	SPIKE DUPL	ICATE: 31436	66		3143667							
				MS	MSD								
			10457417001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	0.11	2.5	2.5	2.6	2.6	98	3 101	90-110	3	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adso	rption 3											
Pace Project No .:	104574	17											
QC Batch:	57973	2		Analys	sis Method	: 6	EPA 353.2						
QC Batch Method:	EPA 3	53.2		Analys	sis Descrip	tion: 3	353.2 Nitrate	+ Nitrite	, preserved				
Associated Lab San	nples:	1045741700	1, 10457417002	, 10457417	7003, 1045	7417004,	1045741700	5					
METHOD BLANK:	314484	2			Matrix: Wa	ter							
Associated Lab San	nples:	1045741700	1, 10457417002	, 10457417	7003, 1045	7417004,	1045741700	5					
				Blan	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qu	alifiers		
Nitrogen, NO2 plus	NO3		mg/L		ND	0.10	0 (	0.018 1	12/08/18 15:41	FS			
LABORATORY COM	NTROL S	SAMPLE: 3	144843										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% F Lin		ualifiers			
Nitrogen, NO2 plus	NO3		mg/L	1	I	1.0	100		90-110 FS		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31448	44		3144845							
				MS	MSD								
Paramete	er	Units	10457419001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	1.0	1(	00 97	90-110	3	20	FS
MATRIX SPIKE & M	IATRIX S		CATE: 31448	46		3144847							
				MS	MSD								
_			10457422001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	<b>.</b> .
Paramete		Units	Result	Conc.	Conc.	Result	Result	% Rec	: % Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	0.12	1	1	1.1	1.1	ę	94 101	90-110	6	20	FS

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457417

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No .:	10457417

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457417001	L3 0 mg/L	EPA 350.1	579600		
10457417002	L3 50 mg/L	EPA 350.1	579600		
10457417003	L3 100 mg/L	EPA 350.1	579600		
10457417004	L3 250 mg/L	EPA 350.1	579600		
10457417005	L3 500 mg/L	EPA 350.1	579600		
10457417001	L3 0 mg/L	EPA 353.2	579732		
10457417002	L3 50 mg/L	EPA 353.2	579732		
10457417003	L3 100 mg/L	EPA 353.2	579732		
10457417004	L3 250 mg/L	EPA 353.2	579732		
10457417005	L3 500 mg/L	EPA 353.2	579732		

Pace Analytical

# CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

/ Section Requirer	Section A Required Clear Information	Section B		;				Sec	Section C										-		
Company	enciatae Brian Dook	Percet To: 10190		auon:				Invo	Invoice Information:	lation:								Page:		oľ	
	VICTION ASSOCIATES DITATI DECK	Keport to: Same	ត្					Atter	Attention:	Jeff Strom	strom				Γ						
Address:	7500 Olson Memorial Hwy	Copy To:						Con	Company Name;		Wenck Associates	sociate	S		BEG.	REGIII ATODV ACENOV		N.			
								Address:	355	same											
Email To:	jstrom@wenck.com	Purchase Order No.	::0					Pace	Pace Quote						- - - -		פֿי	האטטאט שא ובא		DRINKI	DRINKING WATER
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3	L3 100 mg/L	۲.		12/3/18	-		+		< >	Ŧ	+	Ţ	×	× :						609	
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12	Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 3d days.	e's NET 30 day payr	ment ten	ms and agre	eing to late c	harges of 1.5%	per month fo	r any invo	ices not p	aid within :	Se days.	7						E-ALL-(	F-ALL-Q-020rev.08. 12-Oct-2007	8. 12-Oct-1	

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	-	10110-2-2	10-1 68.24	*	<u></u>	Pac	e Minneso	ta Quality	Office	Ì
Sample Condition Client Name:										
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Commercial Pace SpeeDee				C	LIENT	': WE!	1CK			14/ 10
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Custody Seal on Cooler/Box Present?	]No	Seals In	ntact? 4	<b>X</b> Yes	No	Optic	nal: Pro	j. Due Date	e: Pro	j. Name:
Packing Material: 🕅 Bubble Wrap 🗌 Bubble B	ags 🗌 Noi	ne 🗌	]Other:				Tem	p Blank?	Yes	No
Thermometer G87A9170600254 Used: 2687A9155100842	Ту	e of ice:	24	iet 🛄 BJ	ue j	None	Dry	Ме		
Cooler Temp Read (°C): 5-6 Cooler Temp	Corrected (°C	): C.(	0		Biolo	oical Tie	sue Frozei			. Lat
remp should be above freezing to 6°C Correction	Factor: <u>+</u>	<u>ne</u>		te and Init	ials of F	erson E	xamining (	Contents:		∘ ⊠N/A <i>17448</i>
USDA Regulated Soil (X N/A, water sample) Did samples originate in a quarantine zone within the Unit	ed States: Al									••••
No, NN, NT, OK, OK, SC, TN, TX OF VA (check maps)?		- I I	Yes		includ	ing Usug		- D1 13		ernationally, Yes 🕅 No
If Yes to either question, fill out a	Regulated So	il Checkl	list (F-MN	-Q-338) ar	nd inclu	de with	SCUR/CO	paperwo	rk.	ſes ∐No
								MENTS:		
Chain of Custody Present? Chain of Custody Filled Out?	Ves Yes	<u>No</u>	<u> </u>	1.						
	K Yes	No		2.						
Chain of Custody Relinquished?	Yes	No		3.						
Sampler Name and/or Signature on COC?	Yes	No	N/A	4.						
Samples Arrived within Hold Time?	Ves_			5.						
Short Hold Time Analysis (<72 hr)? Rush Turn Around Time Requested?	Yes			6.						
Sufficient Volume?	Yes	K No		7.				·····		
Correct Containers Used?	Ves_	No		8.						
	Yes	[]No		9.						
-Pace Containers Used?	Yes	No								· .
Containers Intact?	¥es	No		10.	<u> </u>					
Filtered Volume Received for Dissolved Tests?	Yes	No	🗹 N/A	11. Not	te if sed	iment is	visible in th	e dissolve d	containe	r
Is sufficient information available to reconcile the samples the COC? Matrix:	to 🕅 Yes	ΠNo		12.						
All containers needing acid/base preservation have been									· · · · · · · · · · · · · · · · · · ·	
checked?	<b>(X</b> Yes	ΠNο	□n/a	13.	۲	INO3	<b>∭</b> H₂SO₄	[]NaC		sitive for Res. Iorine? Y N
All containers needing preservation are found to be in compliance with EPA recommendation?				Sample #		1-	51			
HNO <sub>3</sub> , H <sub>2</sub> SO <sub>4</sub> , <2pH, NaOH >9 Sulfide, NaOH>12 Cvanide)	/XYes	No	∐N/A				ţ	-		
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS		<b></b>		Initial whe			Lot #	ofadded		
leadspace in VOA Vials ( >6mm)?	Yes			complete	d:		- pres	ervative:		<u> </u>
rip Blank Present?	Yes			14. 15.		··				
rip Blank Custody Seals Present?	∐ Yes		GN/A	17.						
ace Trip Blank Lot # (if purchased): NH			777							
CLIENT NOTIFICATION/RESOLUTION		<u>-</u>			<u>-</u>	 Ei 4				
erson Contacted: Jeff Strom				Date/Tim	ie:	rle	id Data Re /4/12	-	∐Yes	_1NO
omments/Resolution: Samples collected in	MN		· · · · ·	<b>, .</b>						
					<u> </u>					<del></del>
Project Manager Review: te: Whenever there is a discrepancy affecting North Largina Id, incorrect preservative, out of temp, incorrect contrainers).	miOdi	ijole	 ,		Date:		12/4/18			
							-			

Labeled by: \_\_\_\_\_\_\_

I...



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 11, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457419

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457419

### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01







# SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457419

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457419001	L4 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457419002	L4 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457419003	L4 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457419004	L4 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457419005	L4 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



# SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457419

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10457419001	 L4 0 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457419002	L4 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457419003	L4 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457419004	L4 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457419005	L4 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



# ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457419

Sample: L4 0 mg/L	Lab ID: 1	10457419001	Collected	: 12/03/18	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	/lethod: EPA 3	50.1						
Nitrogen, Ammonia	0.15	mg/L	0.10	0.030	1		12/07/18 16:40	7664-41-7	
353.2 Nitrate + Nitrite	Analytical M	/lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	ND	mg/L	0.10	0.018	1		12/08/18 15:23	i	FS
Sample: L4 50 mg/L	Lab ID: 1	10457419002	Collected	: 12/03/18	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	/lethod: EPA 3	50.1						
Nitrogen, Ammonia	44.2	mg/L	2.0	0.60	20		12/07/18 16:41	7664-41-7	
353.2 Nitrate + Nitrite	Analytical N	/lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	46.8	mg/L	5.0	0.88	50		12/08/18 15:26	i	
Sample: L4 100 mg/L	Lab ID:	10457419003	Collected	: 12/03/18	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	/lethod: EPA 3	50.1						
Nitrogen, Ammonia	90.0	mg/L	5.0	1.5	50		12/07/18 16:43	7664-41-7	
353.2 Nitrate + Nitrite	Analytical M	/lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	97.5	mg/L	10.0	1.8	100		12/08/18 15:27		
Sample: L4 250 mg/L	Lab ID:	10457419004	Collected	: 12/03/18	8 11:00	Received: 12	2/04/18 09:45 M	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	/lethod: EPA 3	50.1						
Nitrogen, Ammonia	232	mg/L	10.0	3.0	100		12/07/18 16:44	7664-41-7	
353.2 Nitrate + Nitrite	Analytical M	/lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	240	mg/L	20.0	3.5	200		12/08/18 15:28	i	



# ANALYTICAL RESULTS

Project:N adsorption 3Pace Project No.:10457419

Sample: L4 500 mg/L	Lab ID:	10457419005	Collected	: 12/03/18	B 11:00	Received: 12/	04/18 09:45 M	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical N	Method: EPA 3	50.1						
Nitrogen, Ammonia	488	mg/L	20.0	6.0	200		12/07/18 16:48	7664-41-7	
353.2 Nitrate + Nitrite	Analytical I	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	484	mg/L	50.0	8.8	500		12/08/18 15:29	1	



# **QUALITY CONTROL DATA**

Project:	N adso	rption 3											
Pace Project No .:	104574	19											
QC Batch:	57960	00		Analys	sis Method:	E	EPA 350.1						
QC Batch Method:	EPA 3	350.1		Analys	sis Descript	ion: 3	350.1 Ammoi	nia					
Associated Lab San	nples:	1045741900	)1, 10457419002	, 10457419	9003, 1045	7419004, 1	1045741900	5					
METHOD BLANK:	314366	62			Matrix: Wa	ter							
Associated Lab San	nples:	1045741900	)1, 10457419002	, 10457419	9003, 1045 <sup>.</sup>	7419004, 1	1045741900	5					
				Blan	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	) (	).030 12	/07/18 16:14				
LABORATORY COM	NTROL S	SAMPLE: 3	3143663										
Davaa			Linite	Spike	LCS		LCS	% Re		- I'f'			
Paran	neter	<u> </u>	Units	Conc.	Resu		% Rec	Limit		alifiers	-		
Nitrogen, Ammonia			mg/L	2.5	5	2.3	94	9	0-110				
MATRIX SPIKE & M	IATRIX S		CATE: 31436	64		3143665							
				MS	MSD								
			10457416001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.6	2.7	100	104	90-110	3	20	
MATRIX SPIKE & M	IATRIX S	SPIKE DUPL	CATE: 31436	66		3143667							
				MS	MSD	-							
			10457417001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	0.11	2.5	2.5	2.6	2.6	98	101	90-110	3	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adsor	ption 3											
Pace Project No.:	104574	19											
QC Batch:	57973	2		Analys	sis Method	E	PA 353.2						
QC Batch Method:	EPA 3	53.2		Analys	sis Descrip	tion: 3	53.2 Nitrate	+ Nitrite,	preserved				
Associated Lab Sar	nples:	1045741900	1, 10457419002	, 10457419	0003, 1045	7419004, 1	045741900	5					
METHOD BLANK:	314484	2		٦	Matrix: Wa	ter							
Associated Lab Sar	nples:	1045741900	1, 10457419002	, 10457419	9003, 1045	7419004, 1	045741900	5					
				Blank		eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3		mg/L		ND	0.10	) (	0.018 1	2/08/18 15:41	FS			
LABORATORY CO	NTROL S	AMPLE: 3	144843										
5				Spike	LCS		LCS	% R					
Paran			Units	Conc.	Resu		% Rec	Lim		alifiers	-		
Nitrogen, NO2 plus	NO3		mg/L	1		1.0	100		90-110 FS				
MATRIX SPIKE & M	IATRIX S		CATE: 31448	44		3144845							
				MS	MSD								
Paramete		Units	10457419001	Spike	Spike	MS Result	MSD Result	MS % Rec	MSD	% Rec Limits		Max RPD	
			Result	Conc.	Conc.				% Rec		RPD		
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	1.0	10	0 97	90-110	3	20	FS
MATRIX SPIKE & M	IATRIX S		CATE: 31448	46		3144847							
				MS	MSD								
_			10457422001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus													

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457419

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No.:	10457419

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457419001	L4 0 mg/L	EPA 350.1	579600		
10457419002	L4 50 mg/L	EPA 350.1	579600		
10457419003	L4 100 mg/L	EPA 350.1	579600		
10457419004	L4 250 mg/L	EPA 350.1	579600		
10457419005	L4 500 mg/L	EPA 350.1	579600		
10457419001	L4 0 mg/L	EPA 353.2	579732		
10457419002	L4 50 mg/L	EPA 353.2	579732		
10457419003	L4 100 mg/L	EPA 353.2	579732		
10457419004	L4 250 mg/L	EPA 353.2	579732		
10457419005	L4 500 mg/L	EPA 353.2	579732		

Pace Analytical

# CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Samples intect Samples intect Contained Samples intect	Sectio	ПА	Section B							Sei	Section C	~													
Reference         Marce Accordinge Lange         Marce Accordinge Lange         Resolution         Resolution           7         200 Colicer Valipy MI SG27         Jan Fill         Jan Fill<	Require	ed Client Information:	Required Pr	roject In	nforma	tian:				μř	oice Inf	ormation	2					ļ			- Fig.			5	
0         7300 Oten Monnoli Jiwy         Commo Name: Processing         Resource Note (Markowski All Processing)         Resource (Markowski All Processi All Processing)         Re	Compar		Report To:	same						Atte	antion:	j.	ff Stror	Ę											
Sum Bolic Miletion         Source Miletion         Partial Miletio	Address		Copy To:							Co	npany	· ·	Wenc	k Assı	ociates			RE	BULATI	JRY AC	BENCY				
Biointegration         Description         Description         Description         Total         Total           7         2025.033         jint         Description         Description         Description         Total         Total           7         2025.0433         jint         Description         Description <td></td> <td>Suite 300, Golden Valley, MN 55427</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>  .</td> <td>PAc</td> <td>Iress:</td> <td>sal</td> <td>ne</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>NPDES</td> <td> ∟</td> <td>GROUN</td> <td>D WATE</td> <td>L</td> <td>DRINKIN</td> <td>G WATER</td>		Suite 300, Golden Valley, MN 55427							.	PAc	Iress:	sal	ne						NPDES	∟	GROUN	D WATE	L	DRINKIN	G WATER
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или         Пореглание         залище         залищ	Phone:	763-252-6833	Project Nam		d ads	orption 3				Pac	e Projec	1	eyemi	Odijol	Ð			Ч.	e Locati	uc.					
Media function         Media	Reques		Project Num	ber:						Pac	e Profile	推							STAT	ı نۆ					
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Lid 250 mg/L       wr       c       1 220 mg/L       wr       c       1 200 mg/L       wr       c       1 200 mg/L       wr       c       1 200 mg/L       wr       c       wr       c       wr       c       wr       c       wr       w	3	L4 100 mg/L				12/3/18	-	12/3/18		20 1		×				L×	×							ς ľν	
L4 500 mg/L       wr       c       123ris       1100       110	4	L4 250 mg/L			-	12/3/18	11:00	12/3/18	1	7		×				×	×							50	
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Packing Materia Thermometer Used: Cooler Temp Rea Temp should be at USDA Regulated S Did samples origina	VIALC     Fed Ex	USPS ee Other 3 6 Other Bags No Bags No Ty np Corrected (°C n Factor:	Docum F-MN-L-2 Seals Ir Seals Ir pe of Ice:	ent No.: 13-rev.2 Proje [Client mtact? 4 [Other: Data	ct #: PM: CLIE CLIE XIYes No ket Blue Bio te and Initials of	Issu Pace Minr OH : 104 OEO NT : WENCK Optional:	Due Date: Proj. Due Date: emp Blank?	9 12/11/ Proj. N	
Upon Receipt Courier: Commercial Tracking Numbe Custody Seal on Packing Material Thermometer Used: Cooler Temp Rea Temp should be al USDA Regulated S Did samples origina	→ → → → → → → → → → → → → → → → → → →	ee Other <b>3 6 Of 2</b> No Bags No Ty np Corrected (% n Factor:	Seals Ir Seals Ir ne [ pe of Ice: C): <u>C</u> .	 Itact? 4 ]Other: @ww	PM : CLIE Ves No tet Blue Bio te and Initials of	OEO NT : WENCK Optional: T None	Due Date: Proj. Due Date: emp Blank?	12/11/ Proj. N	ame:
Tracking Numbe Custody Seal on Packing Materia Thermometer Used: Cooler Temp Rea Temp should be at USDA Regulated S Did samples origina	er: <u>J.2</u> <u>S75</u> 032 03 <u>5</u> Cooler/Box Present? <u>Tres</u> L: <u>Bubble Wrap</u> Bubble G87A9170600254 <u>G87A9155100842</u> d (°C): <u>S.6</u> Cooler Ten pove freezing to 6°C Correctio oil ( <u>M</u> N/A, water sample) te in a quarantine zone within the U , SC, TN, TX or VA (check maps)?	Bags No Bags No Ty De Corrected (% De Factor:	Seals Ir me [ mpe of Ice: C): <u>S.</u>	]Other: 24w 6 Da	let Blue Binte and Initials o	T	emp Blank?	Ves	
Packing Materia Thermometer Used: Cooler Temp Rea Temp should be at USDA Regulated S Did samples origina	Bubble Wrap Bubble     G87A9170600254     G87A9155100842     G°C: <u>S</u> (Cooler Ten pove freezing to 6°C Correctio oil (X N/A, water sample) te in a quarantine zone within the U , SC, TN, TX or VA (check maps)?	Bags No Ty No Corrected (% n Factor:	ne [ pe of Ice: C): <u>\$.1</u>	]Other: 24w 6 Da	let Blue Binte and Initials o	T	emp Blank?	Ves	
Thermometer Used: Cooler Temp Rea Temp should be at USDA Regulated S Did samples origina	G87A9170600254 G87A9155100842 d (°C): <u>5.6</u> Cooler Ten pove freezing to 6°C Correctio oil (M/A, water sample) te in a quarantine zone within the U , SC, TN, TX or VA (check maps)?	Ty np Corrected (°e n Factor:	rpe of Ice: C): <u>S. (</u>	02/w Da	Bi bite and Initials o	None 🗍	Dry 🗌 Melte		
Used: Cooler Temp Rea Temp should be al USDA Regulated S Did samples origina	G87A9155100842 d (°C): <u>5.6</u> cove freezing to 6°C correctio oil ( N/A, water sample) te in a quarantine zone within the U , SC, TN, TX or VA (check maps)?	np Corrected (° n Factor:	rpe of Ice: C): <u>S. (</u>	02/w Da	Bi bite and Initials o	None 🗍	Dry 🗌 Melte		
Femp should be al USDA Regulated S Did samples origina	oove freezing to 6°C Correctio oil ( ( N/A, water sample) te in a quarantine zone within the U , SC, TN, TX or VA (check maps)?	n Factor:	me	Da	ite and Initials o	ological Tissue Fro	<b></b>		
, , , , , ,	If Yes to either question, fill out					samples originate f	ng Contents:	□No 19~~ 17- rce (interna	
<u> </u>		a Regulated Sc	oil Check	Yes list (F-Mf	∐No inc N- <b>Q-338) and in</b> d	luding Hawaii and P clude with SCUR/	uerto Rico)? COC paperwork	Yes	
Chain of Outer du D							MMENTS:	•	<u> </u>
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hain of Custody Fil	and the second	Yes	No		2.				
hain of Custody Re		Yes	<b>X</b> No		3.				
	or Signature on COC?	- Yes	□ No	<u> N/A</u>	4.				
amples Arrived wit		<b>X</b> Ves			5.	-			<u></u>
hort Hold Time An		Yes			6.				
ush Turn Around T	ime Requested?	Yes	K No		7.		· · · · · · · · · · · · · · · · · · ·		
ufficient Volume?	<u> </u>	Yes	□No		8	<u> </u>			
orrect Containers L	Jsed?	Yes			9.	·····			
-Pace Containers	Used?	<b>E</b> yes	No						
ontainers Intact?		×4×es			10,	<u> </u>	<u> </u>		
tered Volume Rece	eived for Dissolved Tests?	Yes			·	·	· · · · · · · · · · · · · · · · · · ·		
ie COC?	ion available to reconcile the sample Matrix:	es to 🛛 🕅 Yes			12. Note it s	ediment is visible i	n the dissolve d co	ontainer	
ecked? l containers needin mpliance with EPA	g acid/base preservation have been g preservation are found to be in recommendation?	d⊈Yes	⊡No	⊡n/a	13. [ Sample#	]HNO3 [\$\$H₂SI IS ↓	О₄ ∏№аОН		e for Re le?Y
NO3, H2SO4, <2pH, ceptions: VOA, Coli CO/8015 (water) an	NaOH >9 Sulfide, NaOH>12 Cyanide form, TOC/DOC Oil and Grease,		⊡No	□n/a	Initial when		ot # of added		
adspace in VOA Via		Yes	No	KÎN/A	completed:		reservative:		
p Blank Present?		Yes	No		14.				
p Blank Custody Sea	als Present?	☐ Yes	<u>∏</u> No	<b>U</b> N/A	15.				
e Trip Blank Lot # (		∐Yes	No	9n/a					
	OTIFICATION/RESOLUTION Jeff Strom				<u>.</u> ,,	Field Data	Required?	Yes N	 o
nments/Resolutio		N			Date/Time:		4/18		
					······································		· · · · · · · · · · · · · · · · · · ·		
Project Nia	nager Review:	in in in	in all	,		······		····-	
2: Whenever there is	a discrepancy affecting North Carolin ive, out of temp, incorrect cortainers)	a compliance san	ves, a co	v voithic	Date	<u>12/</u>	4/18		



Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 10, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457422

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457422

'ace Analytica

www.pacelabs.com

### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

### CERTIFICATIONS

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



# SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457422

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457422001	L5 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457422002	L5 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457422003	L5 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457422004	L5 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457422005	L5 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



# SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457422

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10457422001	 L5 0 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457422002	L5 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457422003	L5 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457422004	L5 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457422005	L5 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



# ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457422

Sample: L5 0 mg/L	Lab ID:	10457422001	Collected	: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						_
Nitrogen, Ammonia	0.18	mg/L	0.10	0.030	1		12/07/18 16:50	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	0.12	mg/L	0.10	0.018	1		12/08/18 15:31		FS
Sample: L5 50 mg/L	Lab ID:	10457422002	Collected Report	: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	latrix: Water	
Parameters	Results	Units	Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	44.8	mg/L	2.0	0.60	20		12/07/18 16:51	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	47.8	mg/L	5.0	0.88	50		12/08/18 15:36	i	
Sample: L5 100 mg/L	Lab ID:	10457422003	Collected	: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 M	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	93.0	mg/L	5.0	1.5	50		12/07/18 16:53	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	97.7	mg/L	10.0	1.8	100		12/08/18 15:37		
Sample: L5 250 mg/L	Lab ID:	10457422004	Collected	: 12/03/18	8 11:00	Received: 12	2/04/18 09:45 M	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	350.1						
Nitrogen, Ammonia	233	mg/L	10.0	3.0	100		12/07/18 16:54	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	353.2						
Nitrogen, NO2 plus NO3	244	mg/L	20.0	3.5	200		12/08/18 15:38	;	



# ANALYTICAL RESULTS

Project:N adsorption 3Pace Project No.:10457422

Sample: L5 500 mg/L	Lab ID: 1	0457422005	Collected	d: 12/03/18	B 11:00	Received: 12/	/04/18 09:45 Ma	atrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	/lethod: EPA 3	50.1						
Nitrogen, Ammonia	476	mg/L	20.0	6.0	200		12/07/18 16:56	7664-41-7	
353.2 Nitrate + Nitrite	Analytical M	/lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	484	mg/L	50.0	8.8	500		12/08/18 15:40		



# **QUALITY CONTROL DATA**

Project:	N adsor	ption 3											
Pace Project No.:	104574	22											
QC Batch:	57960	0		Analys	sis Method:	E	EPA 350.1						
QC Batch Method:	EPA 3	50.1		Analys	sis Descript	ion: 3	350.1 Ammor	nia					
Associated Lab San	nples:	1045742200	1, 10457422002	, 10457422	2003, 1045	7422004, 1	1045742200	5					
METHOD BLANK:	314366	2			Matrix: Wa	ter							
Associated Lab San	nples:	1045742200	1, 10457422002	, 10457422	2003, 1045	7422004, 1	1045742200	5					
				Blan	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	) (	).030 12	/07/18 16:14				
LABORATORY COM	NTROL S	SAMPLE: 3	143663										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		alifiers			
Nitrogen, Ammonia			mg/L	2.5	5	2.3	94	9	0-110		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31436	64		3143665							
	-	_		MS	MSD								
Paramete	er	Units	10457416001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.6	2.7	100	104	90-110	3	20	
MATRIX SPIKE & M	IATRIX S		CATE: 31436	66		3143667							
				MS	MSD								
			10457417001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	0.11	2.5	2.5	2.6	2.6	98	101	90-110	3	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adso	rption 3											
Pace Project No.:	104574	22											
QC Batch:	57973	32		Analys	sis Method	: E	EPA 353.2						
QC Batch Method:	EPA 3	53.2		Analys	sis Descrip	tion: 3	353.2 Nitrate	+ Nitrite,	preserved				
Associated Lab San	nples:	1045742200	1, 10457422002	, 10457422	2003, 1045	7422004, 1	1045742200	5					
METHOD BLANK:	314484	-2		1	Matrix: Wa	ter							
Associated Lab San	nples:	1045742200	1, 10457422002	, 10457422	2003, 1045	7422004, 1	1045742200	5					
				Blanl	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3		mg/L		ND	0.10	) (	).018 12	/08/18 15:41	FS			
LABORATORY COM	NTROL S	SAMPLE: 3	144843										
Paran	neter		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limit		ualifiers			
Nitrogen, NO2 plus	NO3		mg/L	1		1.0	100	ç	0-110 FS		-		
MATRIX SPIKE & M	IATRIX S		CATE: 31448	44		3144845							
				MS	MSD								
Paramete	er	Units	10457419001 Result	Spike Conc.	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	ND	1	1	1.1	1.0	100	97	90-110	3	20	FS
MATRIX SPIKE & M	IATRIX S		CATE: 31448	46		3144847							
				MS	MSD								
			10457422001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	<u> </u>
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3	mg/L	0.12	1	1	1.1	1.1	94	101	90-110	6	20	FS

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457422

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No.:	10457422

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457422001	L5 0 mg/L	EPA 350.1	579600		
10457422002	L5 50 mg/L	EPA 350.1	579600		
10457422003	L5 100 mg/L	EPA 350.1	579600		
10457422004	L5 250 mg/L	EPA 350.1	579600		
10457422005	L5 500 mg/L	EPA 350.1	579600		
10457422001	L5 0 mg/L	EPA 353.2	579732		
10457422002	L5 50 mg/L	EPA 353.2	579732		
10457422003	L5 100 mg/L	EPA 353.2	579732		
10457422004	L5 250 mg/L	EPA 353.2	579732		
10457422005	L5 500 mg/L	EPA 353.2	579732		

Pace Analytical

# CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

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L5 0 mg/L     Wr     C     23/10     11     X     X     X     X       L5 0 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 100 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 500 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 500 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 500 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 500 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100     23/10       L5 500 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100       L1 5100 mg/L     Wr     C     23/10     1100     23/10     1100     23/10     1100       L1 5100 mg/L     Wr     C     23/10     1100     23/10     100     23/10     100       L1 51     Mr     C     23/10     100     23/10     100	# W3TI										npreserv	<sup>©</sup> ON		<sup>©</sup> C <sup>z</sup> S <sup>z</sup> E	22.2	นทุมอนม		1045	422						
L5 50 mg/L       Wr       6       120/16       Wr       6       120/16       Wr       1       X       N       N         L5 50 mg/L       Wr       6       100 mg/L       Wr       6       100 mg/L       X       N		L5 0 ma/L			+-	+	-	DATE	Time	_	n	Н	_	۶N		nΑ			_				ace Proj	ect No./	Lab I.D.
15       100 mg/L       wr       c       123m       1100       X       x	2	1550 mn/l		4-	-		+-	BL/S/ZI	11:00	, 8		╡			T	× ×			_				9	10	
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emp should be above freezing to 6°C ISDA Regulated Soil ( 🗹 N/A, water s	Correction Fa	ctor: <u></u>	ne	Da	ate and In	itials of P	erson Exar	nining Co	ntents:	∐No Mana va	/N/
id samples originate in a quarantine zo C, NM, NY, OK, OR, SC, TN, TX or VA (cl If Yes to either qu	ne within the United heck maps)? Jestion, fill out a Re			Voc		Did sar includi and includ	nples origin ng Hawaii a l <b>e with SC</b>	ate from a nd Puerto UR/COC	foreign sou Rico)? Paperworl	urce (intern Yes <b>(.</b>	
hain of Custody Present?								COMM	NTS:		
hain of Custody Filled Out?		Ves Yes		,	1		· · · · · · · · · · · · · · · · · · ·				
nain of Custody Relinquished?		<u>K</u> Yes			2.						
impler Name and/or Signature on COC	2	Yes	<u>Ø</u> ₹ÍNo				<u> </u>				
mples Arrived within Hold Time?		Ves	No	□n/a	4.	• <u>•</u>					
ort Hold Time Analysis (<72 hr)?	· · · · · · · · · · · · · · · · · · ·	Yes			5.				<u>.</u>		
ish Turn Around Time Requested?		Yes		<del></del>	6.						
fficient Volume?		Yes	K No	. <u></u>	7.	·					
rrect Containers Used?		<u>(X</u> Yes			8.		····	·····			
-Pace Containers Used?		Yes	∐No		9.						
ntainers Intact?		¥es	No							· · · ·	
ered Volume Received for Dissolved T		• Yes	No	·	10.						
ufficient information available to reco		Yes	No	<u>É</u> N/A	11. N	ote if sedir	nent is visil	ble in the	dissolved c	ontainer	·
e COC? Ma	trix: A	<b>(</b> XYes	No		12.			_			
containers needing acid/base preserva	ition have been		<u></u>								
ecked? containers needing preservation are fo	ound to be in	۲es	[] No	∐n/a	13.	Шнг	103	H₂SO₄	∏NaOH		ve for Re ne? Y
npliance with EPA recommendation?					Sample	<b>;</b>	1-5	1			
IO3, H2SO4, <2pH, NaOH >9 Sulfide, Na eptions: VOA, Coliform, TOC/DOC Oil a	OH>12 Cyanide)	<b>V</b> es	No	□n/a				¥.			
D/8015 (water) and Dioxin/PFAS	nu utease,	Yes	ΠNο	∭∭N/A	Initial wi				faddecł		
dspace in VOA Vials ( >6mm)?	······································	Yes		LIN/A	complete 14.	:u:		preser	vative;	÷	<del></del>
		Yes	No	IN/A	15.	<u> </u>	<u>-</u>			· · · · · · · · · · · · · · · · · · ·	
Blank Present?			-								
Blank Present? Blank Custody Seals Present?		Yes	<b>⊡</b> No	ØN/A							
Blank Present? Blank Custody Seals Present? Trip Blank Lot # (if purchased):	NA	[]Yes	∐No	<b>19</b> N/A							
Blank Present? Blank Custody Seals Present? e Trip Blank Lot # (if purchased): CLIENT NOTIFICATION/RESC	DLUTION	[]Yes	[]No	9 <sup>N/A</sup>	<u> </u>	<u></u>	Field	Jata Reco			
9 Blank Present? 9 Blank Custody Seals Present? e Trip Blank Lot # (if purchased): CLIENT NOTIFICATION/RESC con Contacted:	DLUTION	[]Yes	<b>⊡</b> No	71/4	Date/Tir			)əta Req 2/4/18	uired?	]Yes []]	No
Blank Present? Blank Custody Seals Present? e Trip Blank Lot # (if purchased): CLIENT NOTIFICATION/RESC ON Contacted: Jeff St	DLUTION		<u>□</u> No	<u>19</u> N/A	Date/Ti	me:		Dəta Req 2/4/18	uired?	]Yes 🗍 î	۷٥
Blank Present? Blank Custody Seals Present? e Trip Blank Lot # (if purchased): CLIENT NOTIFICATION/RESC on Contacted: Jeff St	DLUTION		<u>[]</u> №	<u>19</u> 1/A	Date/Tir	me:			uired?	]Yes []]	۷o

hold, incorrect preservative, out of temp, incorrect containers).

Labeled by: \_\_\_\_\_ ヅヽノ

<u>.</u>...

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Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

December 10, 2018

Jeff Strom Wenck Associates, Inc. 7500 Olson Memorial Golden Valley, MN 55427

RE: Project: N adsorption 3 Pace Project No.: 10457423

Dear Jeff Strom:

Enclosed are the analytical results for sample(s) received by the laboratory on December 04, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A

Oyeyemi Odujole oyeyemi.odujole@pacelabs.com (612)607-6402 Project Manager

Enclosures



Project: N adsorption 3 Pace Project No.: 10457423

'ace Analytica

www.pacelabs.com

### **Minnesota Certification IDs**

1700 Elm Street SE, Minneapolis, MN 55414-2485 A2LA Certification #: 2926.01 Alabama Certification #: 40770 Alaska Contaminated Sites Certification #: 17-009 Alaska DW Certification #: MN00064 Arizona Certification #: AZ0014 Arkansas DW Certification #: MN00064 Arkansas WW Certification #: 88-0680 California Certification #: 2929 CNMI Saipan Certification #: MP0003 Colorado Certification #: MN00064 Connecticut Certification #: PH-0256 EPA Region 8+Wyoming DW Certification #: via MN 027-053-137 Florida Certification #: E87605 Georgia Certification #: 959 Guam EPA Certification #: MN00064 Hawaii Certification #: MN00064 Idaho Certification #: MN00064 Illinois Certification #: 200011 Indiana Certification #: C-MN-01 Iowa Certification #: 368 Kansas Certification #: E-10167 Kentucky DW Certification #: 90062 Kentucky WW Certification #: 90062 Louisiana DEQ Certification #: 03086 Louisiana DW Certification #: MN00064 Maine Certification #: MN00064 Marvland Certification #: 322 Massachusetts Certification #: M-MN064 Michigan Certification #: 9909

Pace Analytical Services, LLC 1700 Elm Street - Suite 200 Minneapolis, MN 55414 (612)607-1700

### CERTIFICATIONS

Minnesota Certification #: 027-053-137 Minnesota Dept of Ag Certifcation #: via MN 027-053-137 Minnesota Petrofund Certification #: 1240 Mississippi Certification #: MN00064 Montana Certification #: CERT0092 Nebraska Certification #: NE-OS-18-06 Nevada Certification #: MN00064 New Hampshire Certification #: 2081 New Jersey Certification #: MN002 New York Certification #: 11647 North Carolina DW Certification #: 27700 North Carolina WW Certification #: 530 North Dakota Certification #: R-036 Ohio DW Certification #: 41244 Ohio VAP Certification #: CL101 Oklahoma Certification #: 9507 Oregon NwTPH Certification #: MN300001 Oregon Secondary Certification #: MN200001 Pennsylvania Certification #: 68-00563 Puerto Rico Certification #: MN00064 South Carolina Certification #:74003001 Tennessee Certification #: TN02818 Texas Certification #: T104704192 Utah Certification #: MN00064 Virginia Certification #: 460163 Washington Certification #: C486 West Virginia DW Certification #: 9952 C West Virginia DEP Certification #: 382 Wisconsin Certification #: 999407970 Wyoming UST Certification #: via A2LA 2926.01



# SAMPLE SUMMARY

Project: N adsorption 3 Pace Project No.: 10457423

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10457423001	L6 0 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457423002	L6 50 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457423003	L6 100 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457423004	L6 250 mg/L	Water	12/03/18 11:00	12/04/18 09:45
10457423005	L6 500 mg/L	Water	12/03/18 11:00	12/04/18 09:45



# SAMPLE ANALYTE COUNT

Project:N adsorption 3Pace Project No.:10457423

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10457423001	 L6 0 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457423002	L6 50 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457423003	L6 100 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457423004	L6 250 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M
10457423005	L6 500 mg/L	EPA 350.1	JFP	1	PASI-M
		EPA 353.2	JFP	1	PASI-M



# ANALYTICAL RESULTS

# Project: N adsorption 3

Pace Project No.: 10457423

Sample: L6 0 mg/L	Lab ID:	10457423001	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	0.25	mg/L	0.10	0.030	1		12/07/18 17:00	6 7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	0.21	mg/L	0.10	0.018	1		12/08/18 15:43	3	FS
Sample: L6 50 mg/L	Lab ID:	10457423002	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	45.6	mg/L	2.0	0.60	20		12/07/18 17:0	7 7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	49.0	mg/L	5.0	0.88	50		12/08/18 15:44	4	
Sample: L6 100 mg/L	Lab ID:	10457423003	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	95.0	mg/L	5.0	1.5	50		12/07/18 17:09	9 7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						
Nitrogen, NO2 plus NO3	96.0	mg/L	10.0	1.8	100		12/08/18 15:4	7	
Sample: L6 250 mg/L	Lab ID:	10457423004	Collected	d: 12/03/1	8 11:00	Received: 12	2/04/18 09:45 N	fatrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical	Method: EPA 3	50.1						
Nitrogen, Ammonia	237	mg/L	10.0	3.0	100		12/07/18 17:10	7664-41-7	
353.2 Nitrate + Nitrite	Analytical	Method: EPA 3	53.2						



# ANALYTICAL RESULTS

Project:N adsorption 3Pace Project No.:10457423

Sample: L6 500 mg/L	Lab ID: 1	0457423005	Collected	: 12/03/18	8 11:00	Received: 12/	04/18 09:45 M	latrix: Water	
Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
350.1 Ammonia	Analytical M	lethod: EPA 3	50.1						
Nitrogen, Ammonia	502	mg/L	20.0	6.0	200		12/07/18 17:12	2 7664-41-7	
353.2 Nitrate + Nitrite	Analytical M	lethod: EPA 3	53.2						
Nitrogen, NO2 plus NO3	496	mg/L	50.0	8.8	500		12/08/18 15:50	)	



# **QUALITY CONTROL DATA**

Project:	N adsorp	otion 3											
Pace Project No .:	1045742	3											
QC Batch:	579601			Analys	sis Method:	E	PA 350.1						
QC Batch Method:	EPA 35	50.1		Analys	sis Descript	ion: 3	50.1 Ammor	nia					
Associated Lab San	nples:	1045742300	1, 10457423002	, 10457423	8003, 1045	7423004, 1	045742300	5					
METHOD BLANK:	3143669	)			Matrix: Wa	ter							
Associated Lab San	nples:	1045742300	1, 10457423002	, 10457423	3003, 1045	7423004, 1	045742300	5					
				Blanl	k R	eporting							
Paran	neter		Units	Resu	lt	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, Ammonia			mg/L		ND	0.10	) C	).030 12/	07/18 16:57				
LABORATORY COM		AMPLE: 3	143670										
Paran	notor		Units	Spike Conc.	LCS Resu		LCS % Rec	% Re Limits	-	alifiers			
	netei			·						aimers	-		
Nitrogen, Ammonia			mg/L	2.5	5	2.5	99	90	0-110				
MATRIX SPIKE & M	IATRIX SI		CATE: 31436	71		3143672							
				MS	MSD								
			10457424001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, Ammonia		mg/L	ND	2.5	2.5	2.5	2.5	100	100	90-110	0	20	
MATRIX SPIKE & M	IATRIX SI		CATE: 31436	73		3143674							
				MS	MSD								
_			10457588001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	_
Paramete	er	Units	Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# **QUALITY CONTROL DATA**

Project:	N adsorption 3											
Pace Project No .:	10457423											
QC Batch:	579733		Analys	is Method	: E	EPA 353.2						
QC Batch Method:	EPA 353.2		Analys	is Descrip	tion: 3	353.2 Nitrate	+ Nitrite,	preserved				
Associated Lab San	nples: 1045742	23001, 10457423002	, 10457423	003, 1045	7423004,	1045742300	)5					
METHOD BLANK:	3144848		N	Aatrix: Wa	ter							
Associated Lab San	nples: 1045742	23001, 10457423002	, 10457423	003, 1045	7423004,	1045742300	)5					
			Blank	R	eporting							
Paran	neter	Units	Resul	t	Limit	MDL		Analyzed	Qua	alifiers		
Nitrogen, NO2 plus	NO3	mg/L		ND	0.10	0	0.018 12	2/08/18 16:01	FS			
LABORATORY CON	NTROL SAMPLE:	3144849										
			Spike	LCS	6	LCS	% R	ec				
Paran	neter	Units	Conc.	Resu	ılt	% Rec	Limi	ts Qu	alifiers			
Nitrogen, NO2 plus	NO3	mg/L	1		0.99	99		90-110 FS		-		
MATRIX SPIKE & M	IATRIX SPIKE DL	JPLICATE: 31448	50		3144851							
			MS	MSD								
_		10457424001	Spike	Spike	MS	MSD	MS	MSD	% Rec		Max	
Paramete	er U	nits Result	Conc.	Conc.	Result	Result	% Rec	% Rec	Limits	RPD	RPD	Qual
Nitrogen, NO2 plus	NO3 m	g/L ND	1	1	1.1	1.1	106	6 107	90-110	1	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.



# QUALIFIERS

Project: N adsorption 3 Pace Project No.: 10457423

### DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

**DUP - Sample Duplicate** 

**RPD** - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

### LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

### ANALYTE QUALIFIERS

FS The sample was filtered in the laboratory prior to analysis.



# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project:	N adsorption 3
Pace Project No .:	10457423

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10457423001	L6 0 mg/L	EPA 350.1	579601		
10457423002	L6 50 mg/L	EPA 350.1	579601		
10457423003	L6 100 mg/L	EPA 350.1	579601		
10457423004	L6 250 mg/L	EPA 350.1	579601		
10457423005	L6 500 mg/L	EPA 350.1	579601		
10457423001	L6 0 mg/L	EPA 353.2	579733		
10457423002	L6 50 mg/L	EPA 353.2	579733		
10457423003	L6 100 mg/L	EPA 353.2	579733		
10457423004	L6 250 mg/L	EPA 353.2	579733		
10457423005	L6 500 mg/L	EPA 353.2	579733		

Pace Analytical"

# CHAIN-OF-CUSTODY / Analytical Request Document The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section	section A	Section B					Secti	Section C						L.,				
Company		Required Project Information:	omation:				Invoic	oma	ابر						Page:		of	
fundino o	wenck Associates Brian Beck	Keport To: Same					Attention:		Jeff Strom			Γ		_				
Address:	7500 Olson Memorial Hwy	Copy To:					Compt	any Name:	Company Name: Wenck Associates	sconiatae								
	Suite 300, Golden Valley, MN 55427						Address:	SS:	emes				REGULATORY AGENCY	RY AGEN	X			
Email To:	jstrom@wenck.com	Purchase Order No.:					Dace O		2	Ē			NPDES	С С С С	GROUND WATER	L K	DRINKING WATER	8 WATER
Phone:		Deviant Name:	-				Referen	ice;					UST	L RCRA	4	L	OTHER	ĺ
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цеалеги	Kequested Due Date/TAT: std TAT	Project Number:					Pace P	Pace Profile #.					STATE:					
											Regu	ested And	Requested Analysis Filtered (Y/N)	red (Y/N)				
	Section D Valid Matrix Codes Required Client Information MATRIX CODE	o ieft) CODE		COLL	COLLECTED			D.D.	Proconcetivos	̶ N L		 						
	g water Water St Lid	문자된 C=CC (see valid codes		COMPOSITE	COMPOSITE END/GRAB							<u>∤</u> -≚	+ <b>₩</b>	104		<b>123</b>		
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н мэті		XIRTAM 3J9MA2	DATE	TIME	DATE	HMIT		-INO <sup>3</sup> -I <sup>5</sup> 2O⁵ ∩ubtese	18 <sup>5</sup> 2 <sup>5</sup> 03 190H 101	Analys Methano Ather	inomm in-ətsrti	104	10457423		se —			
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е С	L6 100 mg/L		12/3/18	11:00	12/3/18		20 1	< ×		T	× > × >	+					90 81	
4	L6 250 mg/L	WT G	12/3/18	11:00	12/3/18					T	+						( a)	
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12	*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any involves not raid within an and	e's NET 30 day payment	terms and agr	eeing to late	charges of 1.5	% per month f	or any invoice	es not paid with	on 30 game									1
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Pace Analytical*	Sample Co	Docum	Upon Re nent No.:	ceipt Form			Page 1 o	f 2		
			1911 No.: 213-rev.2				innesota Q		fice	
Sample Condition Client Name: Upon Receipt			Proje	<u> </u>		:10	457	'4 <u>2</u>	3	J
Courier:     Fed Ex     UPS       Commercial     Pace     Spee Dee       Tracking Number:     17 575 032 03 553			Client		M: OEC LIENT:	) Wenck		ate:	12/11/	'18
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Packing Material: Bubble Wrap Bubble B	Bags 🔲 No	ne [	Other:				Temp Bla	nk? C	Yes	
Thermometer 🔲 G87A9170600254 Used: 🗹 G87A9155100842	Ту	pe of Ice:	Øw	let 🔲 Biu	ie 🗖	None				N
ISDA Regulated Soil ( ( N/A, water sample) bid samples originate in a quarantine zone within the Uni IC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)?		AR, CA, F	Da	<b></b> .	Did sam	iples originat	i <b>ning Conte</b> te from a for	eign sourd	□No V 12 Ce (interna □Yes	• •
If Yes to either question, fill out a	Regulated So	il Check	list (F-MN	V-Q-338) an	d include	e with SCU	R/COC pap	erwork.		اليا
hain of Custody Present?	V Ves			+	·····		COMMENT	5:		
hain of Custody Filled Out?				1.		······				
hain of Custody Relinguished?		No		2.	· · · · · ·					
ampler Name and/or Signature on COC?	Yes			3.				·		
imples Arrived within Hold Time?	Yes 🖉	No	N/A		<u> </u>					
nort Hold Time Analysis (<72 hr)?	XYes			5.						
ush Turn Around Time Requested?	Yes		_ <u>,</u>	6.		· · · · · · · · · · · · · · · · · · ·				
ifficient Volume?	<u> </u>	<b>K</b> N₀		7	·					
prrect Containers Used?	(X)Yes	No	<u> </u>	8.						
	Yes	∏No		9.						
Pace Containers Llead2		<b></b>								
	Yes_	No		·						
ntainers Intact?	⊠¥es Æ¥es			10.		<u>_</u>		<u> </u>		
ntainers Intact? ered Volume Received for Dissolved Tests?	ves ↓ Yes				e if sedim	ent is visible	e in the diss	olved cor		
tered Volume Received for Dissolved Tests? sufficient information available to reconcile the samples e COC? Matrix:	ves ↓ Yes	No			e if sedim	ent is visible	e in the diss	olved cor	ntainer	
entainers Intact? tered Volume Received for Dissolved Tests? sufficient information available to reconcile the samples the COC? Matrix: Matrix: containers needing acid/base preservation have been ecked? containers needing preservation are found to be in mpliance with EPA recommendation?	to Øyes	□No □No		11. Note	e if sedim	<u> </u>	······································	olved cor ]NaOH	Positiv	
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ontainers Intact?         tered Volume Received for Dissolved Tests?         sufficient information available to reconcile the samples         ie COC?       Matrix:         containers needing acid/base preservation have been         ecked?       containers needing preservation are found to be in         mpliance with EPA recommendation?       NO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)         ceptions: VOA, Coliform, TOC/DOC Oil and Grease,       O/8015 (water) and Dioxin/PFAS	to XYes UYes to XYes Ves Ves		□n/a □n/a	11.     Note       12.       13.       Sample #       Initial when       completed	HN0	03 <b>[]]</b> H	₂SO₄ [ ] 1	]NaOH	Positiv	
antainers Intact?         tered Volume Received for Dissolved Tests?         sufficient information available to reconcile the samples         ie COC?       Matrix:         containers needing acid/base preservation have been         ecked?       containers needing preservation are found to be in         mpliance with EPA recommendation?         NO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)         reptions: VOA, Coliform, TOC/DOC Oil and Grease,         O/8015 (water) and Dioxin/PFAS         adspace in VOA Vials ( >6mm)?	to ØYes to ØYes ØYes ØYes Ø¥es □Yes □Yes			11.       Note         12.         13.         Sample #         Initial when         completed:         14.	HN0	03 <b>[]]</b> H	₂SO₄ [ ] ↓ Lot # of ad	]NaOH	Positiv	
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ntainers Intact? tered Volume Received for Dissolved Tests? sufficient information available to reconcile the samples e COC? Matrix: containers needing acid/base preservation have been ecked? containers needing preservation are found to be in npliance with EPA recommendation? NO <sub>3</sub> , H <sub>2</sub> SO <sub>4</sub> , <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide) eptions: VOA, Coliform, TOC/DOC Oil and Grease, D/8015 (water) and Dioxin/PFAS adspace in VOA Vials ( >6mm)? Blank Present? Blank Custody Seals Present?	to ØYes to ØYes ØYes ØYes Ø¥es □Yes □Yes			11.       Note         12.         13.         Sample #         Initial when         completed:         14.	HN0	03 <b>[]]</b> H	₂SO₄ [ ] ↓ Lot # of ad	]NaOH	Positiv	
entainers Intact? tered Volume Received for Dissolved Tests? sufficient information available to reconcile the samples te COC? Matrix: containers needing acid/base preservation have been ecked? containers needing preservation are found to be in mpliance with EPA recommendation? NO3, H <sub>2</sub> SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide) reptions: VOA, Coliform, TOC/DOC Oil and Grease, O/8015 (water) and Dioxin/PFAS adspace in VOA Vials ( >6mm)? D Blank Present?	to XYes to XYes to XYes Yes Yes Yes Yes			11.       Note         12.         13.         Sample #         Initial when         completed:         14.	HN0	o₃ ⊠¶ 1~S	2SO4 [ ] Lot # of ad preservation	]NaOH ded ve:	Positiv Chiorir	——————————————————————————————————————
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Page	12	of	12
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# Field Lysimeter and Septic WQ Results

### 02/26/2018 Field Parameters\* Vacuum Sample Time Under ~40 °F Temp Initial Final Vacuum Recovered pН Cond Calm cBar °C cBar HH:MM тI uS/cm 1-5' -45 -38 29:55 80 ---1-12' -45 -42 29:55 15 ---2-19' -45 0 29:55 7 ---2-25' -45 0 29:55 0 ---29:55 0 3-30' -45 -44 ---3-35' 100 -45 -38 29:55 ---Septic Tank Bottles Filled n/a n/a n/a ---

## February 26, 2018 Sampling Event

\*Field parameters were not collected on 02/06/2018

# April 4th, 2018 Sampling Event

04/04/2018	Vacui	um	Time Under	Sample		Field Parameter	'S*
~40 °F	Initial	Final	Vacuum	Recovered	рН	Cond	Temp
High Winds	cBar	cBar	HH: MM	ml	-	uS/cm	°C
1-5'	-50	-44	07:45	50	7.08	698	13.1
1-12'	-50	-47	07:45	0	-	-	-
2-19'	-50	-48	07:45	3	-	-	-
2-25'	-50	-42	07:45	80	7.28	864	12.2
3-30'	-50	-2	07:45	2	-	_	-
3-35'	-50	-42	07:45	100	7.2	967	12.7

\*Field parameters measured only when sufficient sample volume (>30 mL) was recovered

# May 15th, 2018 Sampling Event

05/15/2018	Vacu	um	Time Under	Sample		Field Parameter	·S*
~60 °F	Initial	Final	Vacuum	Recovered	рН	Cond	Temp
Calm	cBar	cBar	HH: MM	ml	-	uS/cm	°C
1-5'	-50	-40	06:20	40	7.79	587	10
1-12'	-50	-48	06:20	0	-	-	-
2-19'	-50	-47	06:20	20	-	-	-
2-25'	-50	-46	06:20	100	7.66	951	10
3-30'	-50	0	06:20	0	-	-	-
3-35'	-50	-38	06:20	100	7.57	917	10

\*Field parameters measured only when sufficient sample volume (>30 mL) was recovered

# June 25th, 2018 Sampling Event

06/25/2018	Vacu	um	Time Under	Sample		Field Parameter	°S*
~70 °F	Initial	Final	Vacuum	Recovered	pН	Cond	Temp
Calm	cBar	cBar	HH: MM	ml	-	uS/cm	°C
1-5'	-50	-44	05:00	30	7.27	1273	-
1-12'	-50	-44	05:00	0	-	-	-
2-19'	-50	-42	05:00	20	7.79	877	-
2-25'	-50	-40	05:00	50	-	-	-
3-30'	-50	-26	05:00	10	-	_	_
3-35'	-50	-38	05:00	90	-	-	-

\*Field parameters were not measured below 19' on 06/25/18 due to an instrument malfunction

# September 5th, 2018 Sampling Event

09/05/2018	Vacu	um	Time Under	Sample		Field Parameter	rs*
~65 °F	Initial	Final	Vacuum	Recovered	рН	Cond	Temp
Breezy	cBar	cBar	HH: MM	ml	-	uS/cm	°C
1-5'	-50	-48	06:05	40	7.78	1467	10.3
1-12'	-50	-48	06:05	30	-	-	-
2-19'	-50	-46	06:05	40	7.44	1322	10.3
2-25'	-50	-44	06:05	80	7.36	1225	10.4
3-30'	-50	-46	06:05	30	-	-	-
3-35'	-50	-42	06:05	80	7.51	1331	10.3

\*Field parameters measured only when sufficient sample volume (>30 mL) was recovered

12/04/2018	Vacu	um	Time Under	Sample	F	ield Parameters	5**
~20 °F	Initial	Final	Vacuum	Recovered*	pН	Cond	Temp
Breezy	cBar	cBar	HH:MM	ml	-	uS/cm	°C
1-5'	-50	-48	05:00	0	_	-	-
1-12'	-50	-48	05:00	5	_	-	-
2-19'	-50	-46	04:10	0	_	-	-
2-25'	-50	-48	04:10	0	_	-	-
3-30'	-50	-46	05:00	10	-	-	-
3-35'	-50	-***	05:00	0	-	_	-
Septic Tank	n/a	n/a	n/a	Bottles Filled	6.75	1006	8.2

## December 4th, 2018 Sampling Event

\*Sample recovery on 12/4/18 was poor because ice blockages developed in the sample collection tubes due to cold tempertures and moderate winds

\*\*Field parameters measured only when sufficient sample volume (>30 mL) was recovered

\*\*\*Final vacuum not recorded

# Lysimeter and Septic Tank Field Parameter - pH

Lysimeter	02/26/2018	04/04/2018	05/15/2018	06/25/2018	09/05/2018	12/04/2018
1-5'	-	7.08	7.79	7.27	7.78	-
1-12'	-	-	-	-	-	-
2-19'	-	-	-	7.79	7.44	-
2-25'	-	7.28	7.66	-	7.36	-
3-30'	-	-	-	-	-	-
3-35'	-	7.2	7.57	-	7.51	-
Septic Tank	-	n/a	n/a	n/a	n/a	6.75

Note: No field parameters were collected on 02/26/18. For all other sampling events,

field parameters were recorded for any sample of sufficient volume (>30 mL)

Lysimeter	02/26/2018	04/04/2018	05/15/2018	06/25/2018	09/05/2018	12/04/2018
1-5'	-	698	587	1273	1467	-
1-12'	-	-	-	-	-	-
2-19'	-	-	-	877	1322	-
2-25'	-	864	951	-	1225	-
3-30'	-	-	-	-	-	-
3-35'	-	967	917	_	1331	-
Septic Tank	-	n/a	n/a	n/a	n/a	1006

Lysimeter and Septic Tank Field Parameter - Conductivity (uS/cm)

Note: No field parameters were collected on 02/26/18. For all other sampling events,

field parameters were recorded for any sample of sufficient volume (>30 mL)

Septic Tank WQ Results



Date: 3/19/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project:	B7218-0001	<b>Report ID:</b> S1802306002
Lab Order:	S1802306	(Replaces S1802306001)

Sample Septic Tank was received on February 27, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

This report, S1802306002, is being issued to replace S1802306001 in order to combine emailed preliminary data with the final report which had data logged in using DEQ GL-8 guidelines per customer request.

Qualifiers by sample

TDS was ran out of holding because of a clerical error.

S1802306-001 - General Parameters/Total Dissolved Solids (180) - Holding times for preparation or analysis exceeded

Reviewed by: Bill Courtment

Bill Courtney, Project Manager



Sample Analysis Report

Analys	es	Result	RL	Qual	Units Date	Analyzed/Init	Method
					COC	: WEB	
Client S	ample ID: Septic Tank				Matrix:	Water	
Lab ID:	S1802306-001				Sampler:	AM	
Project:	B7218-0001				Date Received:	2/27/2018 11:0	0:00 AM
					Collection Date:	2/26/2018 9:30	:00 AM
	Fort Collins, CO 80525				Work Order:	S1802306	
	Bldg E					(Replaces S18	02306001)
	4025 Automation Way				Report ID	S1802306002	
CLIENT:	Wenck Associates				Date Reported:	3/19/2018	

General Parameters         Total Dissolved Solids (180)         440         10         H         mg/L         0309/2018 1459 NLG         SM 2540           Aklanihity, Total (As CaCO2)         566         5         mg/L         0309/2018 1231 IBS         SM 2320B           Nitrogen, Ammonia (as N)         94.4         0.1         mg/L         0305/2018 1086 AMB         EPA 350.1           Nitrogen, Total Kjeldahl (TKN)         89         1         mg/L         0309/2018 2213 IBS         SM 2320B           Alkalinity, Elearbonate as HCO3         714         5         mg/L         0309/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         0309/2018 2213 IBS         SM 4320R           Chioride         0.1         0.1         mg/L         02/28/2018 0254 AB         EPA 300.0           Fluoride         0.1         0.1         mg/L         03/12/2018 1254 AMB         EPA 350.2           Sulfate         12         1         mg/L         03/13/2018 1022 DG         EPA 300.0           Calcium         57         1         mg/L         03/13/2018 1022 DG         EPA 200.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7	Analyses	Result	KL	Quai	Units	Date Analyzed/Init	Method
Alkalinity, Total (As CaCO3)         586         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Nitrogen, Ammonia (as N)         94.4         0.1         mg/L         03/09/2018 1331 AMB         EPA 350.1           Alkalinity, Bicarbonate as HCO3         714         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         41         1         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         41         1         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         12         1         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         12         1         mg/L         03/09/2018 2213 IBS         SM 2320B           Caticum         12         1         mg/L         03/13/2018 1023 DG         EPA 300.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L	General Parameters						
Nitrogen, Ammonia (as N)         94.4         0.1         mg/L         03/12/2018 1331 AMB         EPA 350.1           Nitrogen, Total Kjeldahi (TKN)         89         1         mg/L         03/05/2018 1058 AMB         EPA 351.2           Alkalinity, Bicarbonate as HC03         714         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         41         1         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 4500FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1021 DG         EPA 353.2           Sultate         12         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         57         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         0.1         mg/L<	Total Dissolved Solids (180)	440	10	Н	mg/L	03/09/2018 1459 NLG	SM 2540
Nitrogen, Total Kjeldahl (TKN)         89         1         mg/L         03/05/2018 1058 AMB         EPA 351.2           Anions            Alkalinity, Bicarbonate as HCO3         714         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         41         1         mg/L         02/09/2018 2213 IBS         SM 4300.6           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/09/2018 2213 IBS         SM 4300.6           Sulfate         12         1         mg/L         03/12/2018 1254 AMB         EPA 353.2           Sulfate         12         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Catoins         7         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         71         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Auterium         ND <td>Alkalinity, Total (As CaCO3)</td> <td>586</td> <td>5</td> <td></td> <td>mg/L</td> <td>03/09/2018 2213 IBS</td> <td>SM 2320B</td>	Alkalinity, Total (As CaCO3)	586	5		mg/L	03/09/2018 2213 IBS	SM 2320B
Anions         mg/L         03/09/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         0.1         mg/L         02/28/2018 0926 AB         EPA 300.0           Fluoride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 4500FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1502 AM         EPA 350.2           Sulfate         12         1         mg/L         02/27/2018 1502 AM         EPA 350.2           Cations         71         mg/L         03/13/2018 1023 DG         EPA 200.7           Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metais         3         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Aluminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Barium         0.2         0.1         mg/L         03/13/2018 1023 DG         EPA 200.8           Boron	Nitrogen, Ammonia (as N)	94.4	0.1		mg/L	03/12/2018 1331 AMB	EPA 350.1
Alkalinity, Bicarbonate as HCO3         714         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Alkalinity, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 2320B           Chloride         41         1         mg/L         02/28/2018 0926 AB         EPA 300.0           Fluoride         0.1         0.1         mg/L         03/07/2018 2213 IBS         SM 4600FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1224 AMB         EPA 353.2           Sulfate         1         mg/L         03/13/2018 1023 DG         EPA 300.7           Calcium         57         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Alkalinium         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Astronic         ND         0.01         mg/L         03/13/2018 1023 DG </td <td>Nitrogen, Total Kjeldahl (TKN)</td> <td>89</td> <td>1</td> <td></td> <td>mg/L</td> <td>03/05/2018 1058 AMB</td> <td>EPA 351.2</td>	Nitrogen, Total Kjeldahl (TKN)	89	1		mg/L	03/05/2018 1058 AMB	EPA 351.2
Alkaliniy, Carbonate as CO3         ND         5         mg/L         03/09/2018 2213 IBS         SM 23208           Chloride         41         1         mg/L         02/28/2018 0926 AB         EPA 300.0           Fluoride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 4500FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1254 AMB         EPA 300.0           Sulfate         12         1         mg/L         03/13/2018 1023 DG         EPA 300.0           Catiom         57         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Auminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7	Anions						
Chloride         41         1         mg/L         02/28/2018 0926 AB         EPA 300.0           Fluoride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 4500FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1224 AIMB         EPA 350.2           Sulfate         12         1         mg/L         02/27/2018 1502 AB         EPA 300.0           Cations          7         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         77         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Assenic         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Assenic         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Assenic         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8           Barium         0.2         0.1         mg/L         03/13/2018 1023 DG	Alkalinity, Bicarbonate as HCO3	714	5		mg/L	03/09/2018 2213 IBS	SM 2320B
Fluoride         0.1         0.1         mg/L         03/09/2018 2213 IBS         SM 4500FC           Nitrogen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1254 AMB         EPA 353.2           Sulfate         12         1         mg/L         03/12/2018 1254 AMB         EPA 350.0           Cations	Alkalinity, Carbonate as CO3	ND	5		mg/L	03/09/2018 2213 IBS	SM 2320B
Nitragen, Nitrate-Nitrite (as N)         ND         0.1         mg/L         03/12/2018 1254 AMB         EPA 353.2           Suifate         12         1         mg/L         02/27/2018 1502 AB         EPA 300.0           Cations	Chloride	41	1		mg/L	02/28/2018 0926 AB	EPA 300.0
Sulfate         12         1         mg/L         02/27/2018 1502 AB         EPA 300.0           Cations	Fluoride	0.1	0.1		mg/L	03/09/2018 2213 IBS	SM 4500FC
Cations         Total         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metals         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Aluminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Asrenic         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Auminum         ND         0.01         mg/L         03/13/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         03/13/2018 2119 MS         EPA 200.8           Boron         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8           Cron         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8	Nitrogen, Nitrate-Nitrite (as N)	ND	0.1		mg/L	03/12/2018 1254 AMB	EPA 353.2
Calcium         57         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metals         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Aluminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Arsenic         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Barium         0.2         0.1         mg/L         03/12/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         03/12/2018 2119 MS         EPA 200.8           Cohromium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8           Iron         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7 <td>Sulfate</td> <td>12</td> <td>1</td> <td></td> <td>mg/L</td> <td>02/27/2018 1502 AB</td> <td>EPA 300.0</td>	Sulfate	12	1		mg/L	02/27/2018 1502 AB	EPA 300.0
Magnesium         17         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metals             U         03/13/2018 1023 DG         EPA 200.7           Aluminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Arsenic         ND         0.005         mg/L         03/12/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8           Boron         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Lead         ND         0.02         mg/L         03/12/2018 2119 MS	Cations						
Potassium         24         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metals                EPA 200.7           Aluminum         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Arsenic         ND         0.005         mg/L         03/12/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         0.2         0.1         mg/L         03/12/2018 2119 MS         EPA 200.8           Boron         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.8           Chromium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Lead         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Mercury         ND         0.02         mg/L         03/12/2018 2119 MS	Calcium	57	1		mg/L	03/13/2018 1023 DG	EPA 200.7
Sodium         37         1         mg/L         03/13/2018 1023 DG         EPA 200.7           Dissolved Metals         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Arsenic         ND         0.005         mg/L         03/12/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         03/13/2018 1023 DG         EPA 200.8           Boron         ND         0.1         mg/L         03/13/2018 2119 MS         EPA 200.7           Cadmium         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Lead         ND         0.02         mg/L         03/13/2018 1023 DG         EPA 200.7           Molybdenum         ND         0.02         mg/L         03/14/2018 2119 MS         EPA 200.7	Magnesium	17	1		mg/L	03/13/2018 1023 DG	EPA 200.7
Dissolved Metals         ND         0.1         mg/L         0.3/13/2018 1023 DG         EPA 200.7           Arsenic         ND         0.005         mg/L         0.3/12/2018 2119 MS         EPA 200.8           Barium         0.2         0.1         mg/L         0.3/12/2018 2119 MS         EPA 200.8           Boron         ND         0.1         mg/L         0.3/12/2018 2119 MS         EPA 200.7           Cadmium         ND         0.1         mg/L         0.3/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.01         mg/L         0.3/12/2018 2119 MS         EPA 200.7           Cadmium         ND         0.01         mg/L         0.3/12/2018 2119 MS         EPA 200.8           Chromium         ND         0.01         mg/L         0.3/12/2018 2119 MS         EPA 200.7           Copper         0.01         0.01         mg/L         0.3/12/2018 2119 MS         EPA 200.7           Lead         ND         0.02         mg/L         0.3/12/2018 1023 DG         EPA 200.8           Mercury         ND         0.02         mg/L         0.3/12/2018 1049 MS         EPA 200.8           Nickel         ND         0.01         mg/L         0.3/12/2018 1049 MS         EPA	Potassium	24	1		mg/L	03/13/2018 1023 DG	EPA 200.7
AluminumND0.1mg/L03/13/2018 1023 DGEPA 200.7ArsenicND0.005mg/L03/12/2018 2119 MSEPA 200.8Barium0.20.1mg/L03/12/2018 2119 MSEPA 200.8BoronND0.1mg/L03/12/2018 2119 MSEPA 200.7CadmiumND0.01mg/L03/12/2018 2119 MSEPA 200.7CadmiumND0.001mg/L03/12/2018 2119 MSEPA 200.7Copper0.010.01mg/L03/12/2018 2119 MSEPA 200.7Copper0.010.01mg/L03/12/2018 2119 MSEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.02mg/L03/12/2018 2119 MSEPA 200.8MolydenumND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.02mg/L03/12/2018 2119 MSEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.7Total MetalsIron0.180.05mg/L03/12/2018 2119 MSEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Phosphorus5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Sodium	37	1		mg/L	03/13/2018 1023 DG	EPA 200.7
ArsenicND0.005mg/L03/12/2018 2119 MSEPA 200.8Barium0.20.1mg/L03/12/2018 2119 MSEPA 200.8BoronND0.1mg/L03/13/2018 1023 DGEPA 200.7CadmiumND0.001mg/L03/12/2018 2119 MSEPA 200.8ChromiumND0.01mg/L03/12/2018 2119 MSEPA 200.7Copper0.010.01mg/L03/12/2018 1023 DGEPA 200.7Copper0.010.01mg/L03/12/2018 2119 MSEPA 200.8IronND0.05mg/L03/13/2018 1023 DGEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.001mg/L03/12/2018 2119 MSEPA 200.8NickelND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/13/2018 1023 DGEPA 200.7Selenium0.0030.001mg/L03/13/2018 1023 DGEPA 200.7Selenium0.0030.001mg/L03/13/2018 1023 DGEPA 200.7Total MetalsIron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7	Dissolved Metals						
Barium         0.2         0.1         mg/L         03/12/2018 2119 MS         EPA 200.8           Boron         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Chromium         ND         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Chromium         ND         0.01         0.3/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/12/2018 2119 MS         EPA 200.8           Iron         ND         0.01         mg/L         03/12/2018 1023 DG         EPA 200.7           Lead         ND         0.05         mg/L         03/13/2018 1023 DG         EPA 200.7           Mercury         ND         0.002         mg/L         03/12/2018 2119 MS         EPA 200.8           Mickel         ND         0.02         mg/L         03/12/2018 011 AW         EPA 200.7           Selenium         ND         0.01         mg/L         03/12/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 1023 DG         EPA 200.7	Aluminum	ND	0.1		mg/L	03/13/2018 1023 DG	EPA 200.7
Boron         ND         0.1         mg/L         03/13/2018 1023 DG         EPA 200.7           Cadmium         ND         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Chromium         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Copper         0.01         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Lead         ND         0.05         mg/L         03/13/2018 1023 DG         EPA 200.7           Lead         ND         0.05         mg/L         03/12/2018 2119 MS         EPA 200.7           Mercury         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Mickel         ND         0.01         mg/L         03/12/2018 011 AW         EPA 200.8           Nickel         ND         0.01         mg/L         03/12/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 1023 DG         EPA 200.7           Total         ND         0.01         mg/L         03/12/2018 2119 MS         EPA 200.7 <td>Arsenic</td> <td>ND</td> <td>0.005</td> <td></td> <td>mg/L</td> <td>03/12/2018 2119 MS</td> <td>EPA 200.8</td>	Arsenic	ND	0.005		mg/L	03/12/2018 2119 MS	EPA 200.8
CadmiumND0.001mg/L03/12/2018 2119 MSEPA 200.8ChromiumND0.01mg/L03/13/2018 1023 DGEPA 200.7Copper0.010.01mg/L03/12/2018 2119 MSEPA 200.8IronND0.05mg/L03/13/2018 1023 DGEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.02mg/L03/12/2018 2119 MSEPA 200.8MolybdenumND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/12/2018 1023 DGEPA 200.7Selenium0.0030.001mg/L03/12/2018 1023 DGEPA 200.7Selenium0.0030.01mg/L03/12/2018 1023 DGEPA 200.7Total MetalsND0.01mg/L03/12/2018 1023 DGEPA 200.7Iron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Manganese5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Barium	0.2	0.1		mg/L	03/12/2018 2119 MS	EPA 200.8
ChromiumND0.01mg/L03/13/2018 1023 DGEPA 200.7Copper0.010.010.01mg/L03/12/2018 2119 MSEPA 200.8IronND0.05mg/L03/13/2018 1023 DGEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.001mg/L03/14/2018 0911 AWEPA 200.8MercuryND0.001mg/L03/12/2018 2119 MSEPA 200.8NickelND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/13/2018 1023 DGEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.8ZincND0.01mg/L03/12/2018 11023 DGEPA 200.7Total MetalsIron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Phosphorus5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Boron	ND	0.1		mg/L	03/13/2018 1023 DG	EPA 200.7
Copper0.010.01mg/L03/12/2018 2119 MSEPA 200.8IronND0.05mg/L03/13/2018 1023 DGEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.001mg/L03/14/2018 0911 AWEPA 200.8MolybdenumND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/12/2018 2119 MSEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.7ZincND0.01mg/L03/12/2018 1023 DGEPA 200.7Total MetalsIron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Phosphorus5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Cadmium	ND	0.001		mg/L	03/12/2018 2119 MS	EPA 200.8
IronND0.05mg/L03/13/2018 1023 DGEPA 200.7LeadND0.02mg/L03/12/2018 2119 MSEPA 200.8MercuryND0.001mg/L03/14/2018 0911 AWEPA 200.8MolybdenumND0.02mg/L03/12/2018 2119 MSEPA 200.8NickelND0.01mg/L03/13/2018 1023 DGEPA 200.7Selenium0.0030.001mg/L03/12/2018 2119 MSEPA 200.8ZincND0.01mg/L03/12/2018 2119 MSEPA 200.7Total MetalsIron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Phosphorus5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Chromium	ND	0.01		mg/L	03/13/2018 1023 DG	EPA 200.7
Lead         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Mercury         ND         0.001         mg/L         03/14/2018 0911 AW         EPA 245.1           Molybdenum         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Nickel         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Nickel         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/13/2018 1023 DG         EPA 200.8           Zinc         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Total Metals         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Copper	0.01	0.01		mg/L	03/12/2018 2119 MS	EPA 200.8
Mercury         ND         0.001         mg/L         03/14/2018 0911 AW         EPA 245.1           Molybdenum         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Nickel         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 2119 MS         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/13/2018 1023 DG         EPA 200.7           Total Metals         ND         0.01         mg/L         03/02/2018 1023 DG         EPA 200.7           Manganese         ND         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Iron	ND	0.05		mg/L	03/13/2018 1023 DG	EPA 200.7
Molybdenum         ND         0.02         mg/L         03/12/2018 2119 MS         EPA 200.8           Nickel         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Zinc         ND         0.01         mg/L         03/12/2018 2119 MS         EPA 200.8           Total Metals         ND         0.01         mg/L         03/12/2018 1023 DG         EPA 200.7           Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Lead	ND	0.02		mg/L	03/12/2018 2119 MS	EPA 200.8
Nickel         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Selenium         0.003         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Zinc         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Total Metals         Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Mercury	ND	0.001		mg/L	03/14/2018 0911 AW	EPA 245.1
Selenium         0.003         0.001         mg/L         03/12/2018 2119 MS         EPA 200.8           Zinc         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Total Metals         Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Molybdenum	ND	0.02		mg/L	03/12/2018 2119 MS	EPA 200.8
Zinc         ND         0.01         mg/L         03/13/2018 1023 DG         EPA 200.7           Total Metals         Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Nickel	ND	0.01		mg/L	03/13/2018 1023 DG	EPA 200.7
Total Metals         Iron         0.18         0.05         mg/L         03/02/2018 1449 DG         EPA 200.7           Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Selenium	0.003	0.001		mg/L	03/12/2018 2119 MS	EPA 200.8
Iron0.180.05mg/L03/02/2018 1449 DGEPA 200.7ManganeseND0.02mg/L03/02/2018 1449 DGEPA 200.7Phosphorus5.20.1mg/L03/02/2018 1449 DGEPA 200.7	Zinc	ND	0.01		mg/L	03/13/2018 1023 DG	EPA 200.7
Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Fotal Metals						
Manganese         ND         0.02         mg/L         03/02/2018 1449 DG         EPA 200.7           Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Iron	0.18	0.05		mg/L	03/02/2018 1449 DG	EPA 200.7
Phosphorus         5.2         0.1         mg/L         03/02/2018 1449 DG         EPA 200.7	Manganese	ND	0.02		-	03/02/2018 1449 DG	EPA 200.7
	-	5.2			-	03/02/2018 1449 DG	EPA 200.7

These results apply only to the samples tested.

**RL - Reporting Limit** 

0

U

В Analyte detected in the associated Method Blank Qualifiers: Value above quantitation range Е

С Calculated Value

Analyzed at IML Gillette laboratory G

J Analyte detected below quantitation limits

Outside the Range of Dilutions

Value exceeds Monthly Ave or MCL or is less than LCL Μ

Analysis reported under the reporting limit

Analyzed by another laboratory Not Detected at the Reporting Limit

ND Spike Recovery outside accepted recovery limits S Х

Holding times for preparation or analysis exceeded

Matrix Effect

Bill Courtmen Reviewed by:

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Bill Courtney, Project Manager

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www.intermountainlabs.com

Inter-Mountain Labs, Inc.

<ul> <li>FedEx</li> <li>USPS</li> <li>Hand Carried</li> <li>Other</li> </ul>	SHIPPING INFO	Lis	( ) 2	LAB COMMENTS	13	12	11	10	9	00	7	6	5	4	ω	2	1 SIPDZ 306-	E (Lab Use Only)				Fort Collins CO 80525	4025 Automation Way, B	Report Address	Albany County	Client Name	INTER-MOUNTAIN LABS	
Soii SL Solid SD Filter FT Other OT	Water WT		Wain A														02/26/18 9:30	MPLE	DATE TIME	Bidg. E	1		Bldg. E				Sheridan, WY and Gillette, WY	Inter-Mountain Labs
	Check de		Martal	Relinquished By (Signature/Printed)						-							30 📏 Septic Tank		NE -	Pur	Phone (O		(Stac	Contact Name	B7218-0001 🍬	Project Identification	nd Gillette, WY	ntain Labs
<ul> <li>Standard turnaround</li> <li>RUSH - 5 Working Days</li> <li>URGENT - &lt; 2 Working Days</li> <li>Rush &amp; Urgent Surcharges will be applied</li> </ul>	TURN AROUND TIMES			ure/Printed)														IDENTIFICATION	SAMPLE	Purchase Order #	1705; (C)	1.000				lion	All shaded fields must be completed. This is a legal document; any misrepresentation may be construed as fraud	
Program (SDWA, NPDES,) PWSID / Permit # Chlorinated? Sample Disposal: Lab x	COMPLIANCE INFO		02/22/18 17:00	DATE													WT	Matrix Cor	1000	Quote #	970-691-3259					Sampl	must be comp any misrepresent	CHAIN OF
osal: Lab	COMPLIANCE INFORMATION		:ud	TIME	-												4	ers	# of						Var	npler (Sign	oleted. ation may t	FCUS
DES,)	NFORM		2 ad	77													×		DG			:0		ANA	$\mathbb{R}$	ature/Atte	oe construe	TODY
Y / N Client	ATION		2	eceived B																	-			ANALYSES /	and the	station of	ed as fraud	CUSTODY RECORD
Z			toon 1	Received By (Signature/Printed)																				I PARAN		ler (Signature/Attestation of Authenticity)		ORD -
	ADDI			rinted)																				PARAMETERS				
	ADDITIONAL REMARKS		2.2.7.18	DATE												No radionuclides	Raw septic system H2O		REM						970-223-4705	Telephone #	#WEB	Page
	(S		HAM	TIME												lides	system H2O		REMARKS									of

	15		-		
-	The second		-	-	
		Y			inter.
102.8				8.	1000

Survey Meter # <u>Mode</u> 241-250 pH strip lot # <u>HC 7302.69</u>

			<u></u>	the way	-
Thermometer	SN#	217	1	30	L

# Condition Upon Receipt (Attach to COC)

Sa	mple Receipt						
1	Number of ice chests Note as "O	s/packages received:	ROI?	? Yes	No		
2	Temperature of coole	er/samples. (If more than 8 coolers, p	lease write on ba	ck)			
	Temps Observed (°C						
	Temps Corrected (°C)	): 0°C for Bacteria; and 0.1° to 6°C for most	other water parar	notora Complea	and weather way	had adams to 1	
		cate ROI (Received on Ice) for iced sample					
		ntact for temperatures outside					receipt.
3		ples for radiochemical analyses <		Yes	No	(N/A	
	COC Number (If appl		0.0111.0111.	100	NO		
		ttles agree with the COC?		Yes	No	N/A	
		ceived intact? (no broken bottles, leak	s, etc.)	Yes	No	N/A	
	Were the sample cus			Yes	No	NTA	
		completed, legible, and signed?		Yes	No		
Sa	mple Verification, La	abeling & Distribution					
1	Were all requested a	nalyses understood and appropria	ate?	Yes	No		
2	Did the bottle labels of	correspond with the COC informat	ion?	Yes	No		
3	Samples collected in	method-prescribed containers?		Yes	No		
4	Sample Preservation			$\bigcirc$			
	pH at Receipt:	Final pH (if added in lab):	Preservativ	/e/Lot#		Date/Time Adde	d:
	Total Metals	Total Metals	HNO3			#2' Z.2	7.180
	Diss Metals	Diss Metals	Filtered and pr	eserved in metals		Filtered and preserve	d in metals
	A Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>				1.44
	Cyanide	Cyanide	NaOH			Preservativ	1-100417-2
	Sulfide	Sulfide	ZnAcet			H2SO4-2 NaOH-W	509H29
	Phenol	Phenol					
5	VOA vials have <6mm	n headspace?		Yes	No	N/A	
		hin holding time at the time of rec	eipt?	(Yes)	No		
		letection limits (RLs) assigned?		Yes	No	N/A)	
		due dates been checked and acce	epted?	Yes	No	N/A	
		ubcontracted analyses?	.,	Yes	NO		
	If "Yes", which type of	f subcontracting is required?	General	Customer-S		Certified	4
Sa	mple Receipt, Verifica	tion, Login, Labeling & Distributior	completed by		KB		
			,			518023	26
Dis	crepancy Document	tation (use back of sheet for not	tes on discrep	oancies)			
An	y items listed above	with a response of "No" or do r	not meet spec	ifications mu	st be resc	olved.	
	Person Contacted:	/	Metho	d of Contact:	_ Phone:		
	Initiated By:	Date/Time:					
	Problem:						
	Resolution:						



Date: 12/21/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project:	B7218-0001	<b>Report ID:</b> S1812062002
Lab Order:	S1812062	(Replaces S1812062001)

Sample Septic Tank was received on December 5, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

This report, S1812062002, is being issued to replace S1812062001. DRO, GRO, and uranium have been removed from the report. TKN and total phosphorus have been added to the reported list of constituents.

Reviewed by: Love Babted

Lisa Balstad, Water Lab Supervisor



Sample Analysis Report

Units Date Analyzed/Init Method	Result RI Q		Analyses
COC: WEB			
Matrix: Water		ample ID: Septic Tank	Client Sample
Sampler: AM		S1812062-001	Lab ID:
Date Received: 12/5/2018 12:30:00 PM		B7218-0001	Project:
Collection Date: 12/4/2018 10:30:00 AM			
Work Order: S1812062		Fort Collins, CO 80525	Fort C
(Replaces S1812062001)		Bldg E	0
Report ID: S1812062002		4025 Automation Way	
Date Reported: 12/21/2018		Wenck Associates	CLIENT: Wenc

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
Total Dissolved Solids (180)	460	10		mg/L	12/07/2018 1005 NLG	SM 2540
Alkalinity, Total (As CaCO3)	530	5		mg/L	12/06/2018 1825 AB	SM 2320B
Nitrogen, Ammonia (as N)	70.9	0.1		mg/L	12/11/2018 0911 AMB	EPA 350.1
Nitrogen, Total Kjeldahl (TKN)	80	1		mg/L	12/26/2018 1112 AMB	EPA 351.2
Anions						
Alkalinity, Bicarbonate as HCO3	646	5		mg/L	12/06/2018 1825 AB	SM 2320B
Alkalinity, Carbonate as CO3	ND	5		mg/L	12/06/2018 1825 AB	SM 2320B
Chloride	30	1		mg/L	12/06/2018 1500 AB	EPA 300.0
Fluoride	0.1	0.1		mg/L	12/06/2018 1825 AB	SM 4500FC
Nitrogen, Nitrate-Nitrite (as N)	ND	0.1		mg/L	12/07/2018 1209 AMB	EPA 353.2
Sulfate	2	1		mg/L	12/06/2018 1500 AB	EPA 300.0
Cations						
Calcium	57	1		mg/L	12/06/2018 1418 DG	EPA 200.7
Magnesium	18	1		mg/L	12/06/2018 1418 DG	EPA 200.7
Potassium	23	1		mg/L	12/06/2018 1418 DG	EPA 200.7
Sodium	40	1		mg/L	12/06/2018 1418 DG	EPA 200.7
Dissolved Metals						
Aluminum	ND	0.1		mg/L	12/06/2018 1418 DG	EPA 200.7
Arsenic	ND	0.005		mg/L	12/05/2018 2335 MS	EPA 200.8
Barium	0.2	0.1		mg/L	12/05/2018 2335 MS	EPA 200.8
Boron	ND	0.1		mg/L	12/06/2018 1418 DG	EPA 200.7
Cadmium	ND	0.001		mg/L	12/05/2018 2335 MS	EPA 200.8
Chromium	ND	0.01		mg/L	12/06/2018 1418 DG	EPA 200.7
Copper	0.01	0.01		mg/L	12/05/2018 2335 MS	EPA 200.8
Iron	0.06	0.05		mg/L	12/06/2018 1418 DG	EPA 200.7
Lead	ND	0.02		mg/L	12/05/2018 2335 MS	EPA 200.8
Mercury	ND	0.001		mg/L	12/12/2018 0841 AW	EPA 245.1
Molybdenum	ND	0.02		mg/L	12/05/2018 2335 MS	EPA 200.8
Nickel	ND	0.01		mg/L	12/06/2018 1418 DG	EPA 200.7
Selenium	ND	0.001		mg/L	12/05/2018 2335 MS	EPA 200.8
Zinc	ND	0.01		mg/L	12/06/2018 1418 DG	EPA 200.7
otal Metals						
Iron	1.82	0.05		mg/L	12/10/2018 1706 DG	EPA 200.7
Manganese	0.07	0.02		mg/L	12/10/2018 1706 DG	EPA 200.7
Phosphorus	11.0	0.1		mg/L	12/10/2018 1706 DG	EPA 200.7

### These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers: B Analyte detected in the associated Method Blank

E Value above quantitation range

H Holding times for preparation or analysis exceeded

L Analyzed by another laboratory

ND Not Detected at the Reporting Limit

S Spike Recovery outside accepted recovery limits

X Matrix Effect

Reviewed by: Love Babtad

Lisa Balstad, Water Lab Supervisor

C Calculated Value

G Analyzed at IML Gillette laboratory

J Analyte detected below quantitation limits

M Value exceeds Monthly Ave or MCL or is less than LCL

O Outside the Range of Dilutions

U Analysis reported under the reporting limit

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	Sheridan WV and Gillette WV			SUCUT RECORD -	Page of
INTER-MOUNTAIN LABS	Sheridan, vvr and Gillette, vvr		All shaded fields must be completed. This is a legal document; any misrepresentation may be construed as fraud	/. ay be construed as fraud.	#WEB
Client Name		ication	Sampler (	Sampler (Signature/Attestation of Authenticity)	Telephone #
Albany County		B/218-0001	1 Cha		970-223-4705
A025 Automation Way	Rida E	Mark Stack		ANALYSES / PARAMETERS	
Fort Collins CO 80525	r	mstacy@wenck.com	601 3950	e 8 clides	
4025 Automation Way, Bldg. E	Bidg. E	Purchase Order #	Quote #	idlin	
Fort Collins CO 80525			1800		REMARKS
E (Lab Use Only)	DATE TIME	IDENTIFICATION	# of Matrix Containers		
1 51812012	12/03/18	Septic Tank 🛰	WT 10	x	No Radionuclides
× 87	12/04/18 10:30				RAW SEPTIC WATER
3					
4					
5					
σ					
8					
0					
10					
11					
12					
13					
14					
LAB COMMENTS	Relin	Relinquished By (Signature/Printed)	DATE TIME	Received By (Signature/Printed)	DATE TIME
7.01	adam Ma	to Adam Mash	12/4/18 17:00	Kathy Bays	12.5.18 12:30 -
111					
	8	TURN AROUND TIMES	COMPLIANC	ORMATION	ADDITIONAL REMARKS
	Soil SL	Standard turnaround	Program (SDWA, NPDES,)	vring?Y/N	
Hand Carried	Solid SD Filter FT	URGENT - 5 Working Days	PWSID / Permit # Chlorinated?	Y / N	
U Other	Other OT	Rush & Urgent Surcharges will be applied	Sample Disposal:	Lab x Client	

	 6	- North	
-			and a
	M		and the second
		ALC: NO THE OWNER	and an owner

Survey Meter # 2241-2 pH strip lot # 40739245 Thermometer SN# <u>S/N</u> 27130475

# Condition Upon Receipt (Attach to COC)

Car	nple Receipt		Receipt (Atta		<u> </u>		
	Number of ice chests/pac	kages received.	ROI?	Yes	No		
1		f samples are received over the cou		100			
2	Temperature of cooler/sa	mples. (If more than 8 coolers, p	please write on back	()			
	Temps Observed (°C):						
	emps Corrected (°C):	2 · 2   or Bacteria; and 0.1° to 6°C for most	t other water peram	atora Samplas m	au not have	had adequate time	e to cool
		OI (Received on Ice) for iced sample					
0		t for temperatures outside		Yes	No	N/A	
	사람이 많아서 있는 것 같은 것 같이 많이 많아야 할까? 것 ?	for radiochemical analyses <	< 0.5mR/m	165	140		
	COC Number (If applicab Do the number of bottles			Yes	No	N/A	
		ed intact? (no broken bottles, leal	ks etc.)	Yes	No	N/A	
	Were the sample custody		na, etc.)	Yes	No	(N/A)	
		pleted, legible, and signed?		Yes	No		
	nple Verification, Labeli			100			
		ses understood and appropri	ate?	Yes	No		
		espond with the COC informa		Yes	No		
		hod-prescribed containers?		Yes	No		
	Sample Preservation:			0	1.0		
-1		nal pH (if added in lab):	Preservativ	e/Lot#		Date/Time A	dded:
	VI Total Metals	Total Metals	HNO3			12.5.100	1259
	・ 子 Diss Metals	21 Diss Metals		eserved in metals	_	Filtered and pres	served in metals
-		Nutrient			>		
	Cyanide	Cyanide					
	Sulfide	Sulfide					
	Sunde Phenol	Phenol	<ul> <li>A. (19)</li> </ul>				
	SDWA Rads	SDWA Rads	HNO <sub>3</sub>				
		ad analysis accompanied by			No		
5	VOA vials have <6mm he		TIER DIATIK!	Yes	No	N/A	
		holding time at the time of re	ceint?	Yes	No		
		ction limits (RLs) assigned?	socipt:	Yes	No	N/A	
	CONTRACTOR AND A CONTRACTOR OF A DATA	dates been checked and acc	cented?	Yes	No	NA	
	Do samples require subc		soptou.	Yes	No		
9	If "Yes", which type of su	김 영향은 이번 것은 것이 가격에서 성장을 썼다.	General	Customer-		Cer	tified
Sa		, Login, Labeling & Distributio			KB		
Ja	inple receipt, vernieation	, Eogin, Easoning a Distributio		-		5181	5062
Die	crepancy Documentatio	on (use back of sheet for n	otes on discrep	oancies)			
		h a response of "No" or do			ist be res	olved.	
	Person Contacted:						
	Initiated By:	Date/Time:					
	Problem:						
	Resolution:						

Lysimeter Water Quality Results



Date: 3/14/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	B7218-0001 S1803020	Report ID: S1803020001

Samples L-1 5', L-2 25', L-3 30' and L-3 35' were received on March 1, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

acolos



Sample Analysis Report

CLIENT: Wer	nck Associates				Date I	Reported: 3/14/20	18	
402 Bldg	5 Automation Way g E				F	Report ID: S18030	20001	
Fort	Collins, CO 80525				Wo	rk Order: S18030	20	
					Collect	tion Date: 2/27/20	18 3:50:	00 PM
Project:	B7218-0001				Date I	Received: 3/1/2018	8 11:55:	00 AM
Lab ID:	S1803020-001					Sampler: AM		
Client Sample	e ID: L-1 5'					Matrix: Water		
						COC: WEB		
Analyses		Result	RL	Qual	Units	Date Analyzed	/Init	Method
General Paramet	ters							
Nitrogen, Nitrate	e (As N)	2.74	0.05		mg/L	03/01/2018 1212	AB	EPA 300.0
Nitrogen, Nitrite	(As N)	0.85	0.05		mg/L	03/01/2018 1212	AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	56	1		mg/L	03/05/2018 1041	AMB	EPA 351.2
Anions								
Chloride		61	1		mg/L	03/01/2018 1339	AB	EPA 300.0
Total Metals								
Phosphorus		6.9	0.1		mg/L	03/06/2018 1826	DG	EPA 200.7

These results	apply	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

## Analyte detected in the associated Method Blank

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

. Jacolos John , Reviewed by:

- **RL Reporting Limit** С Calculated Value
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit



Sample Analysis Report

402	enck Associates 25 Automation Way Ig E					eported: 3/14 eport ID: S18		
For	rt Collins, CO 80525				Worl	k Order: S18	03020	
					Collecti	on Date: 2/27	//2018 3:40:	00 PM
Project:	B7218-0001				Date R	eceived: 3/1/2	2018 11:55:	00 AM
Lab ID:	S1803020-002				5	Sampler: AM		
Client Samp	le ID: L-2 25'					Matrix: Wat	er	
						COC: WE	3	
Analyses		Result	RL	Qual	Units	Date Analy	zed/Init	Method
General Parame	eters							
Nitrogen, Nitra	te (As N)	66.0	0.05		mg/L	03/01/2018 1	351 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	0.08	0.05		mg/L	03/01/2018 1	225 AB	EPA 300.0
Nitrogen, Total	l Kjeldahl (TKN)	3	1		mg/L	03/05/2018 1	005 AMB	EPA 351.2
Anions								
Chloride		101	1		mg/L	03/01/2018 1	351 AB	EPA 300.0
<b>Total Metals</b>								
Phosphorus		1.1	0.1		mg/L	03/06/2018 1	828 DG	EPA 200.7

These results	app	ly only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

#### Analyte detected in the associated Method Blank В

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

John M . Jacolos Reviewed by:

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory
  - G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit



Sample Analysis Report

CLIENT: Wer	nck Associates				Date F	Reported: 3/14/2018	
402 Bldg	5 Automation Way g E				F	Report ID: S180302000	1
Fort	Collins, CO 80525				Wo	rk Order: S1803020	
					Collect	ion Date: 2/27/2018 3:2	20:00 PM
Project:	B7218-0001				Date F	Received: 3/1/2018 11:5	55:00 AM
Lab ID:	S1803020-003					Sampler: AM	
Client Sample	e ID: L-3 30'					Matrix: Water	
						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Paramet	ters						
Nitrogen, Nitrate	e (As N)	63.0	0.05		mg/L	03/01/2018 1404 AB	EPA 300.0
Nitrogen, Nitrite	(As N)	ND	0.05		mg/L	03/01/2018 1237 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	4	1		mg/L	03/05/2018 1005 AMB	EPA 351.2
Anions							
Chloride		2540	1		mg/L	03/01/2018 1441 AB	EPA 300.0
Total Metals							
Phosphorus		1.0	0.1		mg/L	03/06/2018 1831 DG	EPA 200.7

These results	appl	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

# **RL - Reporting Limit**

- Analyte detected in the associated Method Blank В Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s
- Spike Recovery outside accepted recovery limits
- Matrix Effect Х

. Jacolos John , Reviewed by:

- С Calculated Value
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit



Sample Analysis Report

402 Bldg	nck Associates 5 Automation Way g E : Collins, CO 80525				R Wor	eported: 3/14/2018 eport ID: S1803020001 k Order: S1803020	
Project: Lab ID: Client Sample	B7218-0001 S1803020-004 e ID: L-3 35'	Collection Date: 2/27/2018 3:20:00 PM Date Received: 3/1/2018 11:55:00 AM Sampler: AM Matrix: Water COC: WEB					
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Paramet	ters						
Nitrogen, Nitrate	e (As N)	51.2	0.05		mg/L	03/01/2018 1428 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	0.09	0.05		mg/L	03/01/2018 1249 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	ND	1		mg/L	03/05/2018 1008 AMB	EPA 351.2
Anions							
Chloride		142	1		mg/L	03/01/2018 1428 AB	EPA 300.0
Total Metals					-		
Phosphorus		1.4	0.1		mg/L	03/06/2018 1833 DG	EPA 200.7

These results	app	ly only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

#### Analyte detected in the associated Method Blank В

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

John M . Jacolos Reviewed by:

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory
  - G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Rev 4.6 Web

www.intermountainlabs.com

Inter-Mountain Labs, Inc.

	Inter-Mountain Labs	ountair	Labs	1	CHAIN OF		CUSTODY	<b>DY RECORD</b>	ORD -	Page
INTER-MOUNTAIN LABS	Sheridan, WY and Gillette, WY	/Y and Gil	lette, WY		nust be co	mpleted.				#WEB
Client Name			Project Identification	iffcation Sampler (Signature/Attestation.etc)		Sampler (Si	gnature//	Attestation of	Sampler (Signature/Attestation of Authenticity)	Telephone #
Albany County			B7218-0001	01		adi	2	Coff.		970-223-4705
Report Address			Contact Name	le			AN	ANALYSES /	/ PARAMETERS	
4025 Automation Way, Fort Collins CO 80525	Bldg. E		Mark Stacy	cy mstacv@wenck.com			Emai			
Invoice Address			Phone		970-691-3259			ne 8		
4025 Automation Way,	Bldg. E			-	Quote #					
Fort Collins CO 80525					1800			sui		REMARKS
∠ LAB ID	DATE	TIME		SAMPLE		# of				
E (Lab Use Only)	SAMPLED	.ED		IDENTIFICATION	Matrix	Containers				
1 \$1923UZU -01	02/27/18	15150	L-1 5'		WT	-	×	_		See attached emails
2 402	02/27/18	(5:40-	L-2 25'		WT	4	×			See attached emails
3	02/27/18	15:20	L-3 30' V		WT	4	×			See attached emails
4 004	02/27/18		L-3 35'		WT	-	×			See attached emails
5										
6										
7										
8							_			
9							_	_		
10										
11							_			
12							_			
13										
14		Doling	ished Dv /S:	innaturo/Duintod)						
		3	The second	A W AI M I			2		Accession by (orginature)	- 9
7. 6 .	x total	0 00	N	1 own 1 high	C1 102 120	10.00	*		toci	2.1.10
(2)										
1 04										
SHIPPING INFO	MATRIX CODES	ODES	T	TURN AROUND TIMES	COM	COMPLIANCE INFORMATION	INFOR	MATION	A	ADDITIONAL REMARKS
	Water		Check des	Check desired service	Compliance Monitoring ?	e Monito	ing?	Y	/N/	
	Solid	SD		RUSH - 5 Working Days	PWSID / Permit #	Permit #	דטבט,.	•••		
	Filter			URGENT - < 2 Working Days	Chlorinated?			Y /N	2	

		*		and the second sec	# Model 241-251
IME					# HC7302.69 # 217130475
INTER-MOUNTAIN LABS	Condition Upon	Receipt (At			AIT 120770
Sample Receipt	<u>condition opon</u>	Receipt (A		21	
1 Number of ice chests/p	packages received:	ROI Inter, unpackaged	? Yes	No	
Temps Observed (°C): Temps Corrected (°C): Acceptable is : 0.1° to 10°C	C for Bacteria; and 0.1° to 6°C for mos ROI (Received on Ice) for iced samp	t other water paral	meters. Samples m		
Client com	tact for temperatures outside	method crite	ria must be do	cumented	d below.
<ul><li>3 Emission rate of sampl</li><li>4 COC Number (If applic</li></ul>	es for radiochemical analyses · able):	< 0.5mR/hr?	Yes	No	N/A
5 Do the number of bottle	es agree with the COC?		Yes	No	N/A
	eived intact? (no broken bottles, lea	ks, etc.)	Yes	No	N/A
7 Were the sample custo	dy seals intact?		Yes	No	( N/A
	mpleted, legible, and signed?		Yes	No	$\bigcirc$
Sample Verification, Lab	eling & Distribution		$\sim$		
	alyses understood and appropri	ate?	Yes	No	
	rrespond with the COC informa		Yes	No	
3 Samples collected in m	ethod-prescribed containers?		Yes	No	
4 Sample Preservation:			$\bigcirc$		
pH at Receipt:	Final pH (if added in lab):	Preservati	ve/Lot#		Date/Time Added:
Total Metals	Total Metals	HNO <sub>3</sub>			
Diss Metals	Diss Metals		reserved in metals		Filtered and preserved in metals
Nutrient	Nutrient				
Cyanide	Cyanide				
Sulfide	Sulfide	ZnAcet			Sovere
Phenol	Phenol	H <sub>2</sub> SO <sub>4</sub>			Vol 1554
5 VOA vials have <6mm	headsnace?		Vee	No	N1/A
	n holding time at the time of re	coint?	Yes	No	N/A
	ection limits (RLs) assigned?		Yes	No	(N/A)
	e dates been checked and acc	anted? 3.T.	Yes	No	
9 Do samples require sub		epteu i	Yes	No	N/A
If "Yes", which type of s	ubcontracting is required?	General	Customer-S	pecified	Certified
Sample Receipt, Verificatio	on, Login, Labeling & Distributio	on completed by	(initials):	KB	~10 A 2 - 01-
Discourse				Set ID:	51803020
	tion (use back of sheet for no				and a
Person Contacted:	ith a response of "No" or do				
	D-1-/T				
Initiated By <u>:</u> Problem:	Date/Time:			_ Email:	
FIODIEIII.					
Resolution:					
hatar Manustain Laba	D		0		

-



Date: 4/19/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	Lysimeter Sampling B7218-0001 S1804069	Report ID: S1804069001

Samples L-1 5', L-2 25' and L-3 35' were received on April 6, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

acolos



Nitrogen, Total Kjeldahl (TKN)

EPA 351.2

04/11/2018 0941 AMB

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

61

7000	ck Associates ) Yellowtail Rd, Suite 230 /enne, WY 82009					Reported: Report ID:	4/19/2018 S1804069001	
,						rk Order: tion Date:	S1804069 4/4/2018 1:30:0	00 PM
Project:	Lysimeter Sampling B7218-0	001			Date	Received:	4/6/2018 9:56:0	00 AM
Lab ID:	S1804069-001					Sampler:	SW	
Client Sample	• ID: L-1 5'					Matrix: COC:	Water 174853	
Analyses		Result	RL	Qual	Units	Date A	nalyzed/Init	Method
eneral Paramete	ers							
Nitrogen, Nitrate	(As N)	0.11	0.05		mg/L	04/06/20	018 1017 AB	EPA 300.0
Nitrogen, Nitrite	(As N)	0.10	0.05		mg/L	04/06/20	018 1017 AB	EPA 300.0

1

mg/L

These results	apply	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

### Analyte detected in the associated Method Blank В

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

John . . Jacolos Reviewed by:

- **RL Reporting Limit** С Calculated Value
  - Analyzed at IML Gillette laboratory
  - G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit





1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

700	nck Associates 0 Yellowtail Rd, Suite 230 eyenne, WY 82009					Reported: 4/19/2 Report ID: S1804		
Project: Lab ID: Client Sample	Lysimeter Sampling B S1804069-002 e ID: L-2 25'	7218-0001			Collec	rk Order: S1804 tion Date: 4/4/20 Received: 4/6/20 Sampler: SW Matrix: Water COC: 17485	018 1:30:0 018 9:56:0	-
Analyses		Result	RL	Qual	Units	Date Analyz	ed/Init	Method
General Paramet	ters							
Nitrogen, Nitrate	e (As N)	72.5	0.05		mg/L	04/06/2018 113	32 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	0.08	0.05		mg/L	04/06/2018 102	29 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	2	1		mg/L	04/11/2018 094	11 AMB	EPA 351.2

These results	apply	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

### Analyte detected in the associated Method Blank В

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

John . . Jacolos Reviewed by:

John Jacobs, Project Manager

## **RL - Reporting Limit**

- С Calculated Value
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
- Value exceeds Monthly Ave or MCL or is less than LCL М
- 0 Outside the Range of Dilutions
- U Analysis reported under the reporting limit





1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

7000	ck Associates ) Yellowtail Rd, Suite 230 /enne, WY 82009					Reported: 4/19/2 Report ID: S1804		
Project: Lab ID: Client Sample	Lysimeter Sampling B72 S1804069-003 ID: L-3 35'	18-0001			Collect	rk Order: S1804 tion Date: 4/4/20 Received: 4/6/20 Sampler: SW Matrix: Water COC: 17485	18 1:30:0 18 9:56:0	• • • • • •
Analyses		Result	RL	Qual	Units	Date Analyze	ed/Init	Method
General Paramete	ers							
Nitrogen, Nitrate	(As N)	51.0	0.05		mg/L	04/06/2018 114	5 AB	EPA 300.0
Nitrogen, Nitrite	(As N)	0.09	0.05		mg/L	04/06/2018 104	2 AB	EPA 300.0
Nitrogen, Total K	(jeldahl (TKN)	1	1		mg/L	04/11/2018 094	4 AMB	EPA 351.2

These results	apply	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

### Analyte detected in the associated Method Blank В

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Matrix Effect Х

. Jacolos John , Reviewed by:

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory
  - G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL М
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Inter-Mountain Labs, Inc.	Other	Hand Carried	US Mail			1000		5	ン イ し		5	14	13	12	11	10	9	0	0	- 6	5	4	-	2 1 002 4	191804069 - V	LAB ID (Lab Use Only)	same as above	IIIVOICE AUDIESS	bot whis, co 80263		Heport Address	Albany County		INTER-MOUNTAIN LABS	
	Other OT	Filter FT				× co	A TANKA AND		which	///	Relingu												4/4/18 13:30	1/4/18 13:30	4/4/18 13:30.	DATE TIME SAMPLED				1	P.La. TI			Sheridan, WY and Gillette, WY	Inter-Mountain Lahs
www.intern	Rush & Urgent Surcharges will be applied	- OTICLET - ~ E WORNING Days	IIRGENT - < 2 Working Dave	Dici E Walia Dai	Check desired service	TURNAROUND TIMES			- made styles wade		Relinguished By (Signature/Printed)												1-3 35'	6-2 25'	6-1.5'	SAMPLE	ruiciase Cirei #	Phone 470-225-4705		217	2	B7218-0001	Project Identification		
ntainlabs.com	Sample Disposal: Lab Client	Chlorinated? Y/N	nit #	PWOD / DOWA, INFUES,)	Compliance Monitoring? Y /(N)	ORMAT			MUDDY 00:51 \$115/1-	Intra VIII	DATE TIME Received By												ω <sub>T</sub> - ×	ET - X		Matrix Containers See	1900 attace guid	he	d		ANALYSE	Jul ada	Sampler (Signature/Attestation of Authenticity)	All shaded fields must be completed. This is a legal document: any misrepresentation may be construed as fraud.	- CHAIN OF CUSTODY REC
Rev 4.6						ADDITIONAL REMARKS				4 5 0	Bv (Signature/Printed) DATE TIME												preservatives		no preservatives added		REMARKS	H13-N04-2509H29 NaOH-Wet-5-1-0	1:1 HNO3-M-100417-2	Preservativo	ANALYSES / PARAMETERS	Ki	f Authenticity) Telephone #	ed as fraud. # 174853	RECORD - Page 1 of 1

						# Nbde! 241-25	0
1						# HC730269	_
INTE	R-MOUNTAIN LABS					# 217 130475	_
		Condition Upon	Receipt (A	ttach to COC	)		
	mple Receipt	1					
1	Number of ice chests/		ROI		No		
0		C " if samples are received over the cour					
	Temps Observed (°C):	r/samples. (If more than 8 coolers, p	lease write on ba	ack)		11 11	1
	Temps Corrected (°C):		-				+
		°C for Bacteria; and 0.1° to 6°C for most	other water para	meters. Samples ma	ay not have	had adequate time to cool	1
	following collection. Indica	ate ROI (Received on Ice) for iced sample	es received on th	e same day as samp	oled, in add	dition to temperature at receipt.	
	Client cor	ntact for temperatures outside	method crite	ria must be doo	umente	d below.	
3		oles for radiochemical analyses <		Yes	No	NTA	
	COC Number (If appli	- 10- 2				$\bigcirc$	
5	Do the number of bott	les agree with the COC?		Yes	No	N/A	
6	Were the samples rec	eived intact? (no broken bottles, leak	s, etc.)	Yes	No	N/A	
7	Were the sample cust	ody seals intact?		Yes	No	(N/A)	
8	Is the COC properly co	ompleted, legible, and signed?		Yes	No	$\bigcirc$	
	mple Verification, Lat		Day	LISA			
1	Were all requested an	alyses understood and appropria	ite?	Yes	No		
2	Did the bottle labels co	prrespond with the COC information	ion?	Yes	No		
3	Samples collected in r	method-prescribed containers?		Yes	No		
4	Sample Preservation:						
	pH at Receipt:	Final pH (if added in lab):	Preservati	ve/Lot#		Date/Time Added:	
	Total Metals	Total Metals	HNO3				
	Diss Metals	Diss Metals	Filtered and p	preserved in metals		Filtered and preserved in metals	
	Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>				
	Cyanide	Cyanide	NaOH		1	lal inclus	
	Sulfide	Sulfide	ZnAcet			101 1554	
	Phenol	Phenol	H <sub>2</sub> SO <sub>4</sub>				
5	VOA vials have <6mm	headspace?		Yes	No	N/A	
6	Were all analyses with	in holding time at the time of rec	eipt?	Yes	No		
		etection limits (RLs) assigned?		Yes	No	N/A	
8	Have rush or project d	ue dates been checked and acce	epted?	Yes	No	N/A	
9		bcontracted analyses?		Yes	No		
		subcontracting is required?	General	Customer-S	pecified	Certified	
Sa	mple Receipt, Verificati	ion, Login, Labeling & Distribution	n completed b	y (initials) :	KB.	0001101	
					Set ID:	51804069	
		ation (use back of sheet for not					
An		vith a response of "No" or do r					
	Person Contacted:						
		Date/Time:			_ Email:		
	Problem:						
	Resolution:						
	The second states and						



Date: 5/25/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	B7218-0001 S1805305	Report ID: S1805305001

Samples 1-5, 2-19, 2-25 and 3-35 were received on May 17, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

### Qualifiers by sample

S1805305-003 - General Parameters/Nitrogen, Nitrate (As N) - Holding times for preparation or analysis exceeded by 14 minutes. Sample ran within holding time initially. Value exceeded calibration curve and was re-ran at a greater dilution. S1805305-004 - General Parameters/Nitrogen, Nitrate (As N) - Holding times for preparation or analysis exceeded by 29 minutes. Sample ran within holding time initially. Value exceeded calibration curve and was re-ran at a greater dilution.

Reviewed by: Bill Courtmen

Bill Courtney, Project Manager



Sample Analysis Report

CLIENT: Wenck Associates 4025 Automation Way Bldg E Fort Collins, CO 80525			Date Reported: 5/25/2018 Report ID: S1805305001 Work Order: S1805305							
						tion Date: 5/15/2018 3:30				
Project:	B7218-0001					Received: 5/17/2018 12:3				
Lab ID: Client Sample	S1805305-001 e ID: 1-5					Sampler: AM Matrix: Water COC: 176089				
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method			
Seneral Paramet	ters									
Nitrogen, Nitrate	e (As N)	6.92	0.05		mg/L	05/17/2018 1434 AB	EPA 300.0			
Nitrogen, Nitrite	e (As N)	0.20	0.05		mg/L	05/17/2018 1434 AB	EPA 300.0			
Nitrogen, Total	Kjeldahl (TKN)	53	1		mg/L	05/22/2018 1142 AMB	EPA 351.2			
					-					
-										
-		26	1		mg/L	05/17/2018 1613 AB	EPA 300.0			
nions		26	1		mg/L	05/17/2018 1613 AB	EPA 300.0			

These results	These results apply only to the samples tested.		RL - Reporting	Limit
Qualifiers:	В	Analyte detected in the associated Method Blank	С	Calculated Value
	Е	Value above quantitation range	G	Analyzed at IML Gillette laboratory
	н	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	L	Analyzed by another laboratory	Μ	Value exceeds Monthly Ave or MCL or is less than LCL
	ND	Not Detected at the Reporting Limit	0	Outside the Range of Dilutions
	S	Spike Recovery outside accepted recovery limits	U	Analysis reported under the reporting limit
	Х	Matrix Effect		
Reviewed b	y: 🤇	Bill Courtmen		Page 1 of 4
	Bi	ll Courtney, Project Manager		Page 1 of 4



Sample Analysis Report

	nck Associates 25 Automation Way g E		Date Reported: 5/25/2018 Report ID: S1805305001							
For	t Collins, CO 80525				Wo	rk Order: S1805305				
			Collection Date: 5/15/2018 3:30:00 PM							
Project:	B7218-0001				Date	Received: 5/17/2018 12:	33:00 PM			
Lab ID:	S1805305-002		Sampler: AM							
Client Sampl					Matrix: Water COC: 176089					
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method			
Seneral Parame	ters									
Nitrogen, Nitrat	e (As N)	75.9	0.05		mg/L	05/17/2018 1530 AB	EPA 300.0			
Nitrogen, Nitrite	e (As N)	ND	0.05		mg/L	05/17/2018 1448 AB	EPA 300.0			
Nitrogen, Total	Kjeldahl (TKN)	5	1		mg/L	05/22/2018 1142 AMB	EPA 351.2			
Anions										
AIIIOIIS										
Chloride		366	1		mg/L	05/17/2018 1530 AB	EPA 300.0			
		366	1		mg/L	05/17/2018 1530 AB	EPA 300.0			

These results a	ppl	y only to the samples tested.	RL - Reporting L	Limit
Qualifiers:	в	Analyte detected in the associated Method Blank	С	Calculated Value
	Е	Value above quantitation range	G	Analyzed at IML Gillette laboratory
	н	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	L	Analyzed by another laboratory	M	Value exceeds Monthly Ave or MCL or is less than LCL
1	ND	Not Detected at the Reporting Limit	0	Outside the Range of Dilutions
	S	Spike Recovery outside accepted recovery limits	U	Analysis reported under the reporting limit
	Х	Matrix Effect		
Reviewed by:	C	3.00 Courtmen		
	Bil	I Courtney, Project Manager		Page 2 of 4



Sample Analysis Report

402 Bldg	nck Associates 5 Automation Way g E t Collins, CO 80525		Date Reported: 5/25/2018 Report ID: S1805305001 Work Order: S1805305						
Project: Lab ID: Client Sample	•								
Analyses		Result	RL	Qual	Units	Date Analyzed/Init Method			
General Paramet	ters								
Nitrogen, Nitrate	e (As N)	74.7	0.05	Н	mg/L	05/17/2018 1544 AB	EPA 300.0		
Nitrogen, Nitrite	e (As N)	0.17	0.05		mg/L	05/17/2018 1502 AB	EPA 300.0		
Nitrogen, Total	Kjeldahl (TKN)	2	1		mg/L	05/22/2018 1143 AMB	EPA 351.2		
Anions									
Anions									
Chloride		202	1		mg/L	05/17/2018 1544 AB	EPA 300.0		
		202	1		mg/L	05/17/2018 1544 AB	EPA 300.0		

These result	These results apply only to the samples tested.		RL - Reporting	Limit
Qualifiers:	В	Analyte detected in the associated Method Blank	С	Calculated Value
	Е	Value above quantitation range	G	Analyzed at IML Gillette laboratory
	н	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	L	Analyzed by another laboratory	Μ	Value exceeds Monthly Ave or MCL or is less than LCL
	ND	Not Detected at the Reporting Limit	0	Outside the Range of Dilutions
	S	Spike Recovery outside accepted recovery limits	U	Analysis reported under the reporting limit
	Х	Matrix Effect		
Reviewed b	y:	Bill Courtmen		Page 3 of 4
	Bi	Il Courtney, Project Manager		



Sample Analysis Report

CLIENT: Wer 4029 Bldg					Reported: 5/25/2018 Report ID: S18053050	01			
	Collins, CO 80525				Wo	rk Order: S1805305			
			Collection Date: 5/15/2018 3:30:00 PM						
Project:	B7218-0001				Date	Received: 5/17/2018 1	2:33:00 PM		
Lab ID:	S1805305-004		Sampler: AM						
Client Sample					Matrix: Water COC: 176089				
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method		
Seneral Paramet	ers								
Nitrogen, Nitrate	e (As N)	53.1	0.05	Н	mg/L	05/17/2018 1559 AB	EPA 300.0		
Nitrogen, Nitrite	(As N)	ND	0.05		mg/L	05/17/2018 1516 AB	EPA 300.0		
Nitrogen, Total I	Kjeldahl (TKN)	1	1		mg/L	05/22/2018 1143 AME	B EPA 351.2		
nions									
<b>nions</b> Chloride		238	1		mg/L	05/17/2018 1559 AB	EPA 300.0		
		238	1		mg/L	05/17/2018 1559 AB	EPA 300.0		

These results apply only to the samples tested. **RL - Reporting Limit** В Analyte detected in the associated Method Blank С Calculated Value Qualifiers: Value above quantitation range Analyzed at IML Gillette laboratory Е G н Holding times for preparation or analysis exceeded J Analyte detected below quantitation limits Analyzed by another laboratory Value exceeds Monthly Ave or MCL or is less than LCL L Μ ND Not Detected at the Reporting Limit 0 Outside the Range of Dilutions Spike Recovery outside accepted recovery limits U Analysis reported under the reporting limit S Matrix Effect Х Bill Courtmen Reviewed by: Page 4 of 4 Bill Courtney, Project Manager

1		www.intermountainlabs.com	www.intermo			Inter-Mountain Lahe Inc	
	× Clier	d Sample Disposal: Lab	Rush & Urgent Surcharges will be applied	OT	Other	Other	
	N/Y	Chiorinated	a contraction of the second second	H	Filter	Hand Carried	
		Chloringtodo	URGENT - < 2 Working Days		Solid	US IVIAII	
		PWSID / Permit #	RUSH - 5 Working Davs	ŝ	Colia I	IC Mail	
			X Standard turnaround	2	Soil	Fed Express	
			Check desired service	WT	Water	UPS	
ADDITIONAL REMARKS	ANCE INFORMATION ADDITIC	COMPLIANC	TURNAROUND TIMES	CODES	MATRIX CODES	SHIPPING INFO	
-							
5.7.10 12:33	Katha Boat	2 adiyis 10:30	Just Adam Marsh	3	(Law		
	Received By (Signature/Printed)	DATE TIME	Relinquished By (Signature/Printed)	Relinquis		LAB COMMENTS	
letal	(2) INN (3) 101 (4)						
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NO. NO. CI-	tollar han ander: (1)						13
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Please Sa necsure							5
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	TK- TK- Tote	# of Matrix Containers	IDENTIFICATION	TIME	DATE   TIN	LAB ID (Lab Use Only)	ITEM
REMARKS	Nt	1800		С.К	505 0	+ Collins, C	ç?
		Quote #	der #	BUS M	way, 1	25 Automation	4025
	-	(0) 970.691.3259	23-4705			Invoice Address	Invoi
	, N	Com	instachewenck.	25	0 805	+ Collins C	202
	lb3		Mark Stacy	de C	Wey, Blo	25 Automation	4025
	ANALYSES / PARAMETERS	(	Contact Name			Report Address	Repo
208-590-9478	in the	1000	87218-000i			Ibaris Countra	A
Telephone #	Sampler (Signature/Attestation of Authenticity)	Sampler (	ectilden	P		Client Name	Clien
# 176089	All shaded tields must be completed. This is a legal document: any misrepresentation may be construed as fraud.	All shaded fields must be completed. This is a legal document: any misrepresen		Sheridan, WY and Gillette, WY	heridan, WY	INTER-MOUNTAIN LABS	INTER
				Inter-Mountain Labs	nter-Mou		1



# Condition Upon Receipt (Attach to COC)

Sample Receipt	1				
1 Number of ice chests/packag Note as "OTC" if sam	es received:	ROI? unter, unpackaged	Yes	No	
2 Temperature of cooler/sample	es. (If more than 8 coolers,	please write on back,		_	r
Temps Observed (°C): 3					
Temps Corrected (°C): 4. Acceptable is: 0.1° to 10°C for Ba		st other water parame	ters. Samples m	ay not have	had adequate time to cool
following collection. Indicate ROI (F					
Client contact fo	r temperatures outside	e method criteria	must be do	cumented	I below.
3 Emission rate of samples for			Yes	No	N/A
4 COC Number (If applicable):	176080	1			$\bigcirc$
5 Do the number of bottles agre	ee with the COC?	<u></u>	Yes	No	N/A
6 Were the samples received in		aks, etc.)	Yes	No	N/A
7 Were the sample custody sea			Yes	No	(N/A
8 Is the COC properly complete			Yes	No	$\sim$
Sample Verification, Labeling					
1 Were all requested analyses		riate?	Yes	No	
2 Did the bottle labels correspo			Yes	No	
3 Samples collected in method			Yes	No	
4 Sample Preservation:			$\smile$		
	pH (if added in lab):	Preservative	e/Lot#		Date/Time Added:
Total Metals	Total Metals	HNO3			
Diss Metals	Diss Metals	Filtered and pre	served in metals		Filtered and preserved in metals
7 Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>			SAIRE
Cyanide	Cyanide	NaOH			JACLICS M.
Sulfide	Sulfide	ZnAcet			NO1155 4
Phenol	Phenol	H <sub>2</sub> SO <sub>4</sub>			
SDWA Rads	SDWA Rads	HNO3			
Preserved samples for Rad a			Yes	No	
5 VOA vials have <6mm heads			Yes	No	N/A
6 Were all analyses within hold		eceipt?	Yes	No	$\bigcirc$
7 Specially requested detection			Yes	No	NA
8 Have rush or project due dat			Yes	No	N/A
9 Do samples require subconti			Yes	No	
If "Yes", which type of subco		General	Customer-	Specified	Certified
Sample Receipt, Verification, Lo		ion completed by	(initials) :	KB Set ID.	51805305
Discrepancy Documentation (	use back of sheet for r	notes on discrep	ancies)		
Any items listed above with a				ist be res	olved.
Person Contacted:					
Initiated By:	Date/Time:			Email:	
Problem:					
Resolution:					



Date: 7/9/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	B7218-0001 S1806434	Report ID: S1806434001

Samples L-1 12', L-1 5', L-2 19', L-2 25', L-3 30' and L-3 35' were received on June 26, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

John M. Jacolos

Inter-Mountain Labs

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: W	enck Associates		Date Reported: 7/9/2018						
	025 Automation Way dg E				R	eport ID: S180	6434001		
Fo	ort Collins, CO 80525				Worl	c Order: S180	6434		
					Collection	on Date: 6/25/	2018 3:00:	00 PM	
Project:	B7218-0001				Date R	eceived: 6/26/	2018 11:25	5:00 AM	
Lab ID:	S1806434-001				Sampler: MS				
Client Samp	ple ID: L-1 5'				Matrix: Water				
						COC: WEB	i		
Analyses		Result	RL	Qual	Units	Date Analyz	ed/Init	Method	
General Param	eters								
Nitrogen, Nitra	ate (As N)	49.2	0.05		mg/L	06/27/2018 09	23 AB	EPA 300.0	
Nitrogen, Nitri	ite (As N)	6.44	0.05		mg/L	06/26/2018 17	18 AB	EPA 300.0	
Nitrogen, Tota	al Kjeldahl (TKN)	30	1		mg/L	07/03/2018 09	49 AMB	EPA 351.2	
Anions									
Chloride		227	1		mg/L	06/27/2018 09	23 AB	EPA 300.0	
Total Metals									
Phosphorus		5.9	0.2		mg/L	07/06/2018 09	25 DG	EPA 200.7	

These results apply only to the samples tested. Qualifiers:

в Analyte detected in the associated Method Blank

Value above quantitation range Е

н Holding times for preparation or analysis exceeded

Analyzed by another laboratory L

ND Not Detected at the Reporting Limit

s Spike Recovery outside accepted recovery limits

. Matrix Effect Х

John M. Jacolos Reviewed by:

John Jacobs, Project Manager

**RL - Reporting Limit** 

- Calculated Value С
- Analyzed at IML Gillette laboratory G J Analyte detected below quantitation limits
- Value exceeds Monthly Ave or MCL or is less than LCL Μ

0 Outside the Range of Dilutions

U Analysis reported under the reporting limit Inter-Mountain Labs -

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

4	Venck Associates 1025 Automation Way Bldg E				Date Reported: 7/9/2018 Report ID: \$1806434001				
F	Fort Collins, CO 80525				Wo	rk Order: S1806434			
					Collec	tion Date: 6/25/2018 3:1	5:00 PM		
Project:	B7218-0001		Date Received: 6/26/2018 11:25:00 AM						
Lab ID:	S1806434-002					Sampler: MS			
Client San	n <b>ple ID:</b> L-1 12'		Matrix: Water						
_						COC: WEB			
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method		
General Para	meters								
Nitrogen, Nit	trate (As N)	91.8	0.05		mg/L	06/26/2018 1730 AB	EPA 300.0		
Nitrogen, Nit	trite (As N)	ND	0.05		mg/L	06/26/2018 1730 AB	EPA 300.0		
Anions									
Chloride		52	1		mg/L	06/26/2018 1730 AB	EPA 300.0		

### These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank

- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- L Analyzed by another laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits
- X Matrix Effect

John M. Jacolos Reviewed by:

- RL Reporting Limit
  - C Calculated Value G Analyzed at IML Gillette laboratory
  - G Analyzed at IML Gillette laboratoryJ Analyte detected below quantitation limits
  - M Value exceeds Monthly Ave or MCL or is less than LCL
  - O Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Inter-Mountain Labs

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: Wei 402 Bldg Fort				R <sup>i</sup> Worl	eported: 7/9/2018 eport ID: S1806434001 k Order: S1806434		
Project: Lab ID: Client Sampl	B7218-0001 S1806434-003 le ID: L-2 19'				Date R	on Date: 6/25/2018 3:25 eceived: 6/26/2018 11:2 Sampler: MS Matrix: Water COC: WEB	
Analyses	Analyses		RL	Qual	Units	Date Analyzed/Init	Method
General Parame	ters						
Nitrogen, Nitrate	e (As N)	69.3	0.05		mg/L	06/27/2018 0936 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	ND	0.05		mg/L	06/26/2018 1743 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	6	1		mg/L	07/03/2018 0952 AMB	EPA 351.2
Anions							
Chloride		366	1		mg/L	06/27/2018 0936 AB	EPA 300.0
Total Metals							
Phosphorus		1	1		mg/L	07/06/2018 0927 DG	EPA 200.7

These results	apply	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

### Analyte detected in the associated Method Blank В

- Е Value above quantitation range
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Х . Matrix Effect

John M. Jacolos Reviewed by:

- **RL Reporting Limit** С Calculated Value
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Inter-Mountain Labs -

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

	nck Associates 5 Automation Way 3 E					Reported: 7/9/2018 Report ID: S1806434001	
Fort	Collins, CO 80525					r <b>k Order:</b> S1806434 i <b>on Date:</b> 6/25/2018 3:35	5:00 PM
Project: Lab ID:	Project:         B7218-0001         Date Received:         6/26/201						
Lab ID: S1806434-004 Client Sample ID: L-2 25'						Matrix: Water COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Paramet	iers						
oonorar r aranno							
Nitrogen, Nitrate		72.3	0.05		mg/L	06/27/2018 0949 AB	EPA 300.0
	e (As N)	72.3 1.41	0.05 0.05		mg/L mg/L	06/27/2018 0949 AB 06/26/2018 1755 AB	EPA 300.0 EPA 300.0
Nitrogen, Nitrate	e (As N) (As N)	-			0		
Nitrogen, Nitrate Nitrogen, Nitrite	e (As N) (As N)	1.41	0.05		mg/L	06/26/2018 1755 AB	EPA 300.0
Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Total I	e (As N) (As N)	1.41	0.05		mg/L	06/26/2018 1755 AB	EPA 300.0
Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Total I Anions	e (As N) (As N)	1.41 3	0.05 1		mg/L mg/L	06/26/2018 1755 AB 07/03/2018 0952 AMB	EPA 300.0 EPA 351.2

These results app	ly only to the	samples tested.
-------------------	----------------	-----------------

## Qualifiers: B Analyte detected in the associated Method Blank

- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- L Analyzed by another laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits
- X Matrix Effect

John M. Jacolos Reviewed by:

- RL Reporting Limit
  - C Calculated Value
  - G Analyzed at IML Gillette laboratoryJ Analyte detected below quantitation limits
  - M Value exceeds Monthly Ave or MCL or is less than LCL
  - O Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Inter-Mountain Labs

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

	enck Associates			Date Reported: 7/9/2018					
	25 Automation Way dg E				Re	oort ID: S1806434001			
Fo	rt Collins, CO 80525				Work	Order: S1806434			
					Collectio	n Date: 6/25/2018 3:45	:00 PM		
Project:	Project: B7218-0001			Date Received: 6/26/2018 11:25:00 AM					
Lab ID:	S1806434-005				Sa	mpler: MS			
Client Samp	<b>ble ID:</b> L-3 30'					Matrix: Water			
						COC: WEB			
Analyses	Analyses		RL	Qual	Units	Date Analyzed/Init	Method		
General Param	eters								
Nitrogen, Nitra	ate (As N)	55.5	0.05		mg/L	06/27/2018 1001 AB	EPA 300.0		
Nitrogen, Nitrit	te (As N)	ND	0.05		mg/L	06/26/2018 1808 AB	EPA 300.0		
Nitrogen, Tota	l Kjeldahl (TKN)	10	1		mg/L	07/03/2018 0952 AMB	EPA 351.2		
Anions									
Chloride		489	1		mg/L	06/27/2018 1001 AB	EPA 300.0		
Total Metals									
Phosphorus		2	1		mg/L	07/06/2018 0931 DG	EPA 200.7		

These results apply only to the samples tested. В Analyte detected in the associated Method Blank

### Qualifiers:

- Е Value above quantitation range
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- . Matrix Effect Х

John M. Jacolos Reviewed by:

- **RL Reporting Limit** 
  - Calculated Value С
  - Analyzed at IML Gillette laboratory G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Inter-Mountain Labs

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: We	enck Associates				Date Reported: 7/9/2018				
	25 Automation Way Ig E				F	Report ID: S180643400			
For	rt Collins, CO 80525				Wor	k Order: S1806434			
					Collect	ion Date: 6/25/2018 4	:00:00 PM		
Project:	B7218-0001		Date Received: 6/26/2018 11:25:00 AM						
Lab ID:	S1806434-006					Sampler: MS			
Client Samp	ole ID: L-3 35'					Matrix: Water			
-						COC: WEB			
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method		
General Parame	eters								
Nitrogen, Nitra	ite (As N)	54.1	0.05		mg/L	06/27/2018 1014 AB	EPA 300.0		
Nitrogen, Nitrit	te (As N)	ND	0.05		mg/L	06/26/2018 1821 AB	EPA 300.0		
Nitrogen, Total	l Kjeldahl (TKN)	2	1		mg/L	07/03/2018 0952 AME	EPA 351.2		
Anions									
Chloride		239	1		mg/L	06/27/2018 1014 AB	EPA 300.0		
Total Metals									
Phosphorus		1.2	0.1		mg/L	07/06/2018 0934 DG	EPA 200.7		

These results	арр	ly only to the samples tested.
Qualifiers:	В	Analyte detected in the associated Method Blank

## Qualifiers:

- Е Value above quantitation range
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Х . Matrix Effect

Jacolo toten. Reviewed by:

John Jacobs, Project Manager

- **RL Reporting Limit** 
  - Calculated Value С
  - Analyzed at IML Gillette laboratory G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Page 6 of 6

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					Client	,)	PDE PDE	SDWA, SDWA, Permit # id?	Program (SDWA, N PWSID / Permit # Chlorinated?	<ul> <li>Standard turnaround</li> <li>Standard turnaround</li> <li>RUSH - 5 Working Days</li> <li>URGENT - &lt; 2 Working Days</li> <li>Rush &amp; Urgent Surcharges will be applied</li> </ul>	Standard turnaround RUSH - 5 Working Days Rush & Urgent Surcharges will be app		Solid Filter	FedEx USPS Hand Carried	
RKS	ADDITIONAL REMARKS	ADDITIO			TION	ORMA	EINF		CON	JND TIMES	TURN AROUND TIMES		MATRIX CODES	SHIPPING INFO	×
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52:11 8	6.26 \$		a	5	\$	A	*				1		-	0.7(	.1
5 1620	612/18				5	4P		1620	6/25/18	Shad	/ MARCE S	()	1	1.4	
TIME	DATE	(be	Received By (Signature/Printed)	(Signati	eived By	Rec		TIME	DATE	ed)	Relinquished By (Signature/Printed)	Relinqu		LAB COMMENTS	
Vietals	(4) Total Metals				_										4
horus	(3) Phosphorus				-										3 2
	(2) TKN			-											-
(1) Nitrate, nitrite, chloride	(1) Nitrate														10
in the following order:	in the follo			-											9
prioritize parameters	prioritize														~
all parameters, please	all parame			-											7
insufficient to measure	insufficie		×	××	×	×	×	-	WT		L-3 35'	1600	V	900	6
volume is	If sample volume is		×	× ×	×	×	×	-	WT		L-3 30'	1545	K	85	5
			×	x x	×	×	×	-	WT		L-2 25'	1535		200	4
ameters	about parameters		×	× ×	×	×	×	-	WT		L-2 19'	1825		003	ω
quote for more details	quote for		×	××	×	×	×	-	WT		L-1 12'	1515		28	N
Please see attached	Please se		×	x x	×	×	×	-	WT		L-1 5'	1500	6/25/12	56806434	-
			Total	Phos Chlor	Total	Nitrite	ø Nitrat	# of Containers	Matrix	PLE CATION	SAMPLE IDENTIFICATION	TIME	DATE TI SAMPLED	LAB ID (Lab Use Only)	ITEM
REMARKS	77					e (as l	e (as		Quote # 1800	rder #	Purchase Order #		ldg. E	4025 Automation Way, Bldg. E Fort Collins CO 80525	Fort
			s	IS		N)	N)		691-3259	(O) 970-223-4705; (C) 970-691-3259	Phone (O) 970-2			Invoice Address	Invoid
					N					y mstacy@wenck.com	Mark Stacy Email mstacy@		idg. E	4025 Automation Way, Bldg. Fort Collins CO 80525	For
		TERS	ANALYSES / PARAMETERS	/ PAI	YSES	ANAL	-				Contact Name		1	Keport Address	керо
705	970-223-4705		Juily )	Dunient	10000	L	A BURNER	omiles forgrammer and anticipation			B7218-0001			Albany County	Alba
	T-1		initia)	Authont	as fraud	onstruec	may be c	Sampler	any misrepre	This is a legal document; any misrepresentation may be construed as fraud	Project Identification			Client Name	Clien
	#WEB						1.	mpleteu	nust be co	All shaded fields must be completed.	llette, WY	VY and Gil	Sheridan, WY and Gillette, WY	INTER-MOUNTAIN LABS	INTE
of	Page			ORD	RECORD	STODY	USTO	OF CU	CHAIN OF		n Labs	ountail	Inter-Mountain Labs	3	1



Survey Meter # Model 2241-2; SN 182115 pH strip lot # HC7302(09 Thermometer SN# 27130475

<b>Condition Upon Rece</b>	ipt (Attach	to COC)
----------------------------	-------------	---------

ample Receipt	1		60		
Number of ice chests/packag Note as "OTC" if sar	ges received:	ROI? nter, unpackaged	Yes	No	
Temperature of cooler/samp Temps Observed (°C): Temps Corrected (°C): Acceptable is: 0.1° to 10°C for Ba following collection. Indicate ROI (	acteria; and 0.1° to 6°C for most	other water param	eters. Samples may	v not have led. in addi	had adequate time to cool tion to temperature at receipt.
	or temperatures outside				
Emission rate of samples for COC Number (If applicable):	radiochemical analyses <		Yes	No	N/A
Do the number of bottles agr			(Yes)	No	N/A
Were the samples received		rs, etc.)	Yes	No	N/A
Were the sample custody se			Yes	No	N/A
			Yes	No	
Is the COC properly complete ample Verification, Labeling					
Were all requested analyses		ate?	Yes	No	
Did the bottle labels corresp			Yes	No	
Samples collected in method			Yes	No	
Sample Preservation:					
pH at Receipt: Final	pH (if added in lab):	Preservativ	/e/Lot#		Date/Time Added:
Total Metals	Total Metals	HNO3			
Diss Metals	Diss Metals	Filtered and pr	reserved in metals		Filtered and preserved in metals
Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>			
Cyanide	Cyanide	NaOH			
Sulfide	Sulfide	ZnAcet			
Phenol	Phenol	H <sub>2</sub> SO <sub>4</sub>			
SDWA Rads	SDWA Rads	HNO3			
Preserved samples for Rad		Field Blank?	Yes	No	
VOA vials have <6mm head			Yes	No	N/A
Were all analyses within hol		eceipt?	Yes	No	~
Specially requested detection			Yes	No	N/A
Have rush or project due da		cepted?	Yes	No	N/A
Do samples require subcon			Yes	No	
If "Yes", which type of subc		General	Customer-S	pecified	Certified
ample Receipt, Verification, L				KB Set ID	51806434
iscrepancy Documentation					alved
ny items listed above with a	a response of "No" or do				
Person Contacted:		Ivieth	od of Contact: _		
Initiated By:	Date/Time:	AL L	En .	_ Email:	1.1
Problem:	Severe	VOI	sall,	ISP	ecially or 2
Resolution:	4	only a	, ten c	nof	5



1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 9/21/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	B7218-0001 S1809066	Report ID: S1809066001

Samples L-1 12', L-1 5', L-2 19', L-2 25', L-3 30' and L-3 35' were received on September 6, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

John M. Jacolos

Inter-Mountain Labs 1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

402 Bld	nck Associates 25 Automation Way g E t Collins, CO 80525				Re	eported: 9/21/2018 eport ID: S1809066001 c Order: S1809066 on Date: 9/5/2018 3:00	
Project: Lab ID: Client Sampl	B7218-0001 S1809066-001 le ID: L-1 5'				Date Re	aceived: 9/6/2018 10:2 ampler: AM Matrix: Water COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parame	ters						
Nitrogen, Nitrat	e (As N)	26.3	0.05		mg/L	09/06/2018 1339 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	5.18	0.05		mg/L	09/06/2018 1339 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	20	1		mg/L	09/13/2018 0857 AMB	EPA 351.2
Anions							
Chloride		27	1		mg/L	09/06/2018 1339 AB	EPA 300.0
Total Metals							
Phosphorus		4.5	0.1		mg/L	09/18/2018 1929 DG	EPA 200.7

These results	apply	only to	the samp	les tested.
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# Qualifiers: B Analyte detected in the associated Method Blank

- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- L Analyzed by another laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits
- X Matrix Effect

John M. Jacolos Reviewed by:

- RL Reporting Limit C Calculated
  - C Calculated Value G Analyzed at IML Gillette laboratory
  - J Analyte detected below quantitation limits
  - M Value exceeds Monthly Ave or MCL or is less than LCL
  - O Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: We	enck Associates				Date Re	ported: 9/21/2018	
	25 Automation Way dg E				Re	port ID: S1809066001	
Fo	ort Collins, CO 80525				Work	Order: S1809066	
					Collectio	n Date: 9/5/2018 3:00:	00 PM
Project:	B7218-0001				Date Re	ceived: 9/6/2018 10:29	9:00 AM
Lab ID:	S1809066-002				Sa	ampler: AM	
Client Samp	ole ID: L-1 12'					Matrix: Water	
						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Param	eters						
Nitrogen, Nitra	ate (As N)	69.0	0.05		mg/L	09/07/2018 1012 AB	EPA 300.0
Nitrogen, Nitrit	te (As N)	ND	0.05		mg/L	09/06/2018 1351 AB	EPA 300.0
Nitrogen, Tota	al Kjeldahl (TKN)	6	1		mg/L	09/13/2018 0858 AMB	EPA 351.2
Anions							
Chloride		75	1		mg/L	09/07/2018 1012 AB	EPA 300.0
<b>Total Metals</b>							
Phosphorus		1.9	0.1		mg/L	09/18/2018 1931 DG	EPA 200.7

These results apply only to the samples tested. Qualifiers:

в Analyte detected in the associated Method Blank

Value above quantitation range Е

н Holding times for preparation or analysis exceeded

Analyzed by another laboratory L

ND Not Detected at the Reporting Limit

s Spike Recovery outside accepted recovery limits

. Matrix Effect Х

John M. Jacolos Reviewed by:

John Jacobs, Project Manager

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ

0 Outside the Range of Dilutions

U Analysis reported under the reporting limit

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

402 Bide					I	Reported: 9/21/2018 Report ID: S1809066001	
For	t Collins, CO 80525					rk Order: S1809066	
					Collec	tion Date: 9/5/2018 3:00	:00 PM
Project:	B7218-0001				Date	Received: 9/6/2018 10:2	9:00 AM
Lab ID:	S1809066-003					Sampler: AM	
Client Sampl	<b>e ID:</b> L-2 19'					Matrix: Water COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parame	ters						
Nitrogen, Nitrat	e (As N)	65.9	0.05		mg/L	09/07/2018 1024 AB	EPA 300.0
Nitrogen, Nitrite	e (As N)	ND	0.05		mg/L	09/06/2018 1404 AB	EPA 300.0
Nitrogen, Total	Kjeldahl (TKN)	1	1		mg/L	09/13/2018 0900 AMB	EPA 351.2
Anions					-		
Chloride		224	1		mg/L	09/07/2018 1024 AB	EPA 300.0
					-		
Total Metals							

These results	apply	only	to the	samples	tested.
		-		-	

Analyte detected in the associated Method Blank Qualifiers: В

- Е Value above quantitation range н
- Holding times for preparation or analysis exceeded L
- Analyzed by another laboratory ND Not Detected at the Reporting Limit
- s
- Spike Recovery outside accepted recovery limits
- Х . Matrix Effect

Jacola John . Reviewed by:

John Jacobs, Project Manager

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

Page 3 of 6

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: W	/enck Associates				Date R	eported: 9/21/2018	
	025 Automation Way Idg E				R	eport ID: S18090660	01
F	ort Collins, CO 80525				Wor	k Order: S1809066	
					Collecti	on Date: 9/5/2018 3:0	00:00 PM
Project:	B7218-0001				Date R	eceived: 9/6/2018 10	:29:00 AM
Lab ID:	S1809066-004				ę	Sampler: AM	
Client Sam	ple ID: L-2 25'					Matrix: Water	
						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Paran	neters						
Nitrogen, Niti	rate (As N)	70.6	0.05		mg/L	09/07/2018 1037 AB	EPA 300.0
Nitrogen, Niti	rite (As N)	ND	0.05		mg/L	09/06/2018 1416 AB	EPA 300.0
Nitrogen, Tot	al Kjeldahl (TKN)	ND	1		mg/L	09/13/2018 0901 AME	B EPA 351.2
Anions							
Chloride		187	1		mg/L	09/07/2018 1037 AB	EPA 300.0
Total Metals							
Phosphorus		1.3	0.1		mg/L	09/18/2018 1942 DG	EPA 200.7

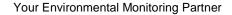
These results	appl	y only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

### Analyte detected in the associated Method Blank В

- Е Value above quantitation range
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- Х . Matrix Effect

Jacolo toten. Reviewed by:

- **RL Reporting Limit** С
  - Calculated Value Analyzed at IML Gillette laboratory
  - G J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit



1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: We	enck Associates				Date F	Reported: 9/2	21/2018	
	25 Automation Way dg E				F	Report ID: S1	809066001	
Fo	rt Collins, CO 80525				Wor	rk Order: S1	809066	
					Collect	ion Date: 9/	5/2018 3:00:0	00 PM
Project:	B7218-0001				Date F	Received: 9/6	6/2018 10:29	:00 AM
Lab ID:	S1809066-005					Sampler: AN	Л	
Client Samp	ole ID: L-3 30'					Matrix: W	ater	
						COC: W	EB	
Analyses		Result	RL	Qual	Units	Date Ana	lyzed/Init	Method
General Parame	eters							
Nitrogen, Nitra	ate (As N)	54.7	0.05		mg/L	09/07/2018	1049 AB	EPA 300.0
Nitrogen, Nitrit	te (As N)	ND	0.05		mg/L	09/06/2018	1429 AB	EPA 300.0
Nitrogen, Tota	l Kjeldahl (TKN)	7	1		mg/L	09/13/2018	0901 AMB	EPA 351.2
Anions								
Chloride		321	1		mg/L	09/07/2018	1049 AB	EPA 300.0
Total Metals								
Phosphorus		2.3	0.1		mg/L	09/18/2018	1944 DG	EPA 200.7

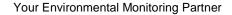
These results	apply	only	to the	samples	tested.
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# Qualifiers: B Analyte detected in the associated Method Blank

- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- L Analyzed by another laboratory
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits
- X Matrix Effect

Jacolo toten. Reviewed by:

- RL Reporting Limit C Calculated
  - C Calculated Value G Analyzed at IML Gillette laboratory
  - G Analyzed at IML Gillette laboratoryJ Analyte detected below quantitation limits
  - M Value exceeds Monthly Ave or MCL or is less than LCL
  - O Outside the Range of Dilutions
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1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

4(	/enck Associates 025 Automation Way Idg E					Reported: 9/21/2018 Report ID: S1809066	
F	ort Collins, CO 80525				Wo	rk Order: S1809066	i
					Collect	ion Date: 9/5/2018 3	3:00:00 PM
Project:	B7218-0001				Date I	Received: 9/6/2018 1	0:29:00 AM
Lab ID:	S1809066-006					Sampler: AM	
Client Sam	ple ID: L-3 35'					Matrix: Water	
						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Ir	nit Method
General Paran	neters						
Nitrogen, Nitr	rate (As N)	55.9	0.05		mg/L	09/07/2018 1102 AE	B EPA 300.0
Nitrogen, Nitr	rite (As N)	ND	0.05		mg/L	09/06/2018 1441 AE	B EPA 300.0
Nitrogen, Tot	al Kjeldahl (TKN)	ND	1		mg/L	09/13/2018 0901 AM	/IB EPA 351.2
Anions							
Chloride		211	1		mg/L	09/07/2018 1102 AE	B EPA 300.0
Total Metals							
Phosphorus		1.3	0.1		mg/L	09/18/2018 1947 D0	G EPA 200.7

These results	apply	only to the samples tested.
Qualifiers:	В	Analyte detected in the associated

Analyte detected in the associated Method Blank В

- Е Value above quantitation range н
- Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L ND Not Detected at the Reporting Limit
- s
- Spike Recovery outside accepted recovery limits
- Х . Matrix Effect

Jacolo toten. Reviewed by:

- **RL Reporting Limit** С Calculated Value
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

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Inter-Mountain Labs, Inc.

ADDITIONAL REMARKS	ADDITION				MATION ·) ·) Client	-ab x	ANCE onitorir /A, NP it #	COMPLIANCE INFORMATION       pliance Monitoring ?     Y /       ram (SDWA, NPDES,)     Y       ID / Permit #     Y       inated?     Y /       ple Disposal:     Lab       X     Client	COMPLIANCE INF Compliance Monitoring ? Program (SDWA, NPDE PWSID / Permit # Chlorinated? Sample Disposal: Lab	IND TIMES e und ng Days f <mark>orking Days</mark> rges will be applied	TURN AROUND TIMES         Check desired service         Image: Standard turnaround         Image: RUSH - 5 Working Days         Image: Urgent Surcharges will be applied	CODES VT SD SD FT	MATRIX C Water Soil Solid Filter Other	SHIPPING INFO UPS FedEx USPS Hand Carried Other	
														103	
9.4.8 10:29		P	Boo	L	the	has		8 17:30	81/20/60	n Marsh	Adas	Tett	Ulan .	, c	-
DATE	đ	Received By (Signature/Printed)	Signatu	ed By (S	Receiv	No. 1	m	TIME	DATE	(pe	Relinquished By (Signature/Printed)	Relingu		LAB COMMENTS	
(4) Total Metals			+	+	+	-	_								14 14
(3) Phosphorus				-	-	-	-	$\top$							
(2) TKN				-	-		-								; =
(1) Nitrate, nitrite, chloride						-	-	T							10
in the following order:				-	-	-	-								9
prioritize parameters				+		-									0
all parameters, please				-	-		-								7
insufficient to measure		×	×	×	×	×	-	_	WT		L-3 35'	<	4	900	6
If sample volume is		×	×	×	×	××			WT		L-3 30'			85	G
		×	×	×	×	××		-	WT		L-2 25'	>		400	4
about parameters		×	×	×	×	x x		_	WT		L-2 19'			2003	ω
quote for more details		×	×	×	×	××			WT		L-1 12'	-	-	82	2
Please see attached		×	x	×	x x	×			WT		L-1 5'	15:00	9/5/18	7-99060818	-
		Total	Chlor	Phos	Total	Nitrat	1	# of Containers	Matrix	PLE	SAMPLE IDENTIFICATION	TIME	DATE TI SAMPLED	LAB ID (Lab Use Only)	ITEM
REMARKS		Metal							Quote #	der#	Purchase Order #		ldg. E	4025 Automation Way, Bldg. E Fort Collins CO 80525	4025 Fort
		s						9	691-325	(O) 970-223-4705; (C) 970-691-3259	Phone (O) 970-2			Invoice Address	Invoic
		PARAMETERS	TAN		ANALTSES	- 1					< Stac		ldg. E	4025 Automation Way, Bldg.	4025
970-223-4705			/		A	A	3	Q			B7218-0001			Albany County Report Address	Alba
Telephone #		city)	uthentio	on of Au	Sampler (Signature/Attestation of Authenticity)	nature//	ler (Sig	Samp			ication			Name	Client Name
#WEB				fraud	trued as	be cons	eted.	resentat	nust be of any misrep	All shaded fields must be completed. This is a legal document; any misrepresentation may be construed as fraud		VY and Gil	Sheridan, WY and Gillette, WY	INTER-MOUNTAIN LABS	INTE
Page of			RD	RECORD		STODY		VOF	CHAIN OF CU		ו Labs	ountair	Inter-Mountain Labs	Z I	1
															)



					Model 2241-2;	
ÍMI-					27130475	.69
TER-MOUNTAIN LABS	o 1111 11	D			21100410	
	Condition Upon	Receipt (Att	ach to COC)			
Sample Receipt		2010	(m			
1 Number of ice chests/packa	iges received:	ROI?	Yes	No		
2 Temperature of cooler/samp Temps Observed (°C):		lease write on bac				
Temps Corrected (°C):	2					
Acceptable is : 0.1° to 10°C for E						
following collection. Indicate ROI	(Received on Ice) for iced sample	es received on the	same day as samp	led, in addi	tion to temperatu	re at receipt.
Client contact f	for temperatures outside	method criteri	a must be doc	umented	below.	
3 Emission rate of samples for	or radiochemical analyses <	: 0.5mR/hr?	Yes	No	N/A	
4 COC Number (If applicable)	: WB				<u> </u>	
5 Do the number of bottles ag	ree with the COC?		Yes	No	N/A	
6 Were the samples received	intact? (no broken bottles, leak	rs, etc.)	Yes	No	N/A	
Were the sample custody s	eals intact?		Yes	No	N/A	A 4
3 Is the COC properly comple			Yes	No	- NO Sa	
ample Verification, Labeling			$\sim$	20	or time	oncoc
Were all requested analyse			Yes	No		
2 Did the bottle labels corresp		tion?	Yes	No		
3 Samples collected in metho	d-prescribed containers?		Yes	No		
4 Sample Preservation:					DIT	and an
	I pH (if added in lab):	Preservativ			Date/Time A	Aaaea:
Total Metals	Total Metals					
Diss Metals	Diss Metals	Filtered and pr	eserved in metals		Filtered and pre	eserved in metals
Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>				
Cyanide	Cyanide	NaOH				
Sulfide	Sulfide	ZnAcet				
Phenol	Phenol	H <sub>2</sub> SO <sub>4</sub>				
SDWA Rads	SDWA Rads	HNO3				
Preserved samples for Rad	I analysis accompanied by	Field Blank?	Yes	No	-	
5 VOA vials have <6mm head	dspace?		Yes	No	N/A	
6 Were all analyses within ho		ceipt?	Yes	No	~	
7 Specially requested detection	on limits (RLs) assigned?		Yes	No	N/A	
8 Have rush or project due da		cepted?	Yes	No	N/A	
9 Do samples require subcor			Yes	No		2017
If "Yes", which type of subc		General	Customer-S		Ce	rtified
Sample Receipt, Verification, L	ogin, Labeling & Distributio	on completed b	y (initials):	KB	-<18 00	1066
		and the local		Set ID.	500	i v ur ur
Discrepancy Documentation					alward	
Any items listed above with	a response ot "No" or do					
Person Contacted:		ivieth	od of Contact:			
Initiated By:	Date/Time:			_Email:		

Problem:

Resolution:

ol. ISSUE!



1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 12/19/2018

CLIENT:	Wenck Associates	CASE NARRATIVE
Project: Lab Order:	B7218-0001 S1812063	Report ID: S1812063001

Samples L-1 12' and L-3 30' were received on December 5, 2018.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition 40 CFR Parts 136 and 141 40 CFR Part 50, Appendices B, J, L, and O Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012 ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by:

acolos

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: We	nck Associates				Date	Reported: 12/19/2018	
402 Bldg	5 Automation Way g E				I	Report ID: S181206300	)1
Fort	t Collins, CO 80525				Wo	rk Order: S1812063	
					Collec	tion Date: 12/4/2018 4	40:00 PM
Project:	B7218-0001				Date	Received: 12/5/2018 12	2:30:00 PM
Lab ID:	S1812063-001					Sampler: AM	
Client Sampl	<b>e ID:</b> L-1 12'					Matrix: Water	
-						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parame	ters						
General Parame		69.7	0.05		mg/L	12/06/2018 0936 AB	EPA 300.0
	e (As N)	69.7 0.06	0.05 0.05		mg/L mg/L	12/06/2018 0936 AB 12/06/2018 0100 AB	EPA 300.0 EPA 300.0
Nitrogen, Nitrate	e (As N) e (As N)				0		EPA 300.0
Nitrogen, Nitrate Nitrogen, Nitrite	e (As N) e (As N)	0.06	0.05		mg/L	12/06/2018 0100 AB	EPA 300.0

These results apply only to the samples tested. Qualifiers:

в Analyte detected in the associated Method Blank

Value above quantitation range Е

н Holding times for preparation or analysis exceeded

Analyzed by another laboratory L

ND Not Detected at the Reporting Limit

s Spike Recovery outside accepted recovery limits

. Matrix Effect Х

John M. Jacolos Reviewed by:

John Jacobs, Project Manager

**RL - Reporting Limit** С

- Calculated Value Analyzed at IML Gillette laboratory
- G J Analyte detected below quantitation limits
- Value exceeds Monthly Ave or MCL or is less than LCL Μ
- 0 Outside the Range of Dilutions

U Analysis reported under the reporting limit

Page 1 of 2

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

CLIENT: We	nck Associates				Date	Reported: 12/19/201	18
402 Bld	25 Automation Way g E				I	Report ID: S1812063	3001
For	t Collins, CO 80525				Wo	rk Order: S1812063	3
					Collec	tion Date: 12/4/2018	3 4:40:00 PM
Project:	B7218-0001				Date	Received: 12/5/2018	3 12:30:00 PM
Lab ID:	S1812063-002					Sampler: AM	
Client Sampl	<b>e ID:</b> L-3 30'					Matrix: Water	
						COC: WEB	
Analyses		Result	RL	Qual	Units	Date Analyzed/I	nit Method
Analyses General Parame	ters	Result	RL	Qual	Units	Date Analyzed/I	nit Method
		Result	<b>RL</b> 0.05	Qual	Units mg/L	Date Analyzed/I	
General Parame	e (As N)			Qual			B EPA 300.0
General Parame Nitrogen, Nitrat Nitrogen, Nitrite	e (As N)	55.4	0.05	Qual	mg/L	12/06/2018 0949 A	B EPA 300.0 B EPA 300.0
General Parame Nitrogen, Nitrat Nitrogen, Nitrite	e (As N) e (As N)	55.4 0.16	0.05 0.05	Qual	mg/L mg/L	12/06/2018 0949 A 12/06/2018 0113 A	B EPA 300.0 B EPA 300.0

These results apply only to the samples tested. в Analyte detected in the associated Method Blank

## Qualifiers:

Reviewed by:

- Value above quantitation range Е
- н Holding times for preparation or analysis exceeded
- Analyzed by another laboratory L
- ND Not Detected at the Reporting Limit
- s Spike Recovery outside accepted recovery limits
- . Matrix Effect Х

John M. Jacolos

John Jacobs, Project Manager

# **RL - Reporting Limit**

- Calculated Value С
  - Analyzed at IML Gillette laboratory G
  - J Analyte detected below quantitation limits
  - Value exceeds Monthly Ave or MCL or is less than LCL Μ
  - 0 Outside the Range of Dilutions
  - U Analysis reported under the reporting limit

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INTER-MOUNTAIN LABS	Sheridan, WY and Gillette, WY	illette, WY	All shaded fields must be completed. This is a legal document: any misrepresentation matrix	nust be comp any misrepreser	oleted. Itation may	be constru	ed as fra	ud			#WEB	
Client Name		Project Identification	1 Sampler (Signature/Attestation of Authenticity)	Sa	mpler (Sigi	nature/Att	estation	of Authe	nticity)		Telephone #	
Albany County		B7218-0001			Den	2	E of	Y			970-223-4705	
Report Address		Contact Name				AN	ANALYSES	$\sim$	ARAM	PARAMETERS	0.0 mm	
-	Bldg. E	Mark Stacy			Т	-		11				
Fort Collins CO 80525		Email msta	mstacy@wenck.com				N					
Invoice Address		Phone (O) 9	(O) 970-223-4705; (C) 970-691-3259	591-3259			ahl	s	s			
4025 Automation Way, I	Bldg. E	Purcha	Purchase Order #	Quote #			lda	-				
Fort Collins CO 80525				1800			Kje		-		REMARKS	ARKS
	DATE   TIME		SAMPLE		-	litrat	otal	hos	hlor			
				IVIGUIX CO	Containers	╉	Т	╀				
-	42/03/18	L-1 5		TW	-	×	×	×	×	1	Please see attached	tached
2 518 12063	12/03/18 16:40	L-1 12'		WT	-	x x	×	×	× ×		quote for more details	re details
G	42/03/18	L-2 19'		TW	-	*	×	×	XX	(	about parameters	eters
4	12/03/18	L-2.25		TW	-	X X	*			1		
5	12/03/18 16; 40	L-3 30'		WT		x x	×	×	x x		If sample volume is	ume is
6	12/03/18	L-3 35'		TW		×	*	*	×	1)	insufficient to measure	o measure
7											all parameters, please	s, please
0	L-1 5 L-	2 19 1-2	251, 1-3 30	بالمن الم	5	1000	500	and	war		prioritize parameters	ameters
G	No samples	s collected	From these	wells				-(			in the following order:	ng order:
10									_		(1) Nitrate, nitrite, chloride	trite, chloi
11											(2) TKN	
12											(3) Phosphorus	sn
13											(4) Total Metals	SIE
14		1		$\vdash$					_			
LAB COMMENTS	Kelin	Relinquished By (Signature/Printed)	a/Printed)	DATE	TIME		eceived	By (Sigr	Received By (Signature/Printed)	nted)	DATE	TIME
2.21	Oan M	H	Adam Marsh	12/4/18 1	17:00		South	4-	april		12.5.10	12:3/
Ro/												
SHIPPING INFO	MATRIX CODES	TURN A	TURN AROUND TIMES	COMP		INFORMATION	ATION		1.1.1	ADDITIO		
	Water WT	ck de	ervice	Compliance Monitoring ?	Monitorir	2 Bi	1 4	2				
			RUSH - 5 Working Days	PWSID / Permit #	rmit #	TUE0,)						
	Other OT	Rush & Urgent S	Rush & Urgent Surcharges will be applied	Sample Disposal:	-	ab x	Client					



Survey Meter # 2241-2 pH strip lot # 40739245 Thermometer SN# <u>S/N</u> 27130475 **to COC** 

	Condition Open	Receipt (Atta		1	
mple Receipt	1		T		
Number of ice chests/p Note as "OTC	c " if samples are received over the con	ROI? unter, unpackaged	Ves	No	
	samples. (If more than 8 coolers,	please write on back)			
Temps Observed (°C):					
Temps Corrected (°C): Acceptable is: 0.1° to 10°	C for Bacteria; and 0.1° to 6°C for mos	st other water parame	ters. Samples m	ay not have	had adequate time to cool
	e ROI (Received on Ice) for iced samp				
Client con	tact for temperatures outside	e method criteria	must be do	cumented	below.
	les for radiochemical analyses		Yes	No	NA
COC Number (If applic	LUAD	0.0111.0111.			
			Yes	No	N/A
5 Do the number of bottles agree with the COC? 6 Were the samples received intact? ( <i>no broken bottles, leaks, etc.</i> )			Yes	No	N/A
Were the sample custody seals intact?				No	(N/A
Is the COC properly completed, legible, and signed?				No	
mple Verification, Lab	전화 가슴이 아니어져 다른 것 같은 것이 없는 것이다.		Yes		
Were all requested analyses understood and appropriate? Yes No					
Did the bottle labels correspond with the COC information?					
Samples collected in method-prescribed containers? Yes No					
Sample Preservation:	lotitod procention containere.				
pH at Receipt: Final pH (if added in lab): Preservative/Lot#					Date/Time Added:
Total Metals	Total Metals	HNO3			
Diss Metals	Diss Metals	Filtered and pres			Filtered and preserved in metals
Nutrient	Nutrient	H <sub>2</sub> SO <sub>4</sub>			
Cyanide	Cyanide	NaOH			
Sulfide	Sulfide	ZnAcet			
	Phenol	H <sub>2</sub> SO <sub>4</sub>			
Phenol					
SDWA Rads	SDWA Rads	HNO3		No	
Preserved samples for Rad analysis accompanied by Field Blank?			Yes	No	(N/A)
5 VOA vials have <6mm headspace?			Yes	No	(N/A)
6 Were all analyses within holding time at the time of receipt? 7 Specially requested detection limits (RLs) assigned?			Yes	No	N/A
B Have rush or project due dates been checked and accepted?			Yes	No	NTA
9 Do samples require subcontracted analyses?			Yes	No	
	subcontracting is required?	General	Customer-	$\sim$	Certified
	on, Login, Labeling & Distributi			100	
ample Receipt, vernicati	on, cogin, cabeling & Distributi	ion completed by	(IIIIIIIII) .	Set ID	51812063
scropancy Documents	ation (use back of sheet for n	notes on discren	ancies)	00110.	<u> </u>
	with a response of "No" or de			st be res	olved.
Person Contacted:					·····
	Date/Time:				
Problem:	Daterrinte				
i iobioiti.					