

TIMBER CREEK OPERATING, LLC

# 2020 COLORADO RULE 608 COMPLIANCE REPORT RATON BASIN, COLORADO

FEBRUARY 2021





# 2020 COLORADO RULE 608 COMPLIANCE REPORT

RATON BASIN,  
COLORADO

TIMBER CREEK OPERATING, LLC

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# EXECUTIVE SUMMARY

WSP USA Inc. (WSP), formerly LT Environmental, Inc., completed the tasks for the 2020 Colorado Rule 608 Compliance Program on behalf of Timber Creek Operating, LLC. (TCO) with respect to TCO natural gas production operations in Las Animas County, Colorado (Project Area). In October 2017, TCO purchased the XTO Energy, Inc. (XTO) assets in the Project Area. WSP completed the tasks in accordance with the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan. Colorado Rule 608 Compliance, Raton Basin, Colorado* (the May 2010 Work Plan), submitted by XTO on May 5, 2010, per the following subsections of the COGCC Rule 608:

- 608(a) – Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter mile of proposed coalbed methane (CBM) wells
- 608(b) – Water well sampling
- 608(c) – Coal outcrop and coal mine monitoring

The 2020 Colorado Rule 608 Compliance Program meets the requirements of subsections a, b, and c of the COGCC Rule 608. The scope of work for the Colorado Rule 608 Compliance Program outlined in the May 2010 Work Plan includes four field tasks and a fifth subsequent report writing task.

The 2020 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and the CBM production wells XTO drilled in 2010 and 2011. Neither XTO nor TCO have drilled any new CBM wells in the Raton Basin since 2011 and, as a result, the 2020 Project Area is identical to the 2011 Project Area. Due to the absence of any proposed 2020 CBM wells, some field tasks of the May 2010 Work Plan related to new wells were omitted from the 2020 Rule 608 Compliance Program. Field tasks completed included pedestrian mapping of active seep areas within the 2020 Project Area and natural spring sampling.

Three mapping areas were identified for surveying in 2020, based on previous investigations. Based on the findings from 2019 and a review of historical flux surveys at these three mapping areas, areas L-1021, 32 & L-1049, and L-1030 appear to be active seep areas.

Two natural springs were sampled for water quality analysis (Chavez01 and Chavez02). The water types appear to be predominately calcium in cationic composition and bicarbonate in anionic composition.

- WSP recommends continued compliance with Rule 608 in Las Animas County in accordance with the COGCC-approved May 2010 Work Plan as TCO development or production activities continue.
- Based on the findings from 2020, and a review of historical flux surveys, WSP recommends active seep areas L-1021, 32 & L-1049, and L-1030 be surveyed in 2021.
- WSP recommends spring sampling to be included in the 2021 survey.

# 1 INTRODUCTION

WSP USA Inc. (WSP), formerly LT Environmental, Inc. (LTE), has prepared this 2020 Colorado Rule 608 Compliance Report for Timber Creek Operating LLC (TCO) to summarize the tasks completed with respect to TCO operations in Las Animas County, Colorado (Project Area, Figure 1). In October 2017, TCO purchased the XTO Energy, Inc. (XTO) assets in the Project Area. Compliance activities were conducted in accordance with the Colorado Oil and Gas Conservation Commission (COGCC)-approved *Work Plan. Colorado Rule 608 Compliance, Raton Basin, Colorado* (the May 2010 Work Plan) previously submitted by XTO on May 5, 2010. This is the tenth annual event conducted in accordance with the Colorado Rule 608 Compliance Program.

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## 1.1 PROJECT HISTORY

The objective of the Colorado Rule 608 Compliance Program is to meet compliance requirements, as discussed in the May 2010 Work Plan, associated with the drilling and installation of coalbed methane (CBM) production wells, specifically in Las Animas County, Colorado, which applies to the following subsections of Rule 608 of the COGCC 600 Series Safety Regulations:

- 608(a): Assessment and monitoring of plugged and abandoned (P&A) production wells within one-quarter mile of proposed CBM wells
- 608(b): Water well sampling
- 608(c): Coal outcrop and coal mine monitoring.

In 2010, ground surveys along the Raton Formation were conducted to meet the requirements of Rule 608(c). The survey was completed in a manner similar to an initial baseline ground survey of methane seeps completed by Apogee Scientific, Inc. (Apogee) for the COGCC in 2000 and a more detailed survey conducted by LTE and Apogee for the COGCC in 2007. The 2010 surveys were conducted using a 4-wheel drive vehicle equipped with an infrared-based gas detector developed by Apogee. This gas detector was designed to detect leaks in natural gas pipelines and is referred to as the Leak Detection System (LDS). A total of three suspect seep areas were identified and field-verified along 106 miles of roadway. Additionally, pedestrian mapping of six seep areas previously identified during the 2010 ground survey was conducted. Detailed mapping to field-verify the nine suspect seep areas was conducted and confirmed the presence of methane gas near all nine areas. Color infrared imagery was collected along the Vermejo Formation within the Project Area, and field verification of suspect areas identified on the imagery occurred but was limited to those areas where access was granted. No methane was detected in any of the subsurface points within the suspect areas identified by infrared mapping.

In 2011, the survey area was expanded, and ground surveys were again conducted by Apogee and field-verified by LTE. Apogee's ground survey took over two days and identified suspect seep areas over approximately 240 miles of roadway. Through the previous 2007 and 2010 investigation and the 2011 ground survey, 39 suspect seep areas within the Project Area were identified. Of the 39 suspect seep areas, nine areas (L-1021, L-1030, 32 & L-1049, L-1050, 5, 14, L-1033, 13 & L-1026, and 19) were identified as active methane seeps during the investigation and 30 suspect seep areas did not record methane or methane was reported due to other potential sources such as fugitive gases from oil and gas equipment/production.

Based on the findings in 2011, the nine seep areas (L-1021, L-1030, 32 & L-1049, L-1050, 5, 14, L-1033, 13 & L-1026, and 19) were monitored annually from 2011 to 2014. In 2014, areas L-1033, 13 & L-1026, and 19 appeared to be diminished. As a result, these seep areas were omitted from future monitoring activities. The remaining six seep areas were monitored in 2015. Findings from the 2015 monitoring event identified areas L-1021, 32 & L-1049, and L-1030 to be active methane seep areas. However, areas L-1050, 5, and 14 no longer had reportable methane flux detections and had limited methane detections in previous years. These three mapping areas were characterized as diminishing methane seeps and, supported by the absence of reportable methane flux in 2015, were omitted from future monitoring activities. From 2016 through 2020, LTE surveyed areas L-1021, 32 & L-1049, and L-1030,

which appear to be continually active seep areas. Summaries of the mapping areas from 2010 to present are included in Table 1.

Natural spring monitoring initially took place at Spring01 in 2010. When sampled, the water appeared to be predominately calcium and sodium + potassium in cationic composition and carbonate + bicarbonate in anionic composition. Dissolved methane was detected in the sample at a concentration of 0.109 milligrams per liter (mg/L), which is below the 2 mg/L threshold to analyze the gas composition and carbon and hydrogen isotopes of methane. Spring01 was dry in 2012 and 2013 and stagnant from 2016 to present; therefore, no samples were collected. Spring samples Chavez01, Chavez02, and Chavez03 were added to the program and collected in 2012. All Chavez samples appear to be calcium in cationic composition and bicarbonate in anionic composition. In 2012, dissolved methane for all three spring samples were below the 2 mg/L threshold applied by the COGCC to require analysis for gas composition and for carbon and hydrogen isotopes of methane. Chavez03 has not been sampled since 2015 due to the presence of stagnant water. Spring03 (Quiet Spring) was discovered in 2014; however, water in the spring has never been sampled due to lack of access or lack of water.

Assessment and monitoring of P&A production wells and water well sampling activities (Rules 608(a) and 608(b)) are described in further detail in the subsequent Section 1.4, Deviations.

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## 1.2 PROJECT AREA

The Project Area is located in the Raton Basin in southern Colorado. The Raton Basin is a geologic structural basin in southern Colorado and northern New Mexico. The basin is situated in Huerfano and Las Animas counties, Colorado, and Colfax County, New Mexico. The basin has long been a source of coal production and more recently a source of CBM. Much of the regional geology presented herein was derived from the report, A Geologic Assessment of Natural Gas from Coal Seams in the Raton and Vermejo Formations, Raton Basin (Stevens, et.al. 1992).

The Raton Basin is an asymmetric synclinal basin with the axis of the La Veta syncline oriented roughly north-south and passing through Weston, Colorado, which is immediately east of the area formerly defined by XTO for development of CBM. The Raton Formation outcrop is exposed over approximately 50 percent of the Project Area. The discontinuous nature of the coal beds both in the subsurface and on the surface make it difficult to identify and/or correlate individual continuous coal beds from the subsurface producing zone to the surface coal outcrop. The area originally proposed for drilling by XTO is located on the western side of the La Veta syncline, suggesting that the formations encountered within the Project Area are dipping to the east.

The Vermejo Formation consists of sandstone, interbedded siltstone, shale, carbonaceous shale, and coal accumulated above the fluvial-deltaic sequences of the Trinidad Sandstone (Stevens, et al. 1992). The Vermejo Formation outcrops along the western edge of the Raton Basin syncline basin, which is on the west side of the Project Area. Of the more than 90,000-acre Project Area, the Vermejo Formation outcrop covers approximately two percent of the overall Project Area. The Raton and Vermejo formation outcrops are depicted on Figure 1.

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## 1.3 SCOPE OF WORK

XTO originally proposed to drill CBM production wells in the Project Area of the Raton Basin over several years starting in 2010 (red outline on Figure 2). Drilling began in 2010. However, XTO did not install any CBM production wells in the Project Area in 2012, 2013, 2014, 2015, 2016, or 2017 and sold their assets in the Project Area to TCO in late 2017. As a result, the 2018, 2019, and 2020 Project Areas were determined by a 2-mile buffer around the 2010 and 2011 proposed CBM production wells and CBM production wells XTO installed in 2010 and 2011. The 2020 Project Area (green outline on Figure 2), proposed 2010 and 2011 CBM production well locations, recorded P&A production well locations, groundwater well locations, topography, and mine features are illustrated on Figure 2. The scope of work for the Colorado Rule 608 Compliance Program outlined in the May 2010 Work Plan includes the following tasks:

- Task 1: Assessment of applicable P&A production wells

- Task 2: Assessment of applicable water wells
- Task 3: Detailed mapping of known and diminishing methane seep areas
- Task 4: Assessment of applicable natural springs
- Task 5: Preparation of this report.

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## 1.4 DEVIATIONS

TCO did not propose or install any new CBM production wells in 2017 to present. As a result, some tasks and subtasks were omitted from the 2020 Colorado Rule 608 Compliance Program as described below. Historical procedures and findings for these tasks are described in previous annual reports.

- There were no new P&A production wells within the Project Area to assess in 2020, and as a result, Task 1 was not conducted for the 2020 Colorado Rule 608 Compliance Program.
- A review of groundwater wells within the 2020 Project Area meeting the requirements set forth in Rule 608(b) identified 11 groundwater wells. However, no new TCO CBM production wells were installed from 2017 to present. As a result, Task 2 was not conducted during the 2020 Colorado Rule 608 Compliance Program. Groundwater wells will be sampled prior to drilling of any new production wells in the Project Area.
- Ground surveys to locate suspect methane seeps on the Raton Formation outcrop and color infrared (CIR) aerial imagery with field verification of suspect areas along the Vermejo Formation and at the Quinto, Tercio, and Vega mines were not conducted as part of Task 3 since no new CBM production wells were proposed for 2020.
- While conducting detailed mapping of methane seeps areas during 2010, 2011, 2012, and 2013, (Task 3), gas samples were collected for isotopic analysis from those areas with reportable methane flux and where existing isotopic information from the 2007 COGCC Phase II seep investigation did not exist. During the 2007 Phase II seep investigation conducted for the COGCC, gas samples were collected from many of the known and suspect seep areas in the Raton Basin. Each methane seep area currently has an associated isotopic analysis. As a result, re-sampling for isotopic analysis of these seep areas was not necessary in 2020.
- In 2011, the COGCC informed XTO and LTE that those natural springs that overlap with other oil and gas companies conducting similar activities to comply with Rule 608 did not need to be sampled. As a result, Task 4 was reduced from the original May 2010 Work Plan by not sampling Spring05 (Vega Canyon), Spring07 (Spring Canyon), or Spring08 (Middle Lorencito). WSP was not granted property access for Spring02, Spring03 (Quiet Spring), Spring04, Spring06, Spring09, or Spring10. As a result, natural spring water samples from these six springs were not collected in 2020.



## 2 FIELD METHODS

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### 2.1 2020 PROJECT AREA

The 2020 Project Area was determined by a 2-mile buffer around the 2010 and 2011 proposed XTO CBM production wells and the CBM production wells that XTO installed in 2010 and 2011. The 2020 Project Area is outlined in green on Figure 2. The overall Project Area is outlined in red on Figure 2.

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### 2.2 PROPERTY ACCESS

Prior to conducting 2020 field activities, WSP acquired landowner information from the Las Animas County Assessor's office. WSP cross-referenced parcel data to identify owners of parcels located in the 2020 Project Area. WSP requested access to all properties where field work was proposed. The 2020 property owner and access information is presented in Table 2.

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### 2.3 FLUX SURVEY

Flux surveys consist of using a West Systems® portable gas flux meter (flux meter) to measure the magnitude and extent of methane seepage, if detected, within the survey area. Measurements are typically collected using a sampling grid approach.

Grids for detailed mapping areas consisted of varying numbers of squares, with grid nodes spaced 50 feet to 100 feet apart, depending on historical data for previously-identified methane seep areas. The smaller grid spacing is typically used to map methane seep areas of relatively small extent. A flux measurement is collected at the corner of each grid square. When methane is detected along the outer edges of the mapping area, additional grid points are developed and measured to determine the extent of methane seepage. Additional measurements are collected between grid nodes if methane seepage is observed. Where appropriate, photographs of vegetative conditions, visible seeps, and sensitive receptors are collected.

The flux meter measures the flux of methane, hydrogen sulfide, and carbon dioxide by employing individual gas-specific sensors that record the increases, if any, of gas concentrations over time for a given surface area. These increases in concentration over time are proportional to the flux of each gas. For this flux survey, only methane flux rates are reported.

The flux meter components include an accumulation chamber connected by circulation tubes to the gas detector unit. At each sampling point, the accumulation chamber is placed on the ground surface to capture gas seeping from the ground. A fan in the chamber continuously mixes the gases in the chamber during the measurement process. A pump moves gases in the accumulation chamber to the detector unit. After passing through the detector unit, gases are returned to the chamber. This closed-loop process allows soil gases discharging to the chamber to increase in concentration over time. Increases in concentrations are measured and recorded automatically. No gas is allowed to escape the system, nor is a vacuum created during the process. This enables measurement of natural gas seep conditions, if present. The result for each gas is reported as a mass flux in units of moles per square meter per day ( $\text{mol/m}^2\text{-day}$ ).

Flux measurement accuracy can be limited by surface conditions. One of the most important factors is the quality of the seal between the accumulation chamber base and the ground surface. To ensure a proper seal between the ground surface and the chamber, field personnel choose relatively flat surfaces where possible and place loose soil surrounding the base of the chamber to reduce the potential for gas loss at the base of the chamber. In addition, ground disturbance is minimized during the measurement process in order to maintain the natural seep conditions. In areas with heterogeneous surfaces, the seal is sometimes difficult to achieve. This scenario is evident at locations with poorly-developed soil or where the soil surface is obscured by decayed organic matter on the forest floor.

The accuracy of the total flux estimation within the Project Area is influenced by the ability of the grid spacing system to represent the actual flux on a detailed level relative to the subsurface fracture system, coal quality, and stratigraphy within the Raton Formation. The methane sensor within the flux meter unit has a range of 60 parts per million (ppm) to 50,000 ppm. The flux meter methane measurement range is 0.0 mol/m<sup>2</sup>-day to 300 mol/m<sup>2</sup>-day. Methane fluxes below 0.2 mol/m<sup>2</sup>-day are detectable with decreased accuracy. As a result, reporting of methane fluxes will not include values less than 0.2 mol/m<sup>2</sup>-day. Information on the flux meter is provided in Appendix A.

During the measurement process, gas concentrations are recorded at 1-second intervals and directly downloaded via Bluetooth® connection to a portable digital assistant (PDA) integrated with the Global Positioning System (GPS) unit. Other measurements recorded include barometric pressure, temperature, date, and time.

Integrated West Systems Flux Manager® software on the GPS unit recorded the gas measurement data. The software plots the curve of gas concentration versus time for each measurement collected. The best-fit line for the curve generated is selected. The slope of the best-fit line is proportional to the flux at the measurement point.

Full color spectrum aerial photographs were used as base maps for field use and figures for reporting. The geologic contacts depicted on the aerial photographic maps were derived from geologic maps prepared by the Colorado Geological Survey (CGS) and digitized. Accuracy of the formation contact is reduced when aerial photographs are viewed at a smaller scale.

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### 2.3.1 GLOBAL POSITIONING SYSTEM DATA MANAGEMENT

Each sample location is recorded using a GPS unit. Soil gas sampling grids are created in ArcView® and pre-loaded into the GPS unit so field personnel can quickly and accurately position detection equipment along the Project Area. Soil gas measurements and other relevant field data are then stored as attributes in the GPS unit along with the associated position data. Data stored in the GPS unit are downloaded later for processing and reporting.

The GPS unit position data are collected in the World Geodetic System 1984 (WGS 84) and projected in Universal Transverse Mercator (UTM) Zone 13 South, North American Datum 1983 (NAD 83) for use in an ArcView® project file. On average, 25 GPS log points are collected for each point feature in order to obtain more accurate positioning.

Readings collected with the GPS unit can be located with 1-meter accuracy. However, the terrain and forest canopy can adversely affect GPS unit accuracy. North-facing slopes and heavily-wooded areas can distort or block satellite signals. When satellite signals are limited, positioning accuracy decreases. In locations where the GPS unit cannot obtain a signal, field personnel will note measurement data on their field reference maps. Specifications of the GPS unit are included in Appendix A.

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### 2.3.2 FLUX VOLUME ESTIMATIONS

WSP estimated the volumetric flux of methane for each mapping area where sufficient reportable methane flux data points are available. Flux data were interpolated and gridded, then contoured and processed to estimate total volumetric flux.

The results were converted to volumetric flux rates common to the natural gas production industry in units of thousand cubic feet per day (MCFD). For a better perspective of the methane flux rates, WSP converted the mass flux values into volumetric flux units of cubic feet per day (CFD), assuming equal areas. The unit conversion is based on the molecular weight of the gas and the density of the gas at approximately 7,100 feet above mean sea level (amsl).

For methane flux, the calculation is as follows:

$$\frac{\text{mol CH}_4}{\text{day}} \times \frac{16.04276 \text{ g CH}_4}{\text{mol CH}_4} \times \frac{0.0698 \text{ ft}^3 \text{ CH}_4}{\text{g CH}_4} = \frac{\text{ft}^3 \text{ CH}_4}{\text{day}}$$

For example,

$$1.0 \text{ mol/day CH}_4 = 1.12 \text{ CFD CH}_4$$

**Notes:**

ft<sup>3</sup> – cubic feet

CH<sub>4</sub> – methane

g – gram

CFD – cubic feet per day

mol - mole

The volumetric flux values calculated are estimates and may not represent actual values for the specific areas. Interpolation calculation techniques are highly sensitive to data skewness and can result in large changes in calculated flux values based on measurements made at only a few locations.

## 2.4 NATURAL SPRINGS MONITORING

Surveys of natural springs are conducted on a spring-by-spring basis. Only natural springs identified on United States Geological Survey (USGS) topographic maps within the 2020 Project Area were surveyed. Once a natural spring was identified, collection of water samples was attempted, barring any property access restrictions or lack of flow. At each natural spring, field personnel located the position and elevation using a GPS. Water quality measurements, including pH, total dissolved solids (TDS), specific conductance (SC), oxidation-reduction potential (ORP), and temperature were collected using a SMARTROLL® meter. The equipment specifications for the water quality field meter are provided in Appendix A.

Water samples from the natural spring were collected and analyzed for the following

- Major Cations [dissolved sodium (Na), calcium (Ca), magnesium (Mg), potassium (K), and iron (Fe)] by United States Environmental Protection Agency (EPA) Method 200.7
- Dissolved Metals [selenium (Se), manganese (Mn)] by EPA Method 200.8
- Alkalinity (carbonate/bicarbonate) by Method SM 2320B-2011
- Major Anions [chloride (Cl), sulfate (SO<sub>4</sub>), bromide (Br), and fluoride (F)] by EPA Method 300
- SC by Method SM 2510B-2011
- Nitrate/Nitrite as Nitrogen (N) by EPA Method 300
- TDS by Method SM2540C
- Methane by Method RSK175 Modified
- pH by Method SM 4500HB
- Hydrogen Sulfide field analysis using Hach® test kit
- Sodium Adsorption Ratio (SAR) by United States Department of Agriculture (USDA) Handbook 60
- Bacteria by Iron Reducing Bacteria (IRB)/Sulfate Reducing Bacteria (SRB)/Slime Forming Bacteria (SLYM).

Laboratory-provided sample bottles were filled with water for analysis of the parameters identified above. All water samples collected were submitted in a cooler under strict chain-of-custody (COC) documentation to Accutest Mountain States Laboratories (Accutest) in Wheat Ridge, Colorado.

WSP sampled natural springs Chavez01 and Chavez02 during the sampling event in 2020. Water samples were not collected from Spring01 and Chavez03 due to stagnation of the water from the natural springs, and water samples were not collected from Spring03 (Quiet Spring) due to lack of access in previous years.

# 3 RESULTS

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## 3.1 FLUX SURVEY

As previously stated, WSP identified three mapping areas for surveying in 2020:

- L-1021
- 32 & L-1049
- L-1030

Reportable methane flux was detected in all three mapping areas. Total reportable volumetric methane flux was calculated as 3.5 MCFD for area L-1021, 4.5 MCFD for area L-1030, and 58 MCFD for area 32 & L-1049. Since 2011, each of the three mapping areas have had reportable methane flux detected and have been considered active seep areas. Methane flux measurements are presented on Figures 3 through 5. Summaries of the mapping areas from 2010 to present are included in Table 1. Flux data is included in Appendix B. Volumetric flux calculations are included in Appendix C.

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## 3.2 NATURAL SPRINGS SURVEY

WSP identified 13 natural springs within the 2020 Project Area (Figure 2). Natural springs Spring05 (Vega Canyon), Spring07 (Spring Canyon), and Spring08 (Middle Lorencito) were excluded from the sampling list as approved by the COGCC. Six natural springs were located on private property with no access granted. Two natural springs (Chavez01 and Chavez02) were sampled on August 26, 2020. Chavez03 and Spring01 were stagnant at the time of sampling, and as a result, no water samples were collected.

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### 3.2.1 SAMPLING AND ANALYSIS

By plotting the major anions and major cations that are dissolved in the natural spring water samples on a Stiff diagram, the water type can be presented graphically. The water types appear to be predominately calcium in cationic composition and bicarbonate + carbonate in anionic composition. Laboratory analytical results for the natural spring samples are summarized in Table 4. A Stiff diagram illustrating the water type is depicted on Figure 6. Natural spring laboratory analytical reports are presented in Appendix D

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### 3.2.2 FIELD OBSERVATIONS

WSP collected field measurements from the Chavez01 and Chavez02 natural springs, which were documented in a field logbook. The following measurements are for Chavez01 and Chavez02 respectively. Specific Electrical Conductance ( $\mu\text{S}/\text{cm}$ ): 331.4, 345.8, pH: 8.7, 8.44, ORP (mV): -76.8, -79.8, Temperature ( $^{\circ}\text{C}$ ): 17.3, 16.5, and TDS (mg/L): 253.8, 269.2, H<sub>2</sub>S (ppm): 0.0, 0.0. The 2020 field observations and measurements for the natural springs are consistent with previous years' sampling events. Field observations and measurements are summarized in Table 3.



## 4 CONCLUSIONS

The 2020 Colorado Rule 608 Compliance Program meets the requirements of subsections a, b, and c of the COGCC Rule 608. WSP identified, through previous investigations, three mapping areas for surveying in 2020. Based on the findings from 2020, the three mapping areas L-1021, 32 & L-1049, and L-1030 continue to be active seep areas, however; when comparing the results from 2019 to 2020, seep area 32 & L-1049 showed a significant decrease in total reportable volumetric methane flux with 780.2 MCFD in 2019 and 58 MCFD in 2020. A similar decrease in volumetric methane flux was observed in 2017; however, the flux increased in the subsequent 2018 and 2019 surveys.

WSP recommends continued compliance with Rule 608 in Las Animas County in accordance with the COGCC-approved May 2010 Work Plan at the three previously identified mapping areas (areas L-1021, 32 & L-1049, and L-1030) for the 2021 flux survey. If a continued reduction in volumetric methane flux is observed during the 2021 survey, WSP may recommend reducing the monitoring frequency.

Two natural springs were sampled for water quality analysis (Chavez01 and Chavez02). The water types appear to be predominately calcium in cationic composition and bicarbonate in anionic composition, which is consistent with previous years' results. There have been no significant changes in the methane concentration of the springs since baseline and the six-year sampling occurred. No methane was detected in water samples collected in 2020. This meets the requirements of 608(b) and based on no change in water quality after 9 years of sampling and only minimal to no methane detected, WSP recommends that sampling of the springs be reduced to every other year.

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# TABLES



TABLE 1

MAPPING AREA SUMMARIES

2020 RULE 608 COMPLIANCE REPORT

RATON BASIN, LAS ANIMAS COUNTY, COLORADO

Area IDs	2007	2010			2011			2012			2013			2014			2015			2016			2017			2018			2019			2020		
	Subsurface Methane Gas Detected	Total Number of Flux Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**	Total Number of Sample Points	Reportable CH <sub>4</sub> Flux Points*	Total CH <sub>4</sub> Flux (MCFD)**			
L-1021	-	-	-	-	44	10	129.71	47	6	6.7	46	2	2.2	51	4	1.9	35	4	6.8	35	6	14.1	35	2	7.5	35	3	193.6	35	5	17.8	28	2	3.5
L-1030	-	-	-	-	17	3	2.19	17	3	2.2	18	1	1	18	4	56.9	18	2	12.7	18	3	5.4	22	7	19.4	22	4	25.4	18	3	2.2	18	5	4.5
32 & L-1049	x	-	-	-	372	146	304.12	217	55	720.4	234	37	332.4	233	33	150.7	239	25	668.4	238	32	204.3	239	29	74.3	240	35	739.3	238	23	780.2	250	22	58
L-1050	-	-	-	-	22	4	0.69	22	2	1.0	22	0	0.0	25	1	1	22	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	167	16	2.16	83	6	1.9	83	0	0.0	80	3	0.8	76	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	94	16	0.563808	50	7	0.34	46	0	0.0	58	3	0.2	66	4	0.4	58	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
L-1033	-	-	-	-	26	1	0.02	40	4	0.1	40	0	0.0	38	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13 & L-1026	-	29	8	10.74	56	2	0.03	61	1	1	61	0	0.0	38	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19	-	-	-	-	23	0	0.00	15	1	1	15	0	0.0	14	0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

**Notes:**

CH<sub>4</sub> - methane

MCFD - thousand cubic feet per day

moles/m<sup>2</sup>·day - moles per meter squared per day

NA - not applicable

- - not measured

1 - not contoured, only one data point

\*\* - volume includes only gridded values > 0.2 moles/m<sup>2</sup>·day

\* - only points where flux values were above the reporting limit of 0.2 moles/m<sup>2</sup>·day

**TABLE 2**

**PROPERTY OWNER AND ACCESS INFORMATION  
2020 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO**

<b>LANDOWNER</b>	<b>PARCEL ID</b>	<b>SECTION</b>	<b>TOWNSHIP</b>	<b>RANGE</b>	<b>PERMISSION GRANTED</b>
Timber Creek Operating, LLC	14533300	28	33	67	Yes
	14533405	27, 28	33	67	
	14533200	27	33	67	
Bill R. and Rossana T. Chavez	13940200	19	33	67	Yes
Bill Toupal	NA	28	33	67	Yes
		27, 28	33	67	
		27	33	67	
Veronica Law	NA	19	33	67	Yes



TABLE 3

**NATURAL SPRING WATER QUALITY MEASUREMENTS  
2020 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO**

Natural Spring	Location	Latitude	Longitude	Inspection Date	Specific Electrical Conductance ( $\mu$ S/cm)	pH (Units)	ORP (mV)	Temperature (°C)	TDS (mg/l)
Spring01	North Fork Apache Canyon	-104.991708	37.108089	8/13/2010	381.0	9.2	140.5	22.4	247.0
				8/19/2011	408.0	7.1	-99.5	13.3	432.0
				9/4/2012	DRY - NOT MEASURED				
				8/15/2013	DRY - NOT MEASURED				
				8/21/2014	515.9	9.1	-61.8	12.4	337.2
				8/13/2015	562.4	8.8	-38.9	11.0	368.8
				8/25/2016	STAGNANT WATER - NOT MEASURED				
				9/6/2017	STAGNANT WATER - NOT MEASURED				
				8/20/2018	STAGNANT WATER - NOT MEASURED				
				10/23/2019	STAGNANT WATER - NOT MEASURED				
				8/26/2020	STAGNANT WATER - NOT MEASURED				
Chavez01	Rancho Escondido	-104.9265768	37.15615866	9/4/2012	391.0	6.8	106.5	15.7	200.7
				8/15/2013	356.0	7.0	12.0	14.9	NM
				8/21/2014	329.0	7.7	200.9	16.3	579.0
				8/12/2015	420.8	6.8	279.5	14.7	275.4
				8/25/2016	284.6	7.1	25.5	14.1	233.4
				9/6/2017	383.6	7.6	610	16.15	249.2
				8/20/2018	711	8.8	-83	18.34	494.3
				10/23/2019	216.8	8.5	-89.3	9.8	197.3
				8/26/2020	331.4	8.7	-76.8	17.2	253.8
Chavez02	Rancho Escondido	-104.922814480	37.152863914	9/4/2012	414.0	6.5	105.5	16.0	207.7
				8/15/2013	417.0	6.9	NM	14.1	NM
				8/21/2014	399.3	7.5	169.7	14.4	260.2
				8/12/2015	550.6	7.1	323.4	14.1	361.2
				8/25/2016	381.4	7.6	44.8	17.5	291.7
				9/6/2017	554.9	7.04	544	16.1	358.8
				8/20/2018	390	8.67	-82.9	18.9	245.6
				10/23/2019	368.8	8.09	-90.6	12.8	309.4
				8/26/2020	345.8	8.44	-79.8	16.5	269.2
Chavez03	Rancho Escondido	-104.916708750	37.156096546	9/4/2012	1,864.0	7.0	104.7	14.1	921.9
				8/15/2013	1,464.0	7.3	47.3	14.7	NM
				8/21/2014	1,922.9	7.6	-40.1	16.3	1,255.3
				8/12/2015	STAGNANT WATER - NOT MEASURED				
				8/25/2016	DRY - NOT MEASURED				
				9/6/2017	STAGNANT WATER- NOT MEASURED				
				8/20/2018	STAGNANT WATER- NOT MEASURED				
				10/23/2019	STAGNANT WATER- NOT MEASURED				
				8/26/2020	STAGNANT WATER - NOT MEASURED				
Spring03 - Quiet Spring	Rancho Escondido	-104.915474	37.174474	8/21/2014	STAGNANT WATER - NOT MEASURED				
				8/13/2015	STAGNANT WATER - NOT MEASURED				
				8/25/2016	STAGNANT WATER - NOT MEASURED				
				9/6/2017	NO ACCESS GRANTED - NOT MEASURED				
				8/20/2018	NO ACCESS GRANTED - NOT MEASURED				
				10/23/2019	NO ACCESS GRANTED - NOT MEASURED				
				8/26/2020	NOT MEASURED				

**Notes:**

°C - degrees Celsius  
mg/l - milligrams per liter  
mV - millivolts  
NM - Not Measured  
ORP - oxidation reduction potential  
TDS - total dissolved solids  
 $\mu$ S/cm - microSiemens per centimeter

TABLE 4

NATURAL SPRING ANALYTICAL RESULTS  
2020 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO

Natural Spring	Location	Sample Date	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Potassium (mg/l)	Manganese (mg/l)	Selenium (mg/l)	Methane (mg/l)	Iron (mg/l)	Sodium Adsorption Ratio	Carbonate (mg/l)	Bicarbonate (mg/l)	TDS (mg/l)	Specific Conductivity (umhos/cm)	pH	Sulfate (mg/l)	Chloride (mg/l)	Bromide (mg/l)	Fluoride (mg/l)	Hydrogen Sulfide (mg/l)	Nitrogen as Nitrate (mg/l)	Nitrogen as Nitrite (mg/l)	Iron Reducing Bacteria (cfu/ml)	Slime Forming Bacteria (cfu/ml)	Sulfate Reducing Bacteria (cfu/ml)
Spring01	North Fork Apache Canyon	8/13/2010	3.4	0.65	97.7	1.41	0.0210	<0.00080	0.10900	1.59	11.4	<5.0	205	280	364	10.13	2.9	3.3	<0.20	0.74	<0.50	<0.23	<0.061	500	>350,000	700,000
		8/15/2011	2.2	0.52	136.0	1.64	0.1260	<0.00080	0.277	3.660	22.2	<5.0	332	420	428	8.16	2.7	3.7	<0.20	1.40	NA	<0.045	<0.011	9,000	350,000	700,000
		9/4/2012	DRY - NOT SAMPLED																							
		8/15/2013	DRY - NOT SAMPLED																							
		8/21/2014	1.4	0.35	129.0	<1.0	0.0063	<0.00080	1.00	<0.010	25.0	<5.0	251	338	406	NA	3.5	3.7	<0.050	1.00	0.5	<0.010	<0.0040	<25	<500	<200
		8/13/2015	1.8	0.47	128.0		0.0111	<0.00080	1.09000	0.0212	20.1	10.9	227	304	402	8.64	7.4	3.9	<0.050	0.97	<0.50	<0.020	<0.0080	<25	<500	<200
		8/25/2016	STAGNANT WATER - NOT SAMPLED																							
		9/6/2017	STAGNANT WATER - NOT SAMPLED																							
		8/20/2018	STAGNANT WATER - NOT SAMPLED																							
		10/23/2019	STAGNANT WATER - NOT SAMPLED																							
		8/26/2020	STAGNANT WATER - NOT SAMPLED																							
Chavez01	Rancho Escondido	9/4/2012	44.5	8.12	20.4	<1.0	<0.0050	<0.0020	0.0012	<0.070	0.738	<5.0	157	194	323	7.28	19.3	3.4	<0.050	0.27	0.0	0.011	<0.0040	74,500	350,000	359,000
		8/15/2013	50.2	8.59	20.8	1.07	NA	<0.0020	NA	<0.070	0.755	<5.0	171	224	358	7.4	28.7	5.8	<0.050	0.27	NA	0.012	<0.0040	74,500	66,500	1,200
		8/21/2014	49.8	8.92	15.0	1.23	<0.0050	<0.00080	0.0035	<0.010	0.490	<5.0	141	210	278	NA	21.6	5.1	<0.050	0.23	0.0	<0.010	<0.0040	9,000	66,500	700
		8/12/2015	53.6	9.92	15.4	<1.0	<0.0050	<0.00080	0.00250	0.0147	0.507	<5.0	139	220	285	7.19	27.5	15.7	<0.050	0.23	<0.50	<0.010	<0.0040	74,500	350,000	<200
		8/25/2016	41.7	8.09	13.4	<1.0	8.090	0.0011	0.0022	<0.010	0.519	<5.0	141	200	291	7.13	24.6	6.7	<0.050	0.21	0.0	<0.050	<0.0054	74,500	66,500	1,200
		9/6/2017	50.0	9.42	15.0	<1.0	0.0023	<0.00080	0.00260	<0.010	0.510	<5.0	137	202	325	7.80	25.1	8.8	<0.050	0.22	0.0	<0.010	<0.0040	74,500	350,000	5,000
		8/20/2018	43.4	8.07	12.1	<1.0	0.003	<0.00080	0.00049	<0.010	0.442	<5.0	131	188	287	7.97	26.1	3.3	<0.050	0.25	NA	0.024	0.024	35,000	440,000	6,000
		10/23/2019	47.9	8.35	11.5	<1.0	<0.002	<0.00080	0.0038	<0.01	0.403	<5.0	129	183	299	7.49	24.9	4.3	<0.050	0.23	NA	0.015	<0.0040	2,200	440,000	27,000
		8/26/2020	37.6	6.79	9.68	<1.0	0.0025	<0.0008	<0.00080	<0.01	0.422	<5.0	115	166	289	7.89	22.5	2	<0.050	0.21	NA	0.027	<0.0040	35,000	440,000	27,000
		9/4/2012	49.3	9.56	18.2	1.43	<0.0050	<0.0020	0.00030	<0.070	0.621	<5.0	163	206	330	7.17	20.3	4.0	<0.050	0.30	0.0	0.088	<0.0040	74,500	350,000	359,000
		8/15/2013	59.7	11.00	20.2	1.51	0.0055	<0.0020	NA	<0.070	0.670	<5.0	201	264	428	7.28	31.3	8.1	<0.050	0.29	NA	1.800	1.800	75,500	12,500	5,000
Chavez02	Rancho Escondido	8/21/2014	57.7	11.20	15.9	1.77	<0.0050	<0.00080	0.00054	0.264	0.489	<5.0	167	242	318	NA	24.0	5.8	<0.050	0.29	0.0	0.400	<0.0040	9,000	<500	5,000
		8/12/2015	71.7	13.30	14.9	1.61	<0.0020	<0.00080	<0.00080	0.0473	0.472	<5.0	196	291	405	7.45	29.8	14.5	<0.050	0.27	<0.50	0.940	0.940	74,500	350,000	5,000
		8/25/2016	56.6	11.80	13.2	15.4	<0.0050	<0.00080	<0.00080	0.0329	0.447	<5.0	195	262	382	7.26	26.7	9.6	<0.050	0.25	0.0	0.42	0.42	74,500	66,500	18,000
		9/6/2017	73.0	14.4	16.8	1.620	0.0041	<0.00080	0.00052	0.022	0.470	<5.0	223	290	471	7.51	27.5	9.5	<0.050	0.27	0.0	0.16	<0.0040	74,500	350,000	700
		8/20/2018	46.0	9.11	12.5	1.380	0.0023	<0.00080	<0.00080	0.013	0.440	<5.0	143	208	310	8.10	28.1	4.1	<0.050	0.27	NA	0.17	0.17	35,000	440,000	6,000
		10/23/2019	72.1	13.30	12.8	1.560	0.0051	<0.00080	0.00097	0.036	0.363	<5.0	191	246	394	7.26	23.9	4.6	<0.050	0.26	NA	0.062	<0.0040	9,000	440,000	115,000
		8/26/2020	49.2	9.20	10.9	1.360	0.0056	<0.00080	<0.00080	0.077	0.367	<5.0	165	222	346	7.99	25.2	2.4	<0.050	0.22	NA	0.120	<0.0040	35,000	1,750,000	27,000
		9/4/2012	117.0	43.20	20.8	6.25	<0.0050	<0.0020	0.0119	0.235	4.17	<5.0	495	990	160	7.44	63.7	254.0	2.0	0.35	0.0	0.083	0.024	74,500	66,500	359,000
		8/15/2013	113.0	48.20	22.3	5.50	<0.0050	<0.0020	NA	0.200	3.91	<5.0	536	1,090	1,850	7.38	47.4	324.0	2.6	0.72	NA	0.260	0.260	9,000	350,000	359,000
		8/21/2014	117.0	53.30	241.0	5.81	0.3730	<0.00080	0.0285	0.122	4.22	<5.0	539	1,160	1,660	NA	42.5	342.0	2.7	<0.50	0.0	0.063	<0.020	2,300	66,500	359,000
		8/12/2015	STAGNANT WATER - NOT SAMPLED																							
Chavez03	Rancho Escondido	8/25/2016	DRY - NOT SAMPLED																							
		9/6/2017	STAGNANT WATER - NOT SAMPLED																							
		8/20/2018	STAGNANT WATER - NOT SAMPLED																							
		10/23/2019	STAGNANT WATER - NOT SAMPLED																							
		8/26/2020	STAGNANT WATER - NOT SAMPLED																							
Spring03 - Quiet Spring	Rancho Escondido	8/21/2014	STAGNANT WATER - NOT SAMPLED																							
		8/12/2015	STAGNANT WATER - NOT SAMPLED																							
		8/25/2016	STAGNANT WATER - NOT SAMPLED																							
		9/6/2017	NO ACCESS GRANTED - NOT SAMPLED																							
		8/20/2018	NO ACCESS GRANTED - NOT SAMPLED																							
		10/23/2019	NO ACCESS GRANTED - NOT SAMPLED																							
		8/26/2020	NOT SAMPLED																							

Notes:  
< - less than the laboratory reporting limit  
> - greater than  
cfu/ml - coliform units per milliliter  
mg/l - milligrams per liter  
NA - not analyzed  
TDS - total dissolved solids  
umhos/cm - microhms per centimeter

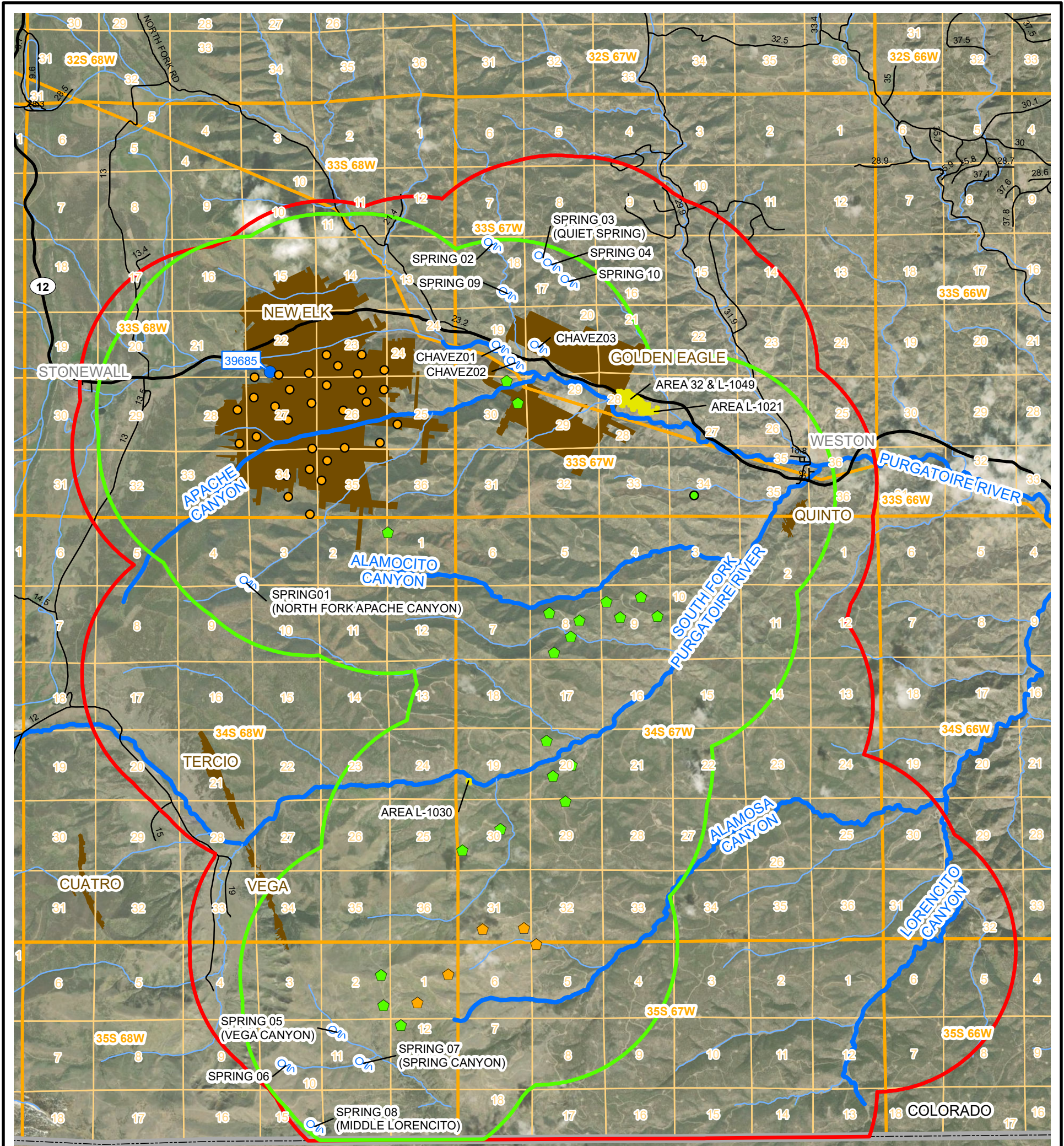
# FIGURES











LEGEND

- 2010 PROPOSED COALBED METHANE PRODUCTION WELL
- 2010 INSTALLED COALBED METHANE PRODUCTION WELL
- 2011 PROPOSED COALBED METHANE PRODUCTION WELL
- 2011 INSTALLED COALBED METHANE PRODUCTION WELL
- WATER WELL LABELED WITH PERMIT NUMBER
- SPRING LABELED WITH SAMPLE ID  
(SPRING NAME, IF APPLICABLE)
- ROAD
- OTHER WATER SOURCE
- MAJOR DRAINAGE
- MAPPING AREA
- 2010 PROJECT AREA
- 2020 PROJECT AREA
- COLORADO STATE LINE
- TOWNSHIP AND RANGE LINES
- SECTION LINE
- MINE BOUNDARY

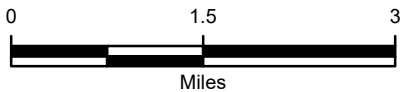


FIGURE 2  
2020 PROJECT AREA MAP  
2020 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO

TIMBER CREEK OPERATING, LLC







IMAGE COURTESY OF ESRI

LEGEND

2020 METHANE FLUX MEASUREMENT  
(mol/m<sup>2</sup> • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 17.0000



2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)  
CONTOUR INTERVAL VARIES

mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED

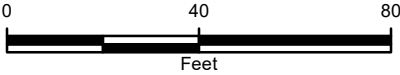


FIGURE 3  
METHANE FLUX CONTOURS  
MAPPING AREA L-1021  
2020 COLORADO RULE 608 COMPLIANCE REPORT  
RATON BASIN, LAS ANIMAS COUNTY, COLORADO  
TIMBER CREEK OPERATING, LLC





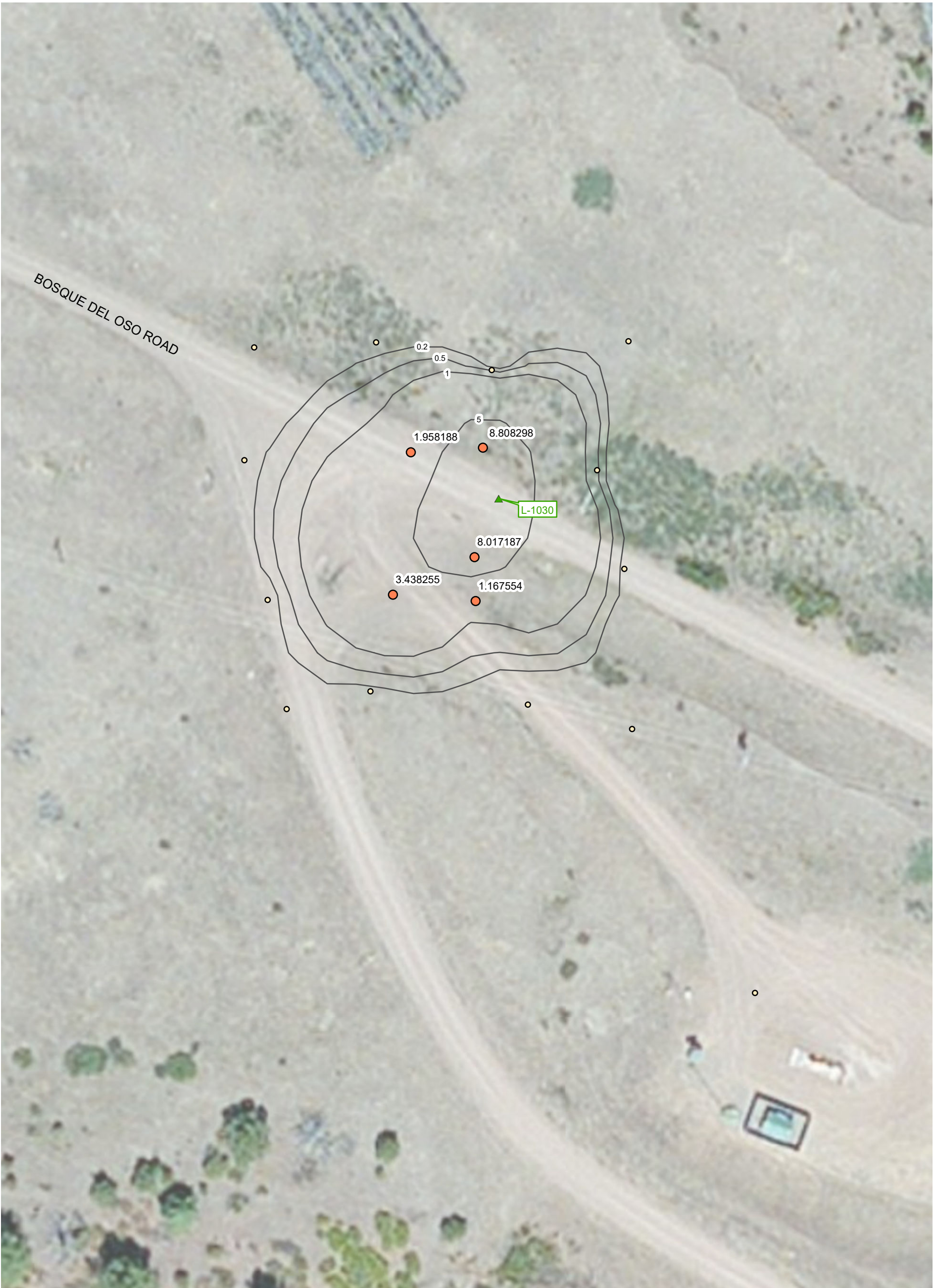


IMAGE COURTESY OF ESRI

**LEGEND**

**2020 METHANE FLUX MEASUREMENT**  
(mol/m<sup>2</sup> • day)

- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 17.0000

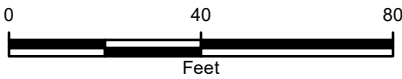


2011 SUSPECT METHANE SEEP (ID LABELED IN GREEN)

METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)

CONTOUR INTERVAL VARIES

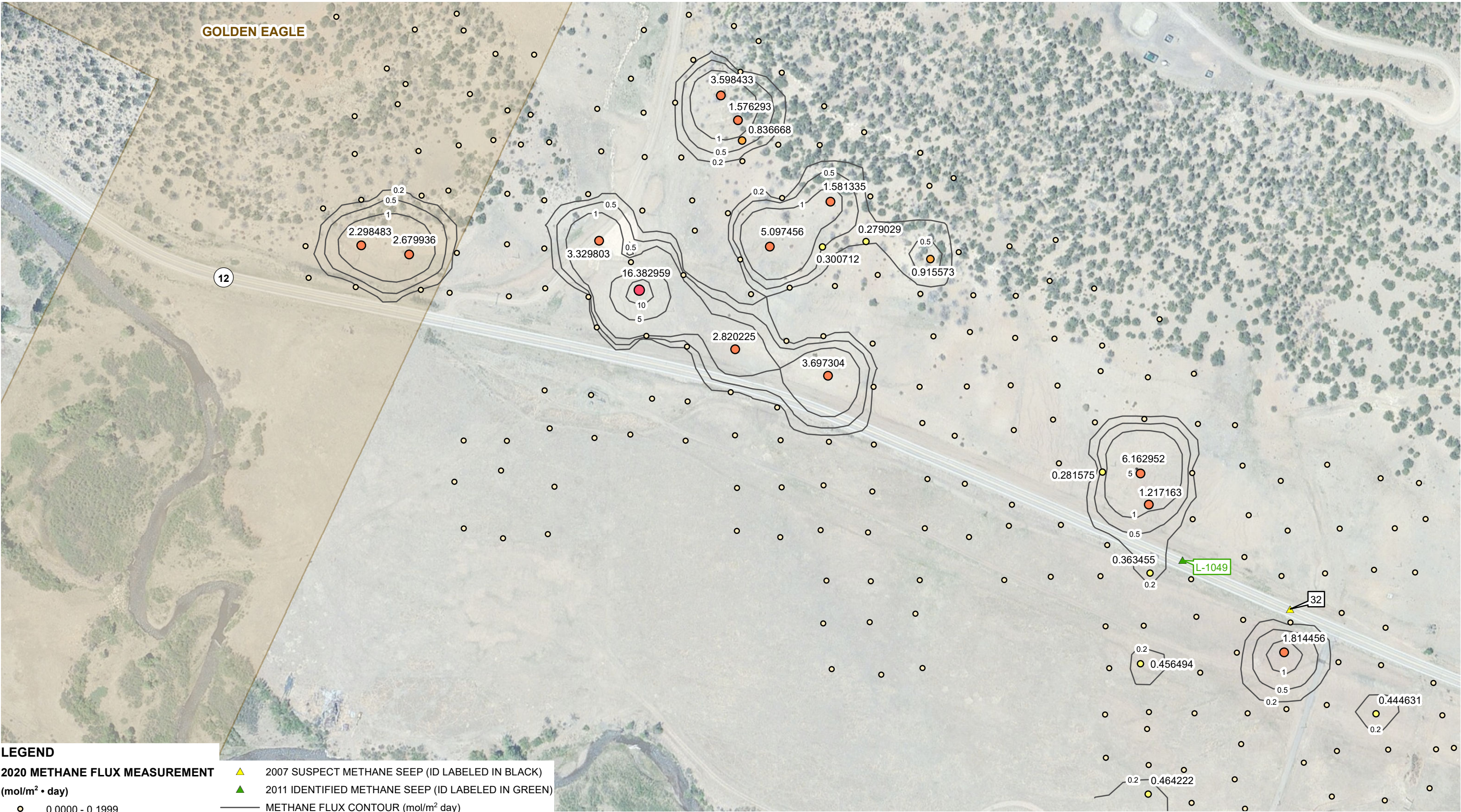
mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED



**FIGURE 4**  
**METHANE FLUX CONTOURS**  
**MAPPING AREA L-1030**  
**2020 COLORADO RULE 608 COMPLIANCE REPORT**  
**RATON BASIN, LAS ANIMAS COUNTY, COLORADO**  
**TIMBER CREEK OPERATING, LLC**







**LEGEND**

**2020 METHANE FLUX MEASUREMENT**  
(mol/m<sup>2</sup> • day)

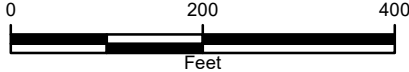
- 0.0000 - 0.1999
- 0.2000 - 0.5000
- 0.5001 - 1.0000
- 1.0001 - 10.0000
- 10.0001 - 17.0000

- ▲ 2007 SUSPECT METHANE SEEP (ID LABELED IN BLACK)
- ▲ 2011 IDENTIFIED METHANE SEEP (ID LABELED IN GREEN)

— METHANE FLUX CONTOUR (mol/m<sup>2</sup> day)  
CONTOUR INTERVAL VARIES

mol/m<sup>2</sup> • day: MOLES PER SQUARE METER PER DAY  
ONLY METHANE FLUX MEASUREMENTS GREATER  
THAN OR EQUAL TO 0.2 mol/m<sup>2</sup> • day ARE LABELED

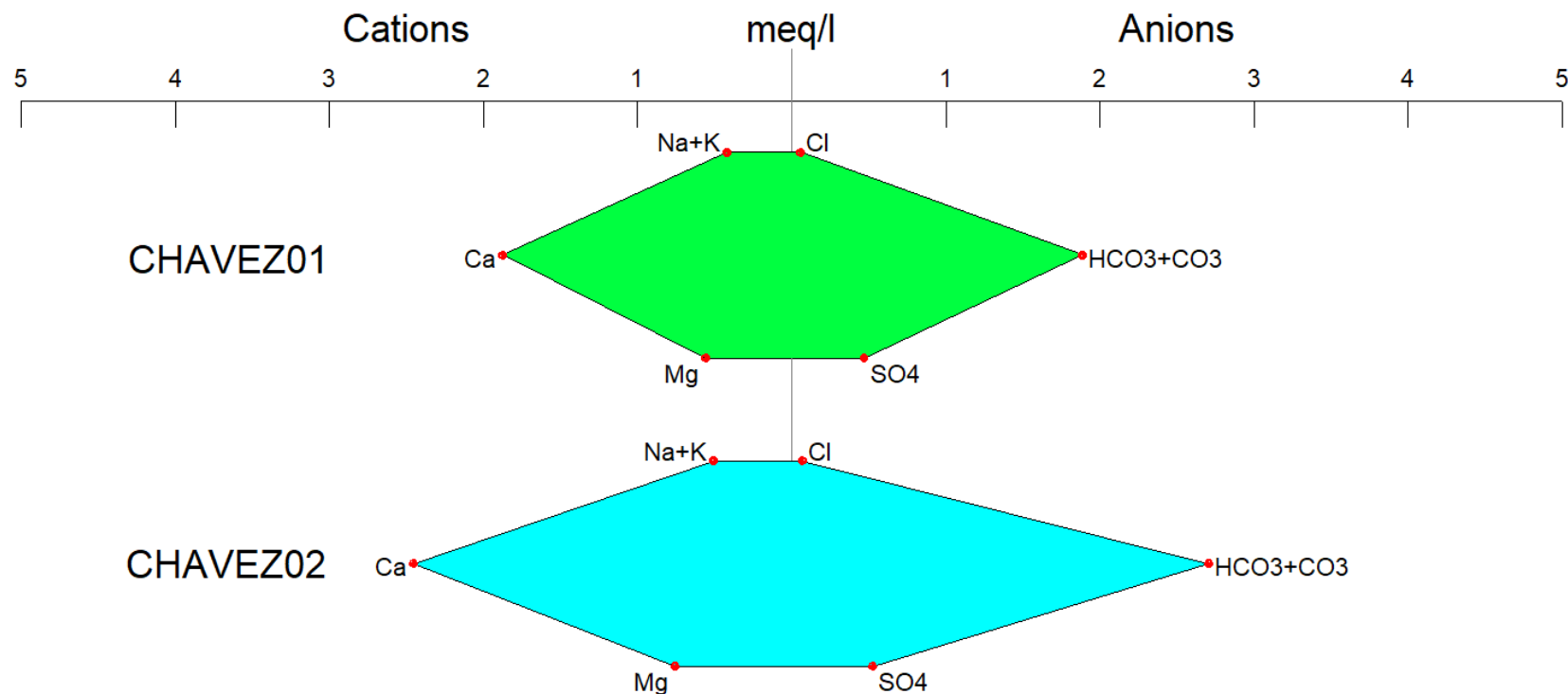
LEWICKI MINE BOUNDARY



**FIGURE 5**  
**METHANE FLUX CONTOURS**  
**MAPPING AREAS 32 & L-1049**  
**2020 COLORADO RULE 608 COMPLIANCE REPORT**  
**RATON BASIN, LAS ANIMAS COUNTY, COLORADO**  
**TIMBER CREEK OPERATING, LLC**







# **LEGEND**

Ca: CALCIUM  
 Cl: CHLORIDE  
 CO3: CARBONATE  
 HCO3: BICARBONATE  
 K: POTASSIUM  
 Mg: MAGNESIUM  
 Na: SODIUM  
 SO4: SULFATE  
 meq/l: MILLIEQUIVALENTS PER LITER

FIGURE 6  
 STIFF DIAGRAMS  
 AUGUST 26, 2020  
 2020 COLORADO RULE 608 COMPLIANCE REPORT  
 RATON BASIN, LAS ANIMAS COUNTY, COLORADO  
 TIMBER CREEK OPERATING, LLC



# APPENDICES



# **APPENDIX A**

## **EQUIPMENT SPECIFICATIONS**

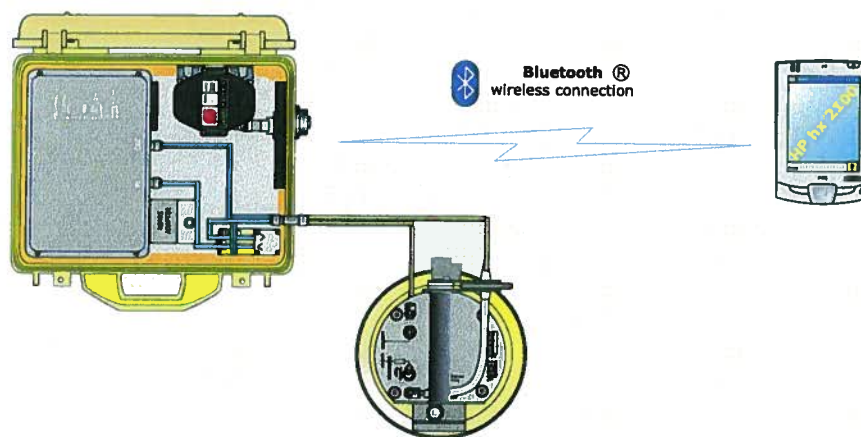
**APPENDIX A**  
**EQUIPMENT SPECIFICATIONS**





# WEST Systems portable soil flux meter for Carbon dioxide, Methane and Hydrogen sulfide fluxes

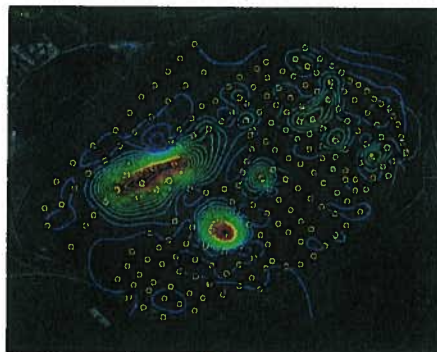
The WEST Systems Fluxmeter is a portable instrument for the measurement of soil gas diffuse degassing phenomena that uses the accumulation chamber method.



This method studied for soil respiration in agronomy (Parkinson) and for soil degassing in volcanic areas (R. Cioni et al.), has been designed by WEST Systems to obtain a portable instrument that allows the performance of measurements with very good accuracy in a short time. The instrument allows a wide range evaluation of the amount of soil gas flux and can be utilized for the evaluation of biogas degassing (landfills), for the survey of non visible degassing phenomena in volcanic and geothermal areas as well as soil respiration rate in agronomy. In the picture below, the results of the degassing survey of a landfill.



Portable fluxmeter



Methane flux contour lines



a group of researchers during a flux mapping fieldwork, using the WS-LI820 flux meter  
Courtesy of United States Geological Survey

West Systems Srl  
Via Molise 3 - Zona Ind. Gello - 56025 Pontedera (PI) Italy  
Phone +39 0587 294216 [www.westsystems.com](http://www.westsystems.com)  
Fax +39 0587 296068 [g.virgili@westsystems.com](mailto:g.virgili@westsystems.com)

**WEST**  
Systems

# Portable soil flux meter

## Common physical characteristics:

Total Weight = 8.3 Kg/16 lbs. to be carried on the back using the backpack-like support vest. The field operator will also have to carry one of the accumulation chambers and the palmtop:

## Warm Up

Only at instrument cold start-up a warm-up time of 20 minutes is required. The typical measurement time ranges from 2 to 4 minutes and the autonomy of the instrument is about 4 hours with a single NiMH 14.4 Volts, 2.6 A/h battery. The instrument comes with two interchangeable batteries.

## Accumulation Chamber specifications:

- Accumulation chamber A diameter : 200 mm / Height: 100 mm / weight: 1.5 Kg/3.3 lbs
- Accumulation chamber B diameter : 200 mm / Height: 200mm / weight : 2.2 Kg /4.84 lbs

**Palm top computer:** PocketPC Color Display based on Windows Mobile operating system.

- PalmTop with cables, 0.3 Kg/0.7 lbs.
- Size 125mm (4.8") x 82mm (3.2") \* 25 mm (1").

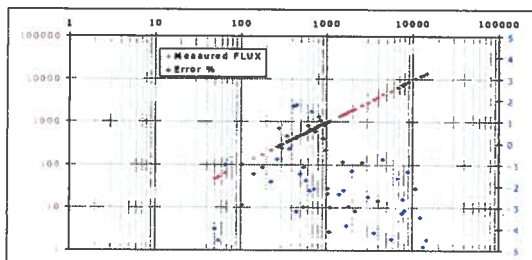
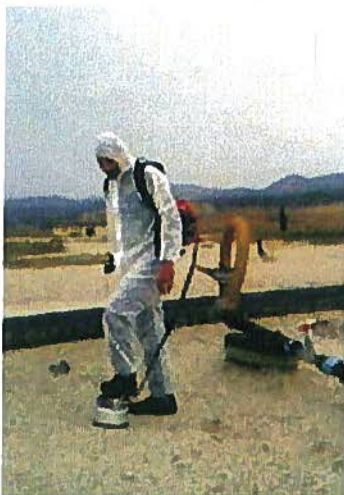
**Software** The instrument is supplied with a custom software, FluxManager, which allows recording and visualization of the increase in concentration of the target gas in the accumulation chamber, and then the flux calculations. The obtained measurements can be saved on the palmtop computer and then transferred to a desktop PC with a USB connection or using a SD card.

## The instrument is supplied complete with:

- backpack-like support vest
- Carrying case for transport and storage
- 2 batteries NiMH 14.4 Volts 2.6 A/h and 1 NiMH battery charger
- Accumulation chamber A and B
- Palmtop Pocket PC
- User Manual, in English
- FLUX Manager Software for Windows Mobile, in English

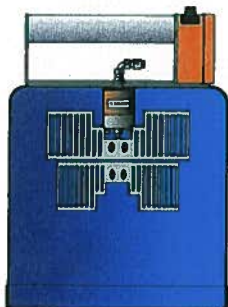
The standard flux meter configuration is supplied with a single gas detector, normally the carbon dioxide detector. The fluxmeter can host two sensors by the way special releases, based on specific customer request, it can be supplied with a maximum of 3 sensors.

Finally we improved the connection between the instrument and the palmtop that now is based on Bluetooth wireless embedded device.



The measured carbon dioxide flux vs imposed flux (grams  $m^{-2} day^{-1}$ );  
The error % vs imposed flux (in blue).

The instrument is extremely versatile and allows measurement of flux in 2/4 minutes. In the picture: Soil bio-gas flux monitoring in a landfill.



## The accumulation chambers

In the normal use of instrument only the chamber B is used. To extend the instrument sensitivity to very low fluxes the accumulation chamber A is supplied.

	Type A	Type B
net area $m^2$	0.0314	
net volume $m^3$	0.003	0.006

Accumulation Chamber Type B





CO<sub>2</sub> - LI820

#### LI820 based Carbon dioxide fluxmeter

The CO<sub>2</sub> Fluxmeter is equipped with the LICOR LI-820 the most accurate and reliable portable carbon dioxide detector. The LI-820 is a double beam infrared sensor compensated for temperature variation in the range from -10 to 45°C and for atmospheric pressure variation in the range 660-1060 HPa. Accuracy 2% repeatability  $\pm 5$  ppm. The full scale range can be set to 1000, 2000, 5000 or 20000 ppmV of carbon dioxide. The characteristics of precision refer to the sensor set to a full scale range of 20000 ppmV. If a very high sensitivity is required, the detector can be set to 1000 or 2000 ppm full scale value to measure with very high precision fluxes in the range from 0 to 10 moles m<sup>-2</sup> day<sup>-1</sup>

**CO<sub>2</sub> FLUX Measurement range:**  
from 0 up 600 moles m<sup>-2</sup> day<sup>-1</sup>

The accuracy depends on the measured flux:

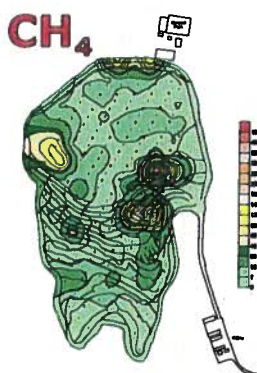
0 to 0.5 moles m <sup>-2</sup> day <sup>-1</sup>	25% (Acc.ch.A)
0.5 to 1 moles m <sup>-2</sup> day <sup>-1</sup>	15% (Acc.ch.A or B)
1 to 150 moles m <sup>-2</sup> day <sup>-1</sup>	10% (Acc.ch.B)
150 to 300 moles m <sup>-2</sup> day <sup>-1</sup>	10% (Acc.ch.B)
300 to 600 moles m <sup>-2</sup> day <sup>-1</sup>	20% (Acc.ch.B)

#### WS-DRAGER: CO<sub>2</sub> Flux measurement:

A double beam infrared sensor compensated for temperature variation in the range from -20 to 65°C. Accuracy 3%. The full scale value can be set from 2,000 to 300,000 ppm of carbon dioxide. Carbon Dioxide flux measurement range from 0.5 to 1500 moles/m<sup>2</sup> per day.

The precision depends on the measured flux:

range: 0.5 – 5 moles/m <sup>2</sup> per day	25% (Acc. chamber A)
5-350 moles/m <sup>2</sup> /day	10% (Acc. chamber B)
350-600 moles/ m <sup>2</sup> /day	25% (Acc. chamber B)
600-1500 moles/ m <sup>2</sup> /day	25% (Acc.Ch.B/ F.S.=10%)



WS-HC CH<sub>4</sub>

#### Methane fluxmeter

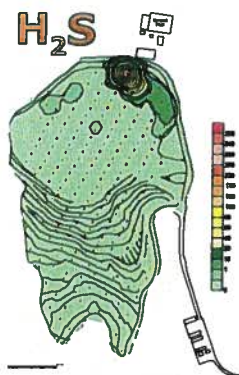
The methane sensor is an IR spectrometer. The full-scale range is 50000ppm, accuracy of 5% of reading, and repeatability is 2% of span. Detection limit 60 ppm, resolution 22 ppm. The detector was designed to measure the not controlled emissions of landfill, but it can be used to detect methane emission from coal or wherever the 0.2 moles/m<sup>2</sup>/day detection limit is acceptable.

#### Methane Flux measurement range

from 0.2 up 300 moles m<sup>-2</sup> day<sup>-1</sup>

The fluxmeter is provided with 2 accumulation chambers and the accuracy depends on the measured flux:

0.2 to 10 moles m <sup>-2</sup> day <sup>-1</sup>	25% (Acc.Ch.A)
10 to 150 moles m <sup>-2</sup> day <sup>-1</sup>	15% (Acc.Ch.A)
150 to 300 moles m <sup>-2</sup> day <sup>-1</sup>	20% (Acc.Ch.B)



H<sub>2</sub>S - WEST

#### Hydrogen sulfide

The hydrogen sulphide detector is a electrochemical cell with the following specifications:

The full-scale range is 20ppm, with a precision of 3% of reading, and the repeatability is 1.5% of span with a zero offset of 0.3%.

H<sub>2</sub>S Flux measurement range: from 0.0025 to 0.5 moles/m<sup>2</sup> per day.

The precision depends on the measured flux:

0.0025 – 0.05 moles/m <sup>2</sup> per day	$\pm 25\%$ (Acc. Chamber A)
0.05 – 0.5 moles/m <sup>2</sup> per day	$\pm 10\%$ (Acc. Chamber B)

NOTE: The hydrogen sulphide flux evaluation can be affected by the presence of large quantities of water in both liquid and vapour phases.

We thanks to N.Lima et al. for the maps.

West Systems Srl  
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Phone +39 0587 294216  
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g.virgili@westsystems.com

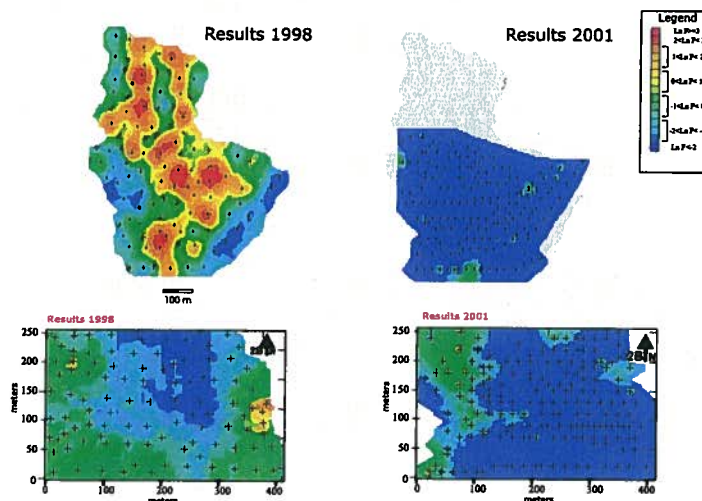
**WEST**  
Systems

## Application on a landfill: mapping the biogas non controlled emissions.

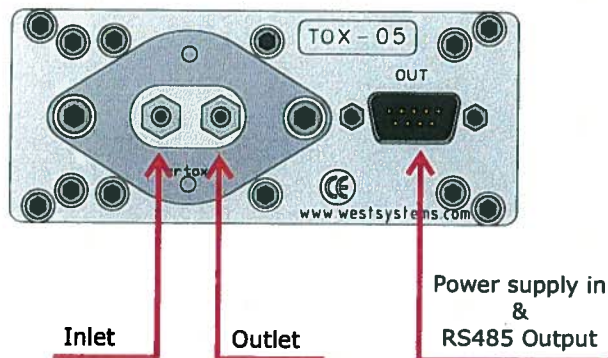
The figure shows the compare between the results of the measurement regime of a land/fill undertaken in 1998 and 2001: the mapping performed in 1998 gave clear indications of the areas which required intervention to improve the cover and the capture system.

The interventions were performed only where necessary with a significant economic savings.

The measurement regime of 2001 indicates without any doubt that the interventions were efficient and state-of-the-art.



# Hydrogen Sulfide Detector



Pin	Signal
1	Gnd
2	+VDC
3	Gnd
4	RS485-B
5	RS485-A
6	Gnd
7	+12V
8	Gnd
9	RS485-B

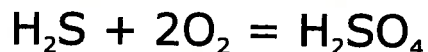
## Legenda

**Gnd:** Ground reference for power supply and RS485  
**+VDC:** 10-28 Volts Power supply input  
**RS485-A:** Digital signal output A  
**RS485-B:** Digital signal output B

## Sensor specifications

Ambient conditions:  
 Air temperature -40°C to 65 °C  
 Air pressure 700 hPa to 1300 hPa  
 Air RH 5% - 95% non condensating.  
 Expected sensor life > 24 months.  
 Chemical cell order code: WEST H2S-BH  
 Detector order code: WEST TOX-05-H2S-BH  
 Factory calibration : 20 ppm  
 RMS Noise <= 0.02 ppm  
 Zero Offset <= 0.2 ppm  
 Max Overrange >= 200 ppm

The chemical cell reaction is:



the gas sample specific consumption is very low:

$$2.5 \times 10^{-10} \text{ moles/Sec per ppm}$$

Due to this consumption the H2S flux is methodically underestimated by a -10% with the AccumulationChamber A and by a -5% when using the accumulation chamber B. Then we advise to use the accumulation chamber B except when the flux is very very low.



## Appendix M

### WS-HC detector

#### WS-HC Hydrocarbon Flux measurement:

The HydroCarbon detector is based on a double beam infrared spectrometer able to detect methane, hexane, propane and other molecules with HC linkages. The instrument comes calibrated for the methane. *The instrument requires a frequent **zero base-line** calibration that will be done using atmospheric air. The calibration requires 20 second.*

#### Detector specifications:

Accuracy 5%

Repeatability 2%

Resolution 22 ppm (Methane equivalent)

Full scale range is 50000 ppm of methane.

Detection limit 60 ppm.

Methane flux measurement range from 0.1 to 150 moles/m<sup>2</sup> per day.

The precision depends on the measured flux:

range	0.1	5	moles/ m <sup>2</sup> per day	±25%
	5	- 150	moles/ m <sup>2</sup> per day	±10%

The measurement of very low fluxes (< 0.1 moles/m<sup>2</sup>/day ) is possible but the error will increase due to the low detector sensitivity.



#### RS485 Connector DB9 Male panel

Pin 1	Gnd
Pin 2	+Power supply
Pin 3	Gnd
Pin 4	RS485 B
Pin 5	RS485 A
Pin 6	Gnd
Pin 7	+Power supply
Pin 8	Gnd
Pin 9	RS485 B

The gas fittings can be used with rilsan 6x4 mm tubes or silicon 5x3.2 tubes. Please respect inlet and outlet ports.

# LI-820 Specifications

## CO<sub>2</sub> Specifications

**Measurement Range:** 0-1000 ppm, 0-2000 ppm with 14 cm bench; 0-5000 ppm, 0-20000 ppm with 5 cm bench

**Accuracy:** < 2.5% of reading with 14 cm bench; 4% of reading with 5 cm bench

### Calibration Drift

<sup>1</sup>**Zero Drift:** < 0.15 ppm / °C

<sup>2</sup>**Span Drift at 370 ppm:** < 0.03% / °C

<sup>3</sup>**Total Drift at 370 ppm:** < 0.4 ppm / °C

**RMS Noise at 370 ppm with 1 sec Signal Filtering:** < 1 ppm

<sup>1</sup> Zero drift is the change with temperature at 0 concentration

<sup>2</sup> Span drift is the change after re-zeroing following a temperature change

<sup>3</sup> Total drift is the change with temperature without re-zeroing or re-spanning

**Measurement Principle:** Non-Dispersive Infrared

**Traceability:** Traceable gases to WMO standards from 0-3000 ppm. Traceable gases to EPA protocol gases from 3000 to 20000 ppm

**Pressure Compensation Range:** 15 kPa-115 kPa

**Maximum Gas Flow Rate:** 1 liter/minute

**Output Signals:** Two Analog Voltage (0-2.5 V or 0-5 V) and Two Current (4-20 mA)  
Digital: TTL (0-5 V) or Open Collector

**DAC Resolution:** 14-bits across user-specified range

**Source Life:** 18000 hours

**Power Requirements:** Input Voltage 12-30 VDC  
1.2A @ 12V (14 W) maximum during warm-up with heaters on  
0.3 A @ 12 V (3.6 W) average after warm-up with heaters on

**Supply Operating Range:** 12-30 VDC

**Operating Temperature Range:** -20 to 45 °C

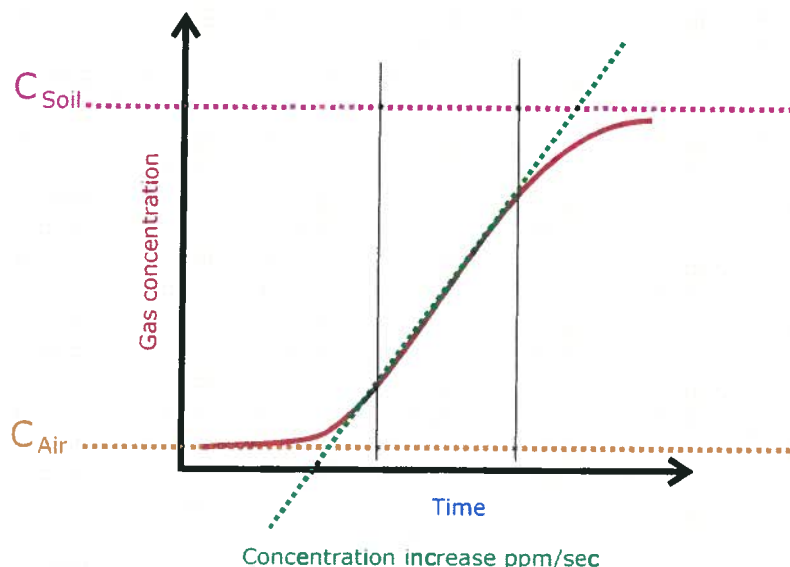
**Relative Humidity Range:** 0 to 95% RH, Non-Condensing

**Dimensions:** 8.75" x 6" x 3" (22.23 x 15.25 x 7.62 cm)

**Weight:** 2.2 lbs (1 kg)

## Quantifying the flux

How explained in the chapter 3 the flux is proportional to the concentration increase ratio ppm/sec. The proportionality factor depends on the chamber volume/surface ratio as well as the barometric pressure and the air temperature inside the accumulation chamber.



There are two methods to carry out the field work, in both cases for each measurement you have to record the type of accumulation chamber used, the barometric pressure, and the air temperature.

The variation of few mBar of the pressure and or few degrees of temperature do not affect the evaluation of flux very much, then you can use a mean value for both parameters. Of course that depends on the accuracy you want to reach for the evaluation of flux.

The instrument measures the barometric pressure, using the embedded pressure sensor of the LICOR, with a good accuracy. A platinum Pt100 or a thermo-couple thermometer can be used to measure the air temperature as well as the soil temperature.

### Choosing the flux measurement unit

The first measurements made, 10 years ago, with the accumulation chamber was expressed in cm/sec which is a speed, the speed of carbon dioxide flowing out from the soil. During the last ten years several units have been used by volcanologist and by geochemistry researchers. The most common unit is grams/squaremeter per day, but using the same instrument for two gas species to express the flux using this unit means to have two different conversion factors. Actually we use the unit **moles/squaremeter per day** that has two advantages: A single conversion factor for every gas specie and an easy conversion of the flux in grams/sm per day simply multiplying the result expressed in moles/sm per day for the molecular weight of the target gas.

From the [tools][settings] menu you can set the accumulation chamber factor in the "A.c.K." field.

If this factor is set to 1 the instrument will give you results expressed in ppm/sec, that's simply the slope of the curve in the selected interval.

If you set the A.c.K to a value different from 1 the instrument will give you the results expressed in moles per square meter per day.

Please see next page.



## Quantifying the flux

### Method 1: Measuring the slope

Set the Accumulation Chamber factor to 1 in order to have the flux measurement expressed in the slope unit "ppm/sec" and translate it in the desired unit with a post processing.

Using this method you can focus only on the accumulation chamber interfacing with the soil, the flux curve shape and the other aspects of the measurement, putting off choosing the correct accumulation chamber factor.

### Method 2: Measuring the flux directly in moles/sm/day.

To get the results directly in moles/sm/day you have to set the Accumulation Chamber factor to the correct value, taking it from the tables.

For each measurement, if there are variations in the air temperature, or of the barometric pressure, or if you changed the accumulation chamber you have to select the [tools][settings] menu and put the correct accumulation chamber factor in the "A.c.K." field. This operation can be "critical". In any case on the saved files you'll find the results of flux evaluation expressed in both units, the raw ppm/sec and the moles/sm/day computed with the A.c.K. you set.

### The accumulation chamber factors

Here following the formula used to compute the A.c.K. :

$$K = \frac{86400 \cdot P}{10^6 \cdot R \cdot T_k} \cdot \frac{V}{A}$$

Where

- **P** is the barometric pressure expressed in mBar (hPa)
- **R** is the gas constant 0.08314510 bar L K<sup>-1</sup> mol<sup>-1</sup>
- **T<sub>k</sub>** is the air temperature expressed in Kelvin degree
- **V** is the chamber net volume in cubic meters
- **A** is the chamber inlet net area in square meters.

The dimensions of the A.c.K. are

$$K = \frac{\text{moles} \cdot \text{meter}^{-2} \cdot \text{day}^{-1}}{\text{ppm} \cdot \text{sec}^{-1}}$$

In the table the conversion factors vs temperature and barometric pressure for the Accumulation Chamber Type A and B are reported.

### An example:

You're using the accumulation chamber B, the slope of the flux curve is 2.5 ppm/sec, the barometric pressure is 1008 mBar (hPa) and the air temperature is 22 °C.

From the table B get the value that correspond to the barometric pressure and temperature. In this case I get the value computed for 25°C and 1013 mBar : 0.696.

Then the flux is: 2.5 x 0.696 = 1.74 moles per square meter per day.

# Gasport® Gas Tester

**MSA**

The Gasport Gas Tester is designed for gas utility workers to detect methane and certain toxic gases. It is a reliable, simple, versatile tool to help your service technicians get the job done quickly! With multiple ranges and sensing capabilities built into one rugged housing, the Gasport Tester simplifies your work by reducing the number of meters you have to carry on the job.



## Applications

The Gasport Tester's poison-tolerant methane sensor provides three measurement ranges for your daily service needs:

- Open air, safety sampling
- Small, in-home leak detection
- Street/outdoor service line leak detection

## Features and Benefits

- **Proven in field use—rugged and reliable**  
Less costly to maintain, less time in repair
- **Multiple functions in one instrument**  
No need to buy, carry & maintain multiple instruments
- **New, poison-tolerant combustible gas sensor**  
Reduces meter ownership costs
- **User-selectable, "silent" operation mode**  
Reduces customer disturbances and worries
- **Fast warm up time**  
Fastest warm up time in industry saves time
- **Can monitor up to four gases at a time**  
Fewer instruments to carry
- **Show all gas concentrations simultaneously**  
Eliminates guesswork on what reading is displayed
- **Autoranging methane sensor**  
Automatically switches between 0-5% and 5-100% methane ranges
- **Gas readings recorded for later retrieval**  
Can double check readings after job is done
- **Simple manual or automated calibration options**  
Reduces training time and helps ensure accuracy
- **Intrinsically safe**  
Meets safety standards for work in hazardous areas
- **Lifetime warranty on case and electronics**  
Reduced maintenance and lifetime costs



## Specifications

Gas	Range	Resolution
Methane	0-5000 ppm	50 ppm
Methane	0-100% LEL or 0-5% CH <sub>4</sub>	1 % LEL or 0.1% CH <sub>4</sub>
Methane	5-100% CH <sub>4</sub>	1% CH <sub>4</sub>
Oxygen	0-25%	0.1%
Carbon Monoxide	0-1000 ppm	1 ppm
Hydrogen Sulfide	0-100 ppm	1 ppm

<b>Battery types:</b>	NiCd and Alkaline
<b>Case material:</b>	Impact resistant, stainless-steel-fiber-filled polycarbonate
<b>Operating temperature:</b>	normal -10 to 40°C; extended -20 to 50°C
<b>Operating humidity:</b>	Continuous: 15-95% RH, non-condensing Intermittent duty: 5-95% RH, non condensing
<b>Warm up time:</b>	Less than 20 seconds to initial readings
<b>Datalog capacity:</b>	12 hours
<b>Input:</b>	3 clearly marked, metal domed keys
<b>Warranty:</b>	Case and Electronics: Lifetime Sensors and consumable parts: 1 year

**The answer for gas utilities' gas detection needs**

# Gasport® Gas Tester

## Ordering Information

### Battery Chargers

Part No.	Description
494716	Omega 120 VAC 50/60Hz
495965	Omega 220 VAC 50/60Hz
801759	Omega 110/220 VAC, Five Unit, 50/60Hz
800525	Omega 8 - 24VDC for vehicle use

### Battery Packs

Part No.	Description
496990	Standard NiCd Rechargeable
800526	Alkaline, Type C
711041	Alkaline, with Thumbscrews
800527	Heavy Duty NiCd Rechargeable

### Sensors

Part No.	Description
813693	Combustible Gas
480566	O <sub>2</sub>
812389	CO
812390	H <sub>2</sub> S

### Protective Boots

Part No.	Description
804955	Black, for NiCd Battery Packs
802806	Orange, for NiCd Battery Packs
806751	Black, for Alkaline Battery Packs
806750	Orange, for Alkaline Battery Packs
806749	Black, for HD NiCd Battery Packs
806748	Orange, for HD NiCd Battery Packs
812833	Yellow Soft Carrying Case with Harness
711022	Black padded Vinyl Carrying Case with Harness

### Sampling Equipment

Part No.	Description
800332	Probe - 1 ft., plastic
800333	Probe - 3 ft., plastic
803561	Probe - 3 ft., plastic (holes 2" from end) (bar hole probe)
803962	Probe - 3 ft., plastic (holes 2" from handle) (solid probe)
803848	Probe - Hot Gas Sampler
710465	Sampling Line - 5 ft., coiled
497333	Sampling Line - 10 ft.
497334	Sampling Line - 15 ft.
497335	Sampling Line - 25 ft.

### Sampling Accessories

Part No.	Description
801582	Replacement Filter, Probe, pkg. of 10
801291	External Filter Holder
014318	Charcoal Filter
711039	Line Scrubber Filter Holder
711059	Line Scrubber Replacement Cartridges, Box of 12
808935	Dust Filter, Pump Module
802897	Water Trap (Teflon) Filter, Pump Module

### Calibration Check Equipment

Part No.	Description
477149	Calibration Kit Model RP with 0.25 lpm Regulator
491041	Calibration Gas - methane, 2.5%
473180	Calibration Gas - 300 ppm CO
813718	Calibration Gas - methane, 2.5% oxygen, 15% 60 ppm CO
813720	Calibration Gas - methane, 2.5% oxygen, 15% 300 ppm CO 10 ppm H <sub>2</sub> S
710288	Gasmiser™ Demand Regulator 0 - 3.0 lpm

### Accessories

Part No.	Description
804679	Data Docking Module Kit. Includes the Data Docking Module, MSA Link Software and Instruction Manual

## Approvals

The Gasport Gas Tester has been designed to meet intrinsic safety testing requirements in certain hazardous atmospheres.

The Gasport Gas Tester is approved by MET (an OSHA Nationally Recognized Testing Laboratory [NRTL]) for use in Class I, Division I, Groups A, B, C, D; Class II, Division I, Groups E, F, G; and Class III Hazardous locations. Gasport Gas Testers sold in Canada are approved by CSA for use in Class I, Division I, Groups A, B, C, and D locations.

Contact MSA at 1-800-MSA-2222 for more information or with questions regarding the status of approvals.

### Gasport Gas Tester Kits

	LEL Display	O <sub>2</sub>	CO	H <sub>2</sub> S	Alarms Always	Alarms Optional	Leak Detect Page	Peak	Alkaline Battery	NiCd Battery	5ft Coiled Line	1ft Probe	Part No.
4-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711489
4-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711490
3-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711493
3-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711494
2-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711495
2-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711496
4-Gas, Alarms On, NiCd	•	•	•	•	•	•	•	•	•	•	•	•	711491
4-Gas, Alarms On, Alkaline	•	•	•	•	•	•	•	•	•	•	•	•	711492

### Assemble-to-Order (ATO) System: You Make the Choices

The ATO System makes it easy to "custom order" the Gasport Gas Tester, configured exactly the way you want it. You can choose from an extensive line of base instrument components and accessories. To obtain a copy of the "ATO System and Price Information for the Gasport Gas Tester," call toll-free 1-800-MSA-2222, and request Bulletin 0804-28. To obtain a copy of the ATO via FAX, call MSA QuickLit Information Service at 1-800-672-9010. At the prompt, request QuickLit Document #2345 (ATO for Gasport Gas Tester).

**Note:** This Data Sheet contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.

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# QRAE II User's Guide



**Covers QRAE II Diffusion & Pump Models  
with Firmware Version 3.60 or higher**

# QRAE II User Guide

## 1.2 Specifications

### QRAE II Specifications

<b>Configuration</b>	Pumped or diffusion 4-gas with datalogging		
<b>Dimensions:</b>	Diffusion: 5" L x 2.8" W x 1.5" H (125mm x 72mm x 38mm)		
	Pump: 5" L x 2.8" W x 1.5" H (125mm x 72mm x 38mm)		
<b>Weight:</b>	Diffusion: 9 oz (250g)		
	Pump: 12 oz (350 g) with battery		
<b>Detectors:</b>	2 Electrochemical toxic gases sensors		
	1 Solid Polymer Electrolyte oxygen sensor		
	1 Catalytic sensor for combustible level organics		
<b>Battery:</b>	Rechargeable 3.7V Li-ion battery pack (6-hour charge time) or a 3 AA alkaline battery adapter.		
<b>Operating Time:</b>	Up to 10 hours continuous w/ Li-ion battery pack		
<b>Display:</b>	4-line graphical LCD with automatic LED backlight for dim lighting conditions		
<b>Keypad:</b>	2 programming/operation keys		
<b>Direct Readout:</b>	Up to 4 simultaneous values with sensor name, battery charge, high and low values for all sensors, elapsed time, and datalogging on/off state		
<b>Sampling Method:</b>	Diffusion or pumped (depending on model)		
<b>Range, Resolution &amp; Response Time:</b>	LEL	0-100%	1 % 15 sec
	O <sub>2</sub>	0-30%	0.1 % 20 sec
	CO	0-1000 ppm	1 ppm 25 sec
	H <sub>2</sub> S	0-100 ppm	0.1 ppm 30 sec
<b>Alarm Settings:</b>	Separate limits for TWA, STEL, High, Low		
<b>Alarms:</b>	≥95 dB @ 30 cm buzzer, flashing red LEDs, vibration alarm, LCD to indicate exceeded preset limits, low battery, or sensor failure		
<b>Calibration:</b>	Two-point field calibration for fresh air and standard reference gas		
<b>Protection:</b>	Password protected calibration settings, alarm limits, and data		
<b>Intrinsic Safety:</b>	CSA Class I, Division 1, Group A, B, C, D, T4 (US & Canada), SIRA ATEX II 2G Ex ia d II C T4 Gb (Europe), IECEx Ex d ia II C T4 Gb		
<b>EM Immunity:</b>	No effect when exposed to 0.43mW/cm <sup>2</sup> RF interference (5-watt transmitter at 12"/10cm).		
<b>Data Storage:</b>	64,000 readings (64 hours, 4 channels at 1 minute interval) in non-volatile memory.		
<b>Datalog Interval:</b>	Programmable 1- to 3,600-second intervals		
<b>Alarm Settings:</b>	Separate alarm limit settings for TWA, STEL, Low and High alarm.		
<b>Communication:</b>	Download data to PC and upload monitor setup from PC through an RS-232 link to PC serial port		
<b>Temperature:</b>	-20° C to 50° C (-4° F to 122° F)		
<b>Humidity:</b>	0% to 95% relative humidity (non-condensing)		

#### Caution:

Refer to RAE Systems Technical Note TN-114 for sensor cross-sensitivities.  
Refer to RAE Systems Technical Note TN-144 for LEL sensor poisoning.

# GeoXT

## The total GPS platform for all your GIS field requirements

The GeoXT™ handheld, from the GeoExplorer® series, is an essential tool for maintaining your GIS. It's all you need to collect location data, keep existing GIS information up to date, and even mobilize your GIS.

The unique GeoExplorer series combines a Trimble® GPS receiver with a rugged field-ready handheld computer running the Microsoft® Windows Mobile™ 2003 software for Pocket PCs. Plus there's an internal battery that easily lasts for a whole day of GPS operation. The result is tightly integrated, tough, and incredibly powerful.

### High-accuracy Integrated GPS

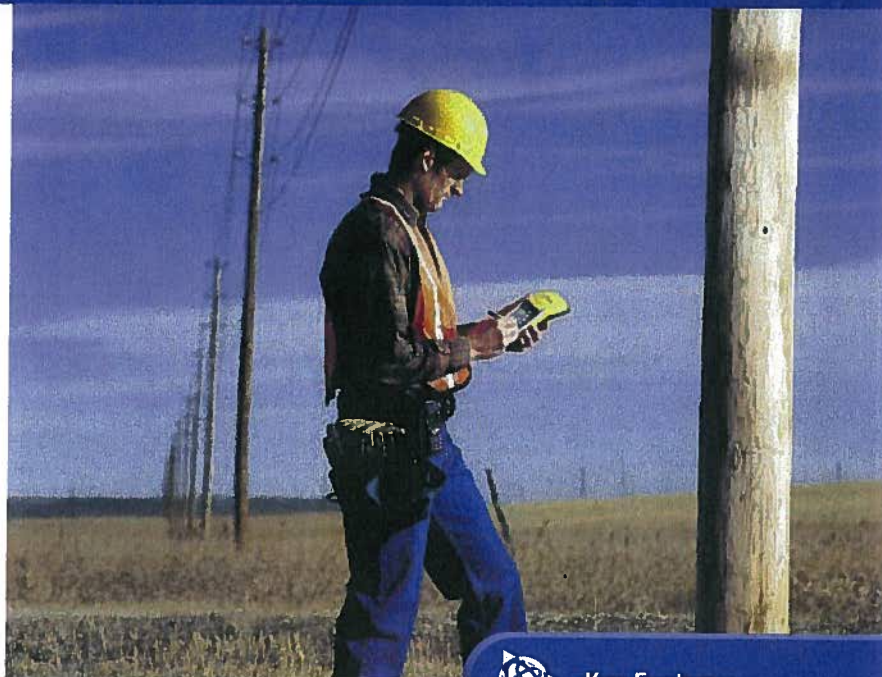
The GeoXT is optimized to provide the reliable, high-accuracy location data you need. Advanced features like EVEREST™ multipath rejection technology let you work under canopy, in urban canyons, or anywhere where accuracy is crucial.

Need submeter accuracy in real-time? Use corrections from a satellite-based augmentation system (SBAS) like WAAS<sup>1</sup> or EGNOS<sup>2</sup>. Want to get that extra edge in precision? Collect data with Trimble's TerraSync™ or GPSCorrect™ software, and then postprocess back in the office.

Because the GPS receiver and antenna are built into the handheld computer, it's never been easier to use GPS in your application. The system is more than just cable-free: it's a totally integrated solution.

### Optimized productivity

Take advantage of the power and flexibility of Windows Mobile software for Pocket PCs by choosing from the most comprehensive range of field software available—whether off-the-shelf or purpose-built. Whatever your needs, Windows



### Key Features

- High-performance submeter GPS with integrated WAAS/EGNOS
- Windows Mobile 2003 software for Pocket PCs, allowing maximum flexibility in software choice
- Rugged handheld with all-day battery
- Advanced color TFT display with backlight
- Integrated Bluetooth for wireless connectivity

Mobile lets you choose a software solution to match your workflow.

Windows Mobile includes familiar Microsoft productivity tools, including Pocket Word, Pocket Excel, and Pocket Outlook®. Pocket Outlook lets you synchronize e-mails, contacts, appointments, and data with your office computer, so whether you're in the office or in the field, you're always up to date.

Go wireless with integrated Bluetooth®\* for connection to other Bluetooth-enabled devices, including cell phones and PCs. You also have the option to use the USB support module to connect to a desktop computer, or use the optional serial clip for cabled connections in the field.

Receive a free copy of Microsoft Streets & Trips\*\* 2004 software with your GeoXT handheld, and take advantage of comprehensive map and travel information for easy navigation and route planning.

### All the memory you need

There's plenty of storage space in the GeoXT for all your GIS data. The fast processor and large memory mean even big graphics files load quickly—and they're crisp and crystal-clear on the advanced TFT outdoor color screen.

From data collection to data maintenance, to mobile GIS and beyond ... the GeoXT is the handheld of choice.

\* Bluetooth type approvals are country specific. GeoExplorer series handhelds are approved for use with Bluetooth in the USA. For a complete list of other countries with Bluetooth approval please refer to: [www.trimble.com/geo\\_bluetooth.html](http://www.trimble.com/geo_bluetooth.html).  
\*\* Microsoft Streets & Trips 2004 software available in US/Canada; Microsoft AutoRoutes® 2004 in Europe.





# GeoXT

## The total GPS platform for all your GIS field requirements

### Standard features

#### System

- Microsoft Windows Mobile 2003 software for Pocket PCs
- 206 MHz Intel StrongARM processor
- 512 MB non-volatile Flash data storage
- Outdoor color display
- Ergonomic cable-free handheld
- Rugged and water-resistant design
- All-day internally rechargeable battery
- Bluetooth wireless

#### GPS

- Submeter accuracy
- Integrated WAAS<sup>1</sup>/EGNOS<sup>2</sup>
- RTCM real-time correction support
- NMEA and TSIP protocol support
- EVEREST multipath rejection technology

#### Software

- GPS Controller for control of Integrated GPS and in-field mission planning
- GPS Connector for connecting Integrated GPS to external ports
- File Explorer, Internet Explorer, Pocket Outlook (Inbox, Calendar, Contacts, Tasks, Notes), Sprite Pocket Backup, Transcriber, Pocket Word, Pocket Excel, Pictures, Windows<sup>®</sup> Media Player, Bluetooth File Transfer, Calculator, ActiveSync<sup>®</sup>
- Microsoft Streets & Trips/AutoRoute 2004 software

#### Accessories

- Support module with power supply and USB data cable
- Getting Started Guide
- Companion CD Includes Outlook 2002 and ActiveSync 3.7.1
- Hand strap
- Pouch
- Stylus

### Optional Features

#### Software

- TerraSync
- GPScorrect for ESRI<sup>®</sup> ArcPad<sup>®</sup>
- GPS Pathfinder<sup>®</sup> Tools Software Development Kit (SDK)
- GPS Pathfinder Office
- Trimble GPS Analyst extension for ArcGIS<sup>®</sup>

#### Accessories

- Serial clip for field data and power input
- Vehicle power adaptor<sup>3</sup>
- Portable power kit<sup>3</sup>
- Hurricane antenna
- External patch antenna
- Pole-mountable ground plane
- Baseball cap with antenna sleeve
- Beacon-on-a-Belt (BoB<sup>™</sup>) differential correction receiver<sup>3</sup>
- Hard carry case
- Null modem cable<sup>3</sup>
- Backpack kit

Specifications subject to change without notice.

### Technical specifications

#### Physical

Size	21.5 cm × 9.9 cm × 7.7 cm (8.5 in × 3.9 in × 3.0 in)
Weight	0.72 kg (1.59 lb) with battery
Processor	206 MHz Intel StrongARM SA-1110
Memory	64 MB RAM and 512 MB Internal Flash disk
Power	
Low (no GPS)	0.6 Watts
Normal (with GPS)	1.4 Watts
High (with GPS, backlight, and Bluetooth)	2.5 Watts
Battery	Internal lithium-Ion, rapidly rechargeable in unit, 21 Watt-hours

#### Environmental

##### Temperature

Operating	-10 °C to +50 °C (14 °F to 122 °F)
Storage	-20 °C to +70 °C (-4 °F to 158 °F)

Humidity . . . . . 99% non-condensing

Casing . . . . . Wind-driven rain and dust-resistant per IP 54 standard  
Slip-resistant grip, shock- and vibration-resistant

#### Input/output

Communications . . . . . Bluetooth for wireless connectivity  
USB via support module, serial via optional DE9 serial clip adaptor

#### Bluetooth

Certification . . . . . Bluetooth type approvals are country specific.  
GeoExplorer series handhelds are approved for use with Bluetooth in the USA.  
For a complete list of other countries with Bluetooth approval please refer to [www.trimble.com/geoxt\\_ts.asp](http://www.trimble.com/geoxt_ts.asp).

#### Profiles

Both client and host support . . . . . Serial Port, File Transfer (using OBEX)  
Client support only . . . . . Dial-Up Networking, Lan Access  
Host support only . . . . . Basic Imaging, Object Push

Display . . . . . Advanced outdoor TFT, 240 × 320 pixel, 65,536 colors, with backlight

Audio . . . . . Microphone and half duplex speaker, record and playback utilities

Interface . . . . . Anti-glare coated touch screen, Soft Input Panel (SIP) virtual keyboard  
2 hardware control keys plus 4 programmable permanent touch buttons

Handwriting recognition software, Audio system events, warnings, and notifications

#### GPS

Channels . . . . . 12

Integrated real-time . . . . . WAAS<sup>1</sup> or EGNOS<sup>2</sup>

Update rate . . . . . 1 Hz

Time to first fix . . . . . 30 sec (typical)

Protocols . . . . . NMEA (GGA, VTG, GLL, GSA, ZDA, GSV, RMC),  
TSIP (Trimble Standard Interface Protocol)

### Accuracy (RMS)<sup>4</sup> after differential correction

Postprocessed<sup>5</sup> . . . . . Submeter

Carrier postprocessed<sup>6</sup> . . . . . Submeter

With 10 minutes tracking satellites . . . . . 30 cm

Real-time . . . . . Submeter

<sup>1</sup> WAAS (Wide Area Augmentation System). Available in North America only.

For more information, see <http://gps.faa.gov/programs/index.htm>.

<sup>2</sup> EGNOS (European Geostationary Navigation Overlay System). Available in Europe only.

For more information, see <http://www.esa.int/export/esaSA/navigation.html>.

<sup>3</sup> Serial clip also required.

<sup>4</sup> Horizontal accuracy. Requires data to be collected with minimum of 4 satellites, maximum PDOP of 6, minimum SNR of 4, minimum elevation of 15 degrees, and reasonable multipath conditions. Ionospheric conditions, multipath signals or obstruction of the sky by buildings or heavy tree canopy may degrade precision by interfering with signal reception. Accuracy varies with proximity to base station by +1 ppm for postprocessing and real-time, and by +5 ppm for carrier postprocessing.

<sup>5</sup> Postprocessing with GPS Pathfinder Office software or GPS Analyst extension for ArcGIS.

<sup>6</sup> Requires collection of carrier data. (Only available with the GPS Pathfinder Office software).

#### NORTH & SOUTH AMERICA

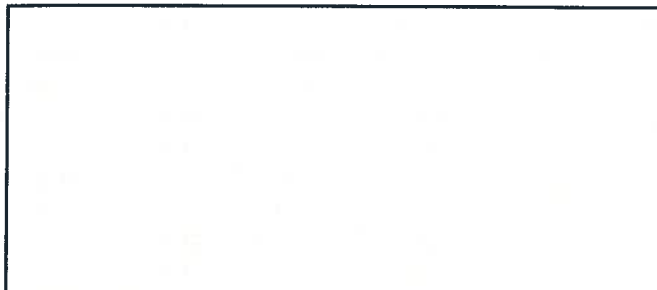
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# Operator's Manual

## SMARTROLL™ MP Handheld Instrument

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## General Specifications

Operating temperature	-5 to 50° C (23 to 122° F)
Storage temperature	-40 to 65° C (-40 to 149° F)
Dimensions	4.7 cm (1.85 in.) OD x 26.9 cm (10.6 in.) with restrictor installed (does not include connector)
Weight	694 g (1.53 lbs)
Wetted materials	PVC, 316 stainless steel, titanium, Acetal, Viton®, PC/PMMA
Environmental rating	IP68 with all sensors and cable attached. IP67 with sensors removed and cable detached.
Reading rate	1 reading every 10 seconds; data logged to smartphone.
Power	6 VDC from battery pack
Interface	iPhone® 4S, iPod touch® 5, or iPad® 3, 4, mini or later; iOS 6.0 or later. Bluetooth® Low Energy (BLE) radio. Purchase the iSitu™ App at the Apple® App Store.
Cable	Black polyurethane. Standard lengths available: 1.5 m, 4.6 m, 9.1 m, 30.5 m (5 ft, 15 ft, 30 ft, 100 ft)
Warranty	2-years
Notes	Specifications are subject to change without notice. Apple, iPhone, iPod touch, and iPad are trademarks of Apple Inc. registered in U.S. and other countries. Bluetooth is a registered trademark of Bluetooth SIG, Inc. Viton is a registered trademark of DuPont Performance Elastomers L.L.C.

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## Sensor Specifications

### Level, Depth, Pressure Sensor Specifications

Accuracy	Typical $\pm 0.1\%$ FS @ $15^{\circ}\text{C}$ ; $\pm 0.3\%$ FS max. from 0 to $50^{\circ}\text{C}$
Range	76 m (250 ft); absolute (non-vented)
Resolution	$\pm 0.01\%$ FS or better
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	Pressure: psi, kPa, bar, mbar, mmHg, inHg Level: mm, cm, m, in, ft
Methodology	Piezoresistive; ceramic

### Barometric Pressure Sensor Specifications (Battery Pack)

Accuracy	$\pm 3$ mbar max.
Range	300 to 1100 mbar
Resolution	0.01 mbar
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	psi, kPa, bar, mbar, mmHg, inHg, Torr, atm
Methodology	Piezoresistive pressure sensor

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## Conductivity Sensor Specifications

Accuracy	Typical $\pm 0.5\%$ + 1 $\mu\text{S}/\text{cm}$ ; $\pm 1\%$ max.
Range	5 to 100,000 $\mu\text{S}/\text{cm}$
Resolution	0.1 $\mu\text{S}/\text{cm}$
Sensor Type	Fixed
Response Time	Instantaneous in thermal equilibrium
Units of Measure	Actual conductivity ( $\mu\text{S}/\text{cm}$ , $\text{mS}/\text{cm}$ ) Specific conductivity ( $\mu\text{S}/\text{cm}$ , $\text{mS}/\text{cm}$ ) Salinity (PSU) Total dissolved solids (ppt, ppm) Resistivity (Ohms-cm) Density ( $\text{g}/\text{cm}^3$ )
Methodology	Std. Methods 2510 EPA 120.1

## Dissolved Oxygen RDO Fast Cap (Optical Sensor) Specifications

Accuracy	$\pm 0.1$ mg/L; $\pm 0.2$ mg/L; $\pm 10\%$ of reading
Range	0 to 8 mg/L; 8 to 20 mg/L; 20 to 50 mg/L; Full operating range: 0 to 50 mg/L
Resolution	0.01 mg/L
Sensor Type	Fixed with replaceable RDO Fast Cap (life: 1 year typical)
Response Time	T90: <30 sec. T95: <45 sec.
Units of Measure	mg/L, % saturation, ppm
Methodology	EPA-approved In-Situ Methods 1002-8-2009 1003-8-2009 1004-8-2009

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## ORP Sensor Specifications

Accuracy	±5.0 mV
Range	±1400 mV
Resolution	0.1 mV
Sensor Type	Replaceable pH/ORP combo sensor
Response Time	<15 sec.
Units of Measure	mV
Methodology	Std. Methods 2580

## pH Sensor Specifications

Accuracy	±0.1 pH unit from 0 to 12 pH units
Range	0 to 14 pH units
Resolution	0.01 pH unit
Sensor Type	Replaceable pH/ORP combo sensor
Response Time	<15 sec., pH 7 to pH 4
Units of Measure	pH units
Methodology	Std. Methods 4500-H+ EPA 150.2

## Air Temperature Sensor Specifications (Battery Pack)

Accuracy	±2° C
Range	-20 to 70° C (-4 to 158° F)
Resolution	0.1° C
Sensor Type	Fixed
Response Time	<30 sec.
Units of Measure	Celsius, Fahrenheit
Methodology	EPA 170.1

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## Sample Temperature Sensor Specifications (Probe)

Accuracy	±0.1° C
Range	-5 to 50° C (23 to 122° F)
Resolution	0.01° C or better
Sensor Type	Fixed
Response Time	<30 sec.
Units of Measure	Celsius, Fahrenheit
Methodology	EPA 170.1

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## Battery Pack Specifications

Battery Type	Four 1.5V AA lithium or alkaline batteries
Operating temperature	-5 to 50° C (23 to 122° F); 95% relative humidity, non-condensing
Storage temperature	-40 to 65° C (-40 to 149° F); 95% relative humidity, non-condensing
Dimensions & weight	9.5 x 7.6 x 5.7 cm (3.75 x 3 x 2.25 in.) (H x D x W). Weight: 165 g (5.8 oz)
Materials	PC/ABS
Environmental rating	IP67 with battery cover closed
Output options	BLE radio
Battery type	4 AA Lithium or Alkaline
Warranty on battery pack	1-year
Warranty on cable	1-year

## **APPENDIX B**

### **FLUX METER DATA**



## Individual Flux Measurements and Calculations

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepAreaL-1021082720_01	1174242	3178846	A	786.5	43.8	8/27/2020	-0.49	-0.016	-0.09	0.2320914	0.000000	0.000000	0.000000
SeepAreaL-1021082720_02	1174217	3178913	A	786.5	43.9	8/27/2020	0	-0.005	0.211	0.2320182	0.000000	0.000000	0.048956
SeepAreaL-1021082720_03	1174023	3178874	A	786.5	44.0	8/27/2020	-0.642	-0.026	0.619	0.2319451	0.000000	0.000000	0.143574
SeepAreaL-1021082720_04	1173984	3178887	A	786.5	44.1	8/27/2020	0	-0.021	0.272	0.2318719	0.000000	0.000000	0.063069
SeepAreaL-1021082720_05	1173969	3178830	A	787.6	44.1	8/27/2020	-0.073	-0.017	0.09	0.2321962	0.000000	0.000000	0.020898
SeepAreaL-1021082720_06	1173974	3178794	A	787.6	44.2	8/27/2020	-0.117	-0.017	0.251	0.2321231	0.000000	0.000000	0.058263
SeepAreaL-1021082720_07	1174028	3178830	A	787.5	44.3	8/27/2020	-0.296	-0.017	0.19	0.2320205	0.000000	0.000000	0.044084
SeepAreaL-1021082720_08	1174027	3178777	A	787.5	44.3	8/27/2020	-0.443	-0.012	0.041	0.2320205	0.000000	0.000000	0.009513
SeepAreaL-1021082720_09	1174022	3178731	A	787.4	44.4	8/27/2020	0	-0.021	1.133	0.231918	0.000000	0.000000	0.262763
SeepAreaL-1021082720_10	1174018	3178671	A	787.5	44.6	8/27/2020	0	-0.017	0.218	0.2318014	0.000000	0.000000	0.050533
SeepAreaL-1021082720_11	1174022	3178615	A	787.4	44.7	8/27/2020	-0.002	-0.009	0.352	0.2316991	0.000000	0.000000	0.081558
SeepAreaL-1021082720_12	1174020	3178564	A	787.4	44.8	8/27/2020	0	-0.015	0.083	0.2316262	0.000000	0.000000	0.019225
SeepAreaL-1021082720_13	1174003	3178573	A	787.5	44.9	8/27/2020	0	-0.019	0.124	0.2315828	0.000000	0.000000	0.028716
SeepAreaL-1021082720_14	1173982	3178635	A	787.5	45.2	8/27/2020	-0.555	-0.01	0.247	0.2313645	0.000000	0.000000	0.057147
SeepAreaL-1021082720_15	1173967	3178677	A	787.6	45.4	8/27/2020	-0.269	-0.021	0.735	0.2312486	0.000000	0.000000	0.169968
SeepAreaL-1021082720_16	1173963	3178718	A	787.9	45.5	8/27/2020	0	-0.032	3.72	0.2312641	0.000000	0.000000	0.860303

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepAreaL-1021082720_17	1173935	3178818	A	788.0	45.6	8/27/2020	42.328	0.003	5.361	0.2312209	9.787119	0.000694	1.239575
SeepAreaL-1021082720_18	1173924	3178869	A	788.1	45.7	8/27/2020	11.268	0.004	6.207	0.2311777	2.604911	0.000925	1.434920
SeepAreaL-1021082720_19	1173918	3178894	A	787.9	45.8	8/27/2020	-0.136	-0.006	0.458	0.2310466	0.000000	0.000000	0.105819
SeepAreaL-1021082720_20	1173864	3178874	A	788.1	45.9	8/27/2020	-0.586	-0.032	0.485	0.2310328	0.000000	0.000000	0.112051
SeepAreaL-1021082720_21	1173878	3178820	A	788.1	45.9	8/27/2020	-0.258	-0.014	0.556	0.2310328	0.000000	0.000000	0.128454
SeepAreaL-1021082720_22	1173893	3178774	A	788.1	46.0	8/27/2020	0	-0.003	0.06	0.2309604	0.000000	0.000000	0.013858
SeepAreaL-1021082720_23	1173902	3178713	A	788.1	46.0	8/27/2020	-0.128	-0.001	0.6	0.2309604	0.000000	0.000000	0.138576
SeepAreaL-1021082720_24	1173916	3178661	A	788.1	46.0	8/27/2020	0	-0.003	1.749	0.2309604	0.000000	0.000000	0.403950
SeepAreaL-1021082720_25	1173929	3178610	A	788.1	46.1	8/27/2020	0	-0.014	4.407	0.2308881	0.000000	0.000000	1.017524
SeepAreaL-1021082720_26	1173942	3178563	A	788.1	46.1	8/27/2020	0	-0.011	2.279	0.2308881	0.000000	0.000000	0.526194
SeepAreaL-1021082720_27			A	788.1	46.3	8/27/2020	-0.298	-0.001	0.464	0.2307435	0.000000	0.000000	0.107065
SeepAreaL-1021082720_28			A	788.1	46.5	8/27/2020	-3.4	-0.04	0.589	0.2305992	0.000000	0.000000	0.135823
L1030Rule608_01	1146309	3164658	A	780.6	30.7	8/24/2020	-0.026	-0.007	0.541	0.2402816	0.000000	0.000000	0.129992
L1030Rule608_02	1146250	3164668	A	780.3	31.2	8/24/2020	0	-0.002	0.808	0.2397946	0.000000	0.000000	0.193754
L1030Rule608_03	1146204	3164676	A	780.2	31.6	8/24/2020	0	-0.001	0.383	0.2394492	0.000000	0.000000	0.091709
L1030Rule608_04	1146212	3164711	A	780.1	31.9	8/24/2020	0	-0.006	0.528	0.239183	0.000000	0.000000	0.126289
L1030Rule608_05	1146253	3164721	A	780.2	32.3	8/24/2020	14.392	0.002	2.955	0.2389004	3.438255	0.000478	0.705951
L1030Rule608_06	1146250	3164756	A	780.2	32.6	8/24/2020	4.892	-0.001	1.319	0.238666	1.167554	0.000000	0.314800

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
L1030Rule608_07	1146268	3164755	A	780.4	32.9	8/24/2020	33.616	-0.005	1.668	0.2384932	8.017187	0.000000	0.397807
L1030Rule608_08	1146206	3164778	A	780.2	33.2	8/24/2020	0	-0.002	0.406	0.2381986	0.000000	0.000000	0.096709
L1030Rule608_09	1146196	3164821	A	780.2	33.4	8/24/2020	0	-0.004	0.681	0.2380432	0.000000	0.000000	0.162107
L1030Rule608_10	1146085	3164873	A	780.1	33.5	8/24/2020	-1.486	-0.003	0.063	0.2379351	0.000000	0.000000	0.014990
L1030Rule608_11	1146263	3164818	A	779.9	33.7	8/24/2020	0	-0.005	0.187	0.2377719	0.000000	0.000000	0.044453
L1030Rule608_12	1146305	3164807	A	780.8	33.8	8/24/2020	0	-0.001	1.552	0.2379158	0.000000	0.000000	0.369245
L1030Rule608_13	1146359	3164820	A	780.8	33.9	8/24/2020	0	-0.004	0.765	0.2378383	0.000000	0.000000	0.181946
L1030Rule608_14	1146347	3164762	A	780.8	34.1	8/24/2020	-0.244	-0.003	0.87	0.2376835	0.000000	0.000000	0.206785
L1030Rule608_15	1146314	3164759	A	780.8	34.2	8/24/2020	37.071	0.004	3.542	0.2376062	8.808298	0.000950	0.841601
L1030Rule608_16	1146312	3164728	A	780.8	34.3	8/24/2020	8.244	-0.001	0.331	0.2375289	1.958188	0.000000	0.078622
L1030Rule608_17	1146359	3164714	A	783.2	34.4	8/24/2020	0	-0.001	1.197	0.2381815	0.000000	0.000000	0.285103
L1030Rule608_18	1146357	3164662	A	780.8	34.4	8/24/2020	0	0	0.179	0.2374516	0.000000	0.000000	0.042504
SeepArea32&L104 9082520_01	1174872	3176140	A	790.0	26.1	8/25/2020	-0.43	-0.006	0.409	0.246913	0.000000	0.000000	0.100987
SeepArea32&L104 9082520_02	1174879	3176078	A	790.2	26.7	8/25/2020	-2.695	-0.001	0.386	0.2464814	0.000000	0.000000	0.095142
SeepArea32&L104 9082520_03	1174885	3175936	A	790.3	27.4	8/25/2020	-0.236	-0.002	1.231	0.2459384	0.000000	0.000000	0.302750
SeepArea32&L104 9082520_04	1174905	3175835	A	790.2	28.1	8/25/2020	0	-0.002	0.96	0.2453359	0.000000	0.000000	0.235522
SeepArea32&L104 9082520_05	1174973	3175828	A	790.6	29.3	8/25/2020	0	-0.001	1.55	0.2444862	0.000000	0.000000	0.378954
SeepArea32&L104 9082520_06	1174975	3175948	A	790.1	30.0	8/25/2020	9.429	0.006	5.451	0.2437674	2.298483	0.001463	1.328776
SeepArea32&L104 9082520_07	1174955	3176052	A	789.9	30.7	8/25/2020	11.022	0.009	2.327	0.2431442	2.679936	0.002188	0.565797



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_08	1174959	3176156	A	789.9	31.3	8/25/2020	-0.539	-0.007	4.871	0.2426651	0.000000	0.000000	1.182021
SeepArea32&L104 9082520_09	1175094	3176137	A	789.9	32.2	8/25/2020	-0.548	-0.002	0.208	0.2419498	0.000000	0.000000	0.050326
SeepArea32&L104 9082520_10	1175083	3176079	A	788.4	32.7	8/25/2020	0	-0.008	4.331	0.2410956	0.000000	0.000000	1.044185
SeepArea32&L104 9082520_11	1175074	3175949	A	788.6	33.4	8/25/2020	0	-0.005	0.503	0.2406061	0.000000	0.000000	0.121025
SeepArea32&L104 9082520_12	1175055	3175866	A	789.0	34.2	8/25/2020	0	-0.002	0.766	0.2401015	0.000000	0.000000	0.183918
SeepArea32&L104 9082520_13	1175173	3175935	A	787.6	35.2	8/25/2020	0	-0.006	0.601	0.2388982	0.000000	0.000000	0.143578
SeepArea32&L104 9082520_14	1175255	3175934	A	787.5	36.0	8/25/2020	0	-0.001	0.019	0.2382497	0.000000	0.000000	0.004527
SeepArea32&L104 9082520_15	1175281	3176028	A	786.5	36.5	8/25/2020	0	-0.007	0.23	0.237563	0.000000	0.000000	0.054639
SeepArea32&L104 9082520_16	1175325	3176045	A	786.7	36.8	8/25/2020	0	-0.005	0.824	0.2373934	0.000000	0.000000	0.195612
SeepArea32&L104 9082520_17	1175358	3176004	A	786.3	37.2	8/25/2020	0	-0.006	0.34	0.2369669	0.000000	0.000000	0.080569
SeepArea32&L104 9082520_18	1175442	3176064	A	785.9	37.6	8/25/2020	-0.848	-0.009	0.585	0.2365415	0.000000	0.000000	0.138377
SeepArea32&L104 9082520_19	1175470	3175895	A	785.1	38.1	8/25/2020	-0.565	-0.007	0.235	0.2359211	0.000000	0.000000	0.055441
SeepArea32&L104 9082520_20	1175477	3176155	A	784.4	38.6	8/25/2020	0	-0.013	0.438	0.2353327	0.000000	0.000000	0.103076
SeepArea32&L104 9082520_21	1175440	3176170	A	784.9	39.0	8/25/2020	0	-0.007	0.551	0.2351809	0.000000	0.000000	0.129585
SeepArea32&L104 9082520_22	1175390	3176239	A	785.1	39.4	8/25/2020	-0.408	-0.012	0.799	0.2349398	0.000000	0.000000	0.187717
SeepArea32&L104 9082520_23	1175388	3176323	A	785.8	39.8	8/25/2020	0	-0.015	1.179	0.2348487	0.000000	0.000000	0.276887

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_24	1175303	3176184	A	786.8	40.2	8/25/2020	0	-0.013	1.341	0.2348474	0.000000	0.000000	0.314930
SeepArea32&L104 9082520_25	1175267	3176265	A	787.4	40.5	8/25/2020	0	-0.012	0.47	0.2348017	0.000000	0.000000	0.110357
SeepArea32&L104 9082520_26	1175258	3176315	A	787.4	40.7	8/25/2020	0	-0.016	0.24	0.2346521	0.000000	0.000000	0.056316
SeepArea32&L104 9082520_27	1175199	3176355	A	787.4	41.1	8/25/2020	-1.49	-0.019	1.546	0.2343534	0.000000	0.000000	0.362310
SeepArea32&L104 9082520_28	1175193	3176294	A	788.0	41.3	8/25/2020	0	-0.022	2.108	0.2343828	0.000000	0.000000	0.494079
SeepArea32&L104 9082520_29	1175203	3176235	A	788.0	41.6	8/25/2020	0	-0.013	1.783	0.2341594	0.000000	0.000000	0.417506
SeepArea32&L104 9082520_30	1175192	3176159	A	788.3	41.8	8/25/2020	0	-0.017	1.101	0.2340998	0.000000	0.000000	0.257744
SeepArea32&L104 9082520_31	1175179	3176073	A	788.0	42.1	8/25/2020	-0.573	-0.018	1.389	0.233788	0.000000	0.000000	0.324732
SeepArea32&L104 9082520_32	1175087	3176265	A	788.2	42.5	8/25/2020	0	-0.02	0.332	0.233551	0.000000	0.000000	0.077539
SeepArea32&L104 9082520_33	1174977	3176264	A	789.3	42.8	8/25/2020	-0.511	-0.017	1.162	0.2336549	0.000000	0.000000	0.271507
SeepArea32&L104 9082520_34	1174865	3176268	A	789.9	43.1	8/25/2020	0	-0.005	0.051	0.2336107	0.000000	0.000000	0.011914
SeepArea32&L104 9082520_35	1174882	3176347	A	790.1	43.4	8/25/2020	0	-0.006	0.311	0.2334484	0.000000	0.000000	0.072602
SeepArea32&L104 9082520_36	1174968	3176345	A	789.8	43.6	8/25/2020	0	-0.02	0.115	0.2332124	0.000000	0.000000	0.026819
SeepArea32&L104 9082520_37	1175073	3176345	A	789.4	43.9	8/25/2020	0	-0.017	0.237	0.2328737	0.000000	0.000000	0.055191
SeepArea32&L104 9082520_38	1175086	3176440	A	789.1	44.2	8/25/2020	0	-0.004	4.942	0.2325652	0.000000	0.000000	1.149337
SeepArea32&L104 9082520_39	1175179	3176468	A	789.3	44.3	8/25/2020	0	-0.025	3.663	0.2325508	0.000000	0.000000	0.851834

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_40	1175271	3176459	A	789.3	44.5	8/25/2020	0	-0.012	0.742	0.2324044	0.000000	0.000000	0.172444
SeepArea32&L104 9082520_41	1175336	3176533	A	788.9	44.7	8/25/2020	0	-0.025	0.53	0.2321405	0.000000	0.000000	0.123034
SeepArea32&L104 9082520_42	1175441	3176560	A	789.0	45.0	8/25/2020	-0.511	-0.032	0.051	0.231951	0.000000	0.000000	0.011829
SeepArea32&L104 9082520_43	1175474	3176658	A	788.7	45.3	8/25/2020	-0.299	-0.028	0.666	0.2316443	0.000000	0.000000	0.154275
SeepArea32&L104 9082520_44	1175377	3176668	A	788.3	45.6	8/25/2020	-0.893	-0.032	2.859	0.231309	0.000000	0.000000	0.661312
SeepArea32&L104 9082520_45	1175351	3176769	A	788.2	45.8	8/25/2020	-0.344	-0.02	0.371	0.2311346	0.000000	0.000000	0.085751
SeepArea32&L104 9082520_46	1175450	3176756	A	787.0	45.9	8/25/2020	-0.555	-0.014	0.058	0.2307104	0.000000	0.000000	0.013381
SeepArea32&L104 9082520_47	1175417	3176809	A	786.5	45.9	8/25/2020	-0.808	-0.032	1.001	0.2305638	0.000000	0.000000	0.230794
SeepArea32&L104 9082520_48	1175349	3176859	A	785.8	45.9	8/25/2020	-0.185	-0.038	0.537	0.2303586	0.000000	0.000000	0.123703
SeepArea32&L104 9082520_49	1175277	3176951	A	785.5	45.8	8/25/2020	-0.687	-0.027	0.422	0.2303428	0.000000	0.000000	0.097205
SeepArea32&L104 9082520_50	1175220	3177038	A	785.2	45.7	8/25/2020	-0.35	-0.025	0.295	0.2303271	0.000000	0.000000	0.067946
SeepArea32&L104 9082520_51	1175175	3177159	A	785.4	45.5	8/25/2020	-0.1	-0.034	1.638	0.2305303	0.000000	0.000000	0.377609
SeepArea32&L104 9082520_52	1175121	3177231	A	785.4	45.5	8/25/2020	-0.404	-0.023	0.31	0.2305303	0.000000	0.000000	0.071464
SeepArea32&L104 9082520_53	1175104	3177179	A	785.6	45.4	8/25/2020	-0.436	-0.03	0.647	0.2306614	0.000000	0.000000	0.149238
SeepArea32&L104 9082520_54	1175081	3177051	A	785.8	45.4	8/25/2020	-0.426	-0.025	1.822	0.2307201	0.000000	0.000000	0.420372
SeepArea32&L104 9082520_55	1175070	3176964	A	787.3	45.5	8/25/2020	6.843	0.008	1.534	0.231088	1.581335	0.001849	0.354489



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_56	1175078	3176860	A	787.8	45.6	8/25/2020	-0.427	-0.034	1.101	0.2311622	0.000000	0.000000	0.254510
SeepArea32&L104 9082520_57	1175192	3176941	A	787.8	45.8	8/25/2020	-0.059	-0.046	1.12	0.2310173	0.000000	0.000000	0.258739
SeepArea32&L104 9082520_58	1175193	3176852	A	786.2	46.1	8/25/2020	-0.072	-0.035	1.632	0.2303315	0.000000	0.000000	0.375901
SeepArea32&L104 9082520_59	1175157	3176774	A	787.1	46.3	8/25/2020	-1.549	-0.034	5.175	0.2304507	0.000000	0.000000	1.192583
SeepArea32&L104 9082520_60	1175202	3176773	A	787.5	46.5	8/25/2020	3.631	0.02	3.64	0.2304236	0.836668	0.004608	0.838742
SeepArea32&L104 9082520_61	1175246	3176764	A	787.4	46.7	8/25/2020	6.846	0.007	1.128	0.2302503	1.576293	0.001612	0.259722
SeepArea32&L104 9082520_62	1175300	3176727	A	787.3	47.0	8/25/2020	15.645	0.01	2.155	0.2300053	3.598433	0.002300	0.495661
SeepArea32&L104 9082520_63	1175284	3176628	A	787.4	47.3	8/25/2020	0	-0.046	0.931	0.2298192	0.000000	0.000000	0.213962
SeepArea32&L104 9082520_64	1175263	3176560	A	788.2	47.4	8/25/2020	0	-0.029	2.564	0.2299809	0.000000	0.000000	0.589671
SeepArea32&L104 9082520_65	1175167	3176562	A	790.5	47.5	8/25/2020	-0.361	-0.002	0.154	0.2305801	0.000000	0.000000	0.035509
SeepArea32&L104 9082520_66	1175165	3176642	A	788.3	47.6	8/25/2020	0	-0.022	0.941	0.2298667	0.000000	0.000000	0.216305
SeepArea32&L104 9082520_67	1175072	3176665	A	788.1	47.7	8/25/2020	0	-0.035	0.752	0.2297367	0.000000	0.000000	0.172762
SeepArea32&L104 9082520_68	1175045	3176742	A	788.1	47.8	8/25/2020	0	-0.032	1.432	0.2296651	0.000000	0.000000	0.328880
SeepArea32&L104 9082520_69	1174972	3176833	A	788.1	48.0	8/25/2020	22.209	0.017	5.068	0.2295221	5.097456	0.003902	1.163218
SeepArea32&L104 9082520_70	1174972	3176947	A	788.2	48.0	8/25/2020	1.31	0.011	4.525	0.2295512	0.300712	0.002525	1.038719
SeepArea32&L104 9082520_71	1174983	3177041	A	787.5	48.1	8/25/2020	1.217	0.024	2.364	0.229276	0.279029	0.005503	0.542008

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_72	1174911	3177067	A	787.4	48.2	8/25/2020	-3.116	-0.058	0.983	0.2291755	0.000000	0.000000	0.225280
SeepArea32&L104 9082520_73	1174887	3176974	A	787.8	48.3	8/25/2020	-10.096	-0.05	0.364	0.2292206	0.000000	0.000000	0.083436
SeepArea32&L104 9082520_74	1174883	3176876	A	787.8	48.4	8/25/2020	-3.443	-0.052	1.409	0.2291493	0.000000	0.000000	0.322871
SeepArea32&L104 9082520_75	1174869	3176793	A	787.8	48.4	8/25/2020	-1.924	-0.069	0.458	0.2291493	0.000000	0.000000	0.104950
SeepArea32&L104 9082520_76	1174944	3176769	A	788.3	48.5	8/25/2020	-2.537	-0.065	0.316	0.2292235	0.000000	0.000000	0.072435
SeepArea32&L104 9082520_77	1175007	3176671	A	788.3	48.6	8/25/2020	-1.658	-0.075	0.459	0.2291522	0.000000	0.000000	0.105181
SeepArea32&L104 9082520_78	1175050	3176557	A	788.3	48.7	8/25/2020	-2.613	-0.061	1.385	0.229081	0.000000	0.000000	0.317277
SeepArea32&L104 9082520_79	1174985	3176463	A	788.3	48.8	8/25/2020	14.54	0.006	1.742	0.2290099	3.329803	0.001374	0.398935
SeepArea32&L104 9082520_80	1174939	3176532	A	788.3	49.0	8/25/2020	-119.895	-0.053	7.076	0.2288677	0.000000	0.000000	1.619468
SeepArea32&L104 9082520_81	1174863	3176441	A	788.2	49.0	8/25/2020	-1.628	-0.061	0.299	0.2288387	0.000000	0.000000	0.068423
SeepArea32&L104 9082520_82	1174797	3176458	A	788.5	49.0	8/25/2020	-1.684	-0.041	0.247	0.2289258	0.000000	0.000000	0.056545
SeepArea32&L104 9082520_83	1174779	3176566	A	788.3	49.0	8/25/2020	-2.371	-0.038	0.217	0.2288677	0.000000	0.000000	0.049664
SeepArea32&L104 9082520_84	1174756	3176654	A	788.5	48.9	8/25/2020	-2.062	-0.061	1.59	0.2289968	0.000000	0.000000	0.364105
SeepArea32&L104 9082520_85	1174750	3176758	A	788.6	48.9	8/25/2020	12.314	0.006	2.791	0.2290259	2.820225	0.001374	0.639211
SeepArea32&L104 9082520_86	1174768	3176869	A	788.7	48.8	8/25/2020	-143.252	-0.085	0.152	0.2291261	0.000000	0.000000	0.034827
SeepArea32&L104 9082520_87	1174778	3176949	A	788.3	48.8	8/25/2020	-2.482	-0.06	0.531	0.2290099	0.000000	0.000000	0.121604

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082520_88	1174762	3177056	A	788.1	48.8	8/25/2020	-1.704	-0.042	0.71	0.2289518	0.000000	0.000000	0.162556
SeepArea32&L104 9082520_89	1174911	3176646	A	788.3	48.8	8/25/2020	-1.55	-0.083	0.152	0.2290099	0.000000	0.000000	0.034809
SeepArea32&L104 9082520_90	1174878	3176550	A	788.3	48.7	8/25/2020	71.516	0.01	2.812	0.229081	16.382960	0.002291	0.644176
SeepArea32&L104 9082720_100	1174481	3177636	A	787.3	28.1	8/27/2020	25.213	0.004	7.821	0.2444355	6.162952	0.000978	1.911730
SeepArea32&L104 9082720_101	1174484	3177554	A	787.3	28.9	8/27/2020	1.155	0.007	5.232	0.2437881	0.281575	0.001707	1.275499
SeepArea32&L104 9082720_102	1174503	3177459	A	787.2	29.6	8/27/2020	0	-0.005	0.325	0.2431936	0.000000	0.000000	0.079038
SeepArea32&L104 9082720_103	1174575	3177361	A	787.2	30.3	8/27/2020	0	-0.001	0.494	0.2426325	0.000000	0.000000	0.119860
SeepArea32&L104 9082720_104	1174563	3177234	A	787.2	31.2	8/27/2020	0	-0.009	0.819	0.241915	0.000000	0.000000	0.198128
SeepArea32&L104 9082720_105	1174590	3177164	A	787.5	31.8	8/27/2020	0	0	1.108	0.2415311	0.000000	0.000000	0.267616
SeepArea32&L104 9082720_106	1174669	3177157	A	787.1	32.6	8/27/2020	0	-0.001	1.018	0.2407768	0.000000	0.000000	0.245111
SeepArea32&L104 9082720_107	1174669	3177058	A	787.1	33.2	8/27/2020	0	-0.005	0.576	0.2403052	0.000000	0.000000	0.138416
SeepArea32&L104 9082720_108	1174693	3176959	A	787.1	33.8	8/27/2020	15.416	0.011	4.257	0.2398355	3.697304	0.002638	1.020980
SeepArea32&L104 9082720_109	1174778	3177187	A	787.2	34.7	8/27/2020	-0.68	-0.003	0.712	0.2391647	0.000000	0.000000	0.170285
SeepArea32&L104 9082720_110	1174870	3177159	A	786.3	35.2	8/27/2020	0	-0.003	0.064	0.2385039	0.000000	0.000000	0.015264
SeepArea32&L104 9082720_111	1174946	3177181	A	785.9	35.7	8/27/2020	3.847	0.005	2.023	0.2379966	0.915573	0.001190	0.481467
SeepArea32&L104 9082720_112	1174960	3177242	A	785.2	36.2	8/27/2020	0	-0.003	1.532	0.2374003	0.000000	0.000000	0.363697



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_113	1174973	3177352	A	785.1	36.6	8/27/2020	0	-0.006	0.647	0.2370635	0.000000	0.000000	0.153380
SeepArea32&L104 9082720_114	1174987	3177452	A	784.7	36.8	8/27/2020	0	-0.008	0.533	0.2367899	0.000000	0.000000	0.126209
SeepArea32&L104 9082720_115	1174882	3177535	A	784.4	37.0	8/27/2020	0	-0.008	0.18	0.2365467	0.000000	0.000000	0.042578
SeepArea32&L104 9082720_116	1174898	3177439	A	784.4	37.2	8/27/2020	0	-0.002	0.101	0.2363943	0.000000	0.000000	0.023876
SeepArea32&L104 9082720_117	1174866	3177366	A	785.3	37.2	8/27/2020	0	-0.014	1.264	0.2366655	0.000000	0.000000	0.299145
SeepArea32&L104 9082720_118	1174867	3177274	A	787.9	37.3	8/27/2020	0	-0.002	3.014	0.2373726	0.000000	0.000000	0.715441
SeepArea32&L104 9082720_119	1174787	3177267	A	786.0	37.4	8/27/2020	0	-0.007	8.417	0.2367239	0.000000	0.000000	1.992505
SeepArea32&L104 9082720_120	1174669	3177260	A	786.5	37.6	8/27/2020	-0.361	-0.008	0.278	0.236722	0.000000	0.000000	0.065809
SeepArea32&L104 9082720_121	1174672	3177355	A	786.7	37.9	8/27/2020	0	-0.005	0.115	0.2365539	0.000000	0.000000	0.027204
SeepArea32&L104 9082720_122	1174775	3177365	A	786.1	38.3	8/27/2020	0	-0.006	1.806	0.2360699	0.000000	0.000000	0.426342
SeepArea32&L104 9082720_123	1174773	3177449	A	786.0	38.6	8/27/2020	0	-0.015	0.87	0.2358127	0.000000	0.000000	0.205157
SeepArea32&L104 9082720_124	1174758	3177553	A	785.8	39.0	8/27/2020	0	-0.007	3.269	0.2354506	0.000000	0.000000	0.769688
SeepArea32&L104 9082720_125	1174815	3177677	A	785.5	39.5	8/27/2020	0	-0.005	0.188	0.2349843	0.000000	0.000000	0.044177
SeepArea32&L104 9082720_126	1174697	3177751	A	785.3	40.0	8/27/2020	0	-0.016	3.084	0.2345494	0.000000	0.000000	0.723350
SeepArea32&L104 9082720_127	1174689	3177652	A	786.0	40.2	8/27/2020	0	-0.012	0.729	0.2346086	0.000000	0.000000	0.171030
SeepArea32&L104 9082720_128	1174703	3177550	A	786.1	40.5	8/27/2020	0	-0.013	0.838	0.234414	0.000000	0.000000	0.196439

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_129	1174672	3177456	A	786.4	40.7	8/27/2020	0	-0.011	0.927	0.2343541	0.000000	0.000000	0.217246
SeepArea32&L104 9082720_130	1174598	3177446	A	786.7	40.9	8/27/2020	-0.002	-0.016	0.851	0.2342942	0.000000	0.000000	0.199384
SeepArea32&L104 9082720_131	1174592	3177537	A	789.0	41.2	8/27/2020	0	0	1.28	0.2347549	0.000000	0.000000	0.300486
SeepArea32&L104 9082720_132	1174599	3177644	A	786.5	41.4	8/27/2020	0	-0.007	0.781	0.2338623	0.000000	0.000000	0.182646
SeepArea32&L104 9082720_133	1174588	3177760	A	786.5	41.7	8/27/2020	0	-0.01	0.28	0.2336394	0.000000	0.000000	0.065419
SeepArea32&L104 9082720_134	1174586	3177841	A	786.3	41.8	8/27/2020	0	-0.012	0.423	0.2335059	0.000000	0.000000	0.098773
SeepArea32&L104 9082720_135	1174482	3177748	A	786.7	42.0	8/27/2020	-0.703	-0.015	5.7	0.2334764	0.000000	0.000000	1.330815
SeepArea32&L104 9082720_136	1174498	3177857	A	786.5	42.2	8/27/2020	0	-0.015	0.808	0.233269	0.000000	0.000000	0.188481
SeepArea32&L104 9082720_137	1174391	3177870	A	786.7	42.4	8/27/2020	0	-0.025	1.855	0.2331804	0.000000	0.000000	0.432550
SeepArea32&L104 9082720_138	1174357	3177955	A	787.1	42.5	8/27/2020	0	-0.015	1.267	0.2332251	0.000000	0.000000	0.295496
SeepArea32&L104 9082720_139	1174465	3177940	A	789.0	42.7	8/27/2020	0	-0.001	0.788	0.23364	0.000000	0.000000	0.184108
SeepArea32&L104 9082720_140	1174500	3178040	A	786.5	42.9	8/27/2020	0	-0.012	0.721	0.2327523	0.000000	0.000000	0.167814
SeepArea32&L104 9082720_141	1174362	3178067	A	786.8	43.0	8/27/2020	0	-0.02	0.506	0.2327675	0.000000	0.000000	0.117780
SeepArea32&L104 9082720_142	1174362	3178187	A	786.8	43.1	8/27/2020	0	-0.016	1.851	0.2326939	0.000000	0.000000	0.430716
SeepArea32&L104 9082720_143	1174471	3178156	A	786.5	43.3	8/27/2020	0	-0.014	0.347	0.2324581	0.000000	0.000000	0.080663
SeepArea32&L104 9082720_144	1174460	3178239	A	786.3	43.4	8/27/2020	0	-0.018	0.614	0.2323256	0.000000	0.000000	0.142648

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_145	1174382	3178253	A	786.5	43.5	8/27/2020	0	-0.016	0.176	0.2323113	0.000000	0.000000	0.040887
SeepArea32&L104 9082720_148	1173920	3178565	A	788.1	46.7	8/27/2020	-2.159	-0.056	1.034	0.230455	0.000000	0.000000	0.238290
SeepArea32&L104 9082720_149	1173906	3178511	A	788.1	46.7	8/27/2020	-1.1	-0.038	0.071	0.230455	0.000000	0.000000	0.016362
SeepArea32&L104 9082720_150	1173910	3178465	A	787.5	46.7	8/27/2020	-0.552	-0.057	0.335	0.2302795	0.000000	0.000000	0.077144
SeepArea32&L104 9082720_151	1173917	3178413	A	787.3	46.7	8/27/2020	-1.12	-0.01	1.587	0.230221	0.000000	0.000000	0.365361
SeepArea32&L104 9082720_152	1173925	3178354	A	787.3	46.7	8/27/2020	-4.126	-0.044	0.055	0.230221	0.000000	0.000000	0.012662
SeepArea32&L104 9082720_153	1173981	3178350	A	787.3	46.8	8/27/2020	-4.077	-0.044	0.275	0.2301491	0.000000	0.000000	0.063291
SeepArea32&L104 9082720_154	1173957	3178290	A	787.1	46.8	8/27/2020	-2.34	-0.051	1.154	0.2300906	0.000000	0.000000	0.265525
SeepArea32&L104 9082720_155	1173884	3178276	A	787.3	46.8	8/27/2020	-2.201	-0.041	0.408	0.2301491	0.000000	0.000000	0.093901
SeepArea32&L104 9082720_156	1173887	3178314	A	787.3	46.8	8/27/2020	-2.025	-0.054	0.391	0.2301491	0.000000	0.000000	0.089988
SeepArea32&L104 9082720_157	1173857	3178361	A	787.2	46.7	8/27/2020	-0.755	-0.059	0.255	0.2301918	0.000000	0.000000	0.058699
SeepArea32&L104 9082720_158	1173848	3178421	A	787.4	46.6	8/27/2020	-1.292	-0.044	2.434	0.2303223	0.000000	0.000000	0.560604
SeepArea32&L104 9082720_159	1173858	3178450	A	787.4	46.5	8/27/2020	-0.849	-0.005	4.349	0.2303943	0.000000	0.000000	1.001985
SeepArea32&L104 9082720_160	1173850	3178512	A	787.4	46.4	8/27/2020	-1.657	-0.033	0.11	0.2304664	0.000000	0.000000	0.025351
SeepArea32&L104 9082720_161	1173805	3178520	A	787.7	46.2	8/27/2020	-5.308	-0.023	0.162	0.2306986	0.000000	0.000000	0.037373
SeepArea32&L104 9082720_162	1173807	3178452	A	787.5	45.9	8/27/2020	-8.858	-0.032	0.081	0.2308569	0.000000	0.000000	0.018699

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_163	1173806	3178406	A	787.5	45.8	8/27/2020	-0.739	-0.006	0.839	0.2309293	0.000000	0.000000	0.193750
SeepArea32&L104 9082720_164	1173801	3178357	A	787.5	45.6	8/27/2020	-2.002	-0.038	0.764	0.2310742	0.000000	0.000000	0.176541
SeepArea32&L104 9082720_165	1173799	3178262	A	787.4	45.4	8/27/2020	-0.146	-0.026	0.13	0.2311899	0.000000	0.000000	0.030055
SeepArea32&L104 9082720_166	1173773	3178165	A	787.7	45.2	8/27/2020	-0.629	-0.028	0.339	0.2314233	0.000000	0.000000	0.078452
SeepArea32&L104 9082720_167	1173883	3178172	A	787.9	45.0	8/27/2020	-0.442	-0.033	0.62	0.2316276	0.000000	0.000000	0.143609
SeepArea32&L104 9082720_168	1173961	3178146	A	787.4	44.7	8/27/2020	1.919	0.011	4.723	0.2316991	0.444631	0.002549	1.094315
SeepArea32&L104 9082720_169	1174066	3178157	A	787.4	44.4	8/27/2020	-9.186	-0.034	0.001	0.231918	0.000000	0.000000	0.000232
SeepArea32&L104 9082720_170	1174073	3178065	A	787.1	44.1	8/27/2020	-0.205	-0.014	2.793	0.2320488	0.000000	0.000000	0.648112
SeepArea32&L104 9082720_171	1173980	3178039	A	787.2	43.9	8/27/2020	0	-0.026	0.789	0.2322247	0.000000	0.000000	0.183225
SeepArea32&L104 9082720_172	1173880	3178061	A	787.8	43.7	8/27/2020	-0.227	-0.012	0.303	0.2325484	0.000000	0.000000	0.070462
SeepArea32&L104 9082720_173	1173781	3178050	A	788.3	43.6	8/27/2020	-1.032	-0.004	0.147	0.2327695	0.000000	0.000000	0.034217
SeepArea32&L104 9082720_174	1173855	3177990	A	788.4	43.4	8/27/2020	-2.018	-0.015	0.163	0.2329461	0.000000	0.000000	0.037970
SeepArea32&L104 9082720_175	1173971	3177952	A	788.0	43.2	8/27/2020	-1.61	-0.023	0.424	0.2329751	0.000000	0.000000	0.098781
SeepArea32&L104 9082720_176	1174158	3177960	A	787.4	41.1	8/27/2020	-0.21	-0.044	0.732	0.2343534	0.000000	0.000000	0.171547
SeepArea32&L104 9082720_177	1174094	3177947	A	787.4	40.8	8/27/2020	7.735	0.007	2.011	0.2345773	1.814456	0.001642	0.471735
SeepArea32&L104 9082720_178	1174164	3177858	A	787.6	40.7	8/27/2020	-29.683	-0.015	1.226	0.2347117	0.000000	0.000000	0.287757



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_179	1174093	3177844	A	787.8	40.6	8/27/2020	-1.676	-0.008	0.523	0.2348461	0.000000	0.000000	0.122825
SeepArea32&L104 9082720_180	1173962	3177868	A	787.9	40.5	8/27/2020	-1.101	-0.008	0.707	0.2349508	0.000000	0.000000	0.166110
SeepArea32&L104 9082720_181	1173895	3177854	A	787.9	40.3	8/27/2020	-2.319	-0.003	0.502	0.2351007	0.000000	0.000000	0.118021
SeepArea32&L104 9082720_182	1173819	3177840	A	788.3	40.2	8/27/2020	-0.384	-0.011	0.399	0.2352951	0.000000	0.000000	0.093883
SeepArea32&L104 9082720_183	1173755	3177862	A	788.4	40.0	8/27/2020	-0.304	-0.007	0.616	0.2354753	0.000000	0.000000	0.145053
SeepArea32&L104 9082720_184	1173768	3177746	A	788.4	39.9	8/27/2020	-0.412	-0.007	0.246	0.2355505	0.000000	0.000000	0.057945
SeepArea32&L104 9082720_185	1173839	3177730	A	788.4	39.8	8/27/2020	-2.369	-0.01	0.333	0.2356258	0.000000	0.000000	0.078463
SeepArea32&L104 9082720_186	1173962	3177753	A	788.2	39.7	8/27/2020	-1.61	-0.006	0.558	0.2356413	0.000000	0.000000	0.131488
SeepArea32&L104 9082720_187	1174050	3177765	A	787.9	39.6	8/27/2020	-2.003	-0.005	0.402	0.2356269	0.000000	0.000000	0.094722
SeepArea32&L104 9082720_188	1174171	3177757	A	787.8	39.5	8/27/2020	-0.567	-0.015	3.349	0.2356724	0.000000	0.000000	0.789267
SeepArea32&L104 9082720_189	1174252	3177745	A	787.2	39.4	8/27/2020	-1.319	-0.015	0.554	0.2355682	0.000000	0.000000	0.130505
SeepArea32&L104 9082720_190	1174265	3177656	A	787.4	39.3	8/27/2020	1.542	0.009	4.037	0.2357035	0.363455	0.002121	0.951535
SeepArea32&L104 9082720_191	1174152	3177643	A	787.4	39.2	8/27/2020	-3.425	-0.011	0.247	0.2357789	0.000000	0.000000	0.058237
SeepArea32&L104 9082720_192	1174069	3177636	A	787.6	39.1	8/27/2020	1.935	0.009	3.322	0.2359143	0.456494	0.002123	0.783707
SeepArea32&L104 9082720_193	1173964	3177654	A	787.8	39.0	8/27/2020	-1.748	-0.006	0.478	0.2360499	0.000000	0.000000	0.112832
SeepArea32&L104 9082720_194	1173928	3177650	A	787.9	39.0	8/27/2020	-1.541	-0.003	0.633	0.2360798	0.000000	0.000000	0.149439

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082720_195	1173850	3177653	A	788.0	39.0	8/27/2020	0	-0.009	1.32	0.2361098	0.000000	0.000000	0.311665
SeepArea32&L104 9082720_196	1173787	3177653	A	788.2	38.9	8/27/2020	1.965	0.009	0.253	0.2362454	0.464222	0.002126	0.059770
SeepArea32&L104 9082720_91	1174179	3178071	A	788.0	21.9	8/27/2020	-0.28	-0.002	1.713	0.2497938	0.000000	0.000000	0.427897
SeepArea32&L104 9082720_92	1174147	3178166	A	787.8	22.6	8/27/2020	-0.961	-0.001	1.012	0.2491394	0.000000	0.000000	0.252129
SeepArea32&L104 9082720_93	1174267	3178231	A	788.0	23.4	8/27/2020	-0.496	-0.002	0.019	0.2485303	0.000000	0.000000	0.004722
SeepArea32&L104 9082720_94	1174272	3178142	A	787.5	24.0	8/27/2020	0	-0.001	0.048	0.2478711	0.000000	0.000000	0.011898
SeepArea32&L104 9082720_95	1174265	3178035	A	787.7	24.6	8/27/2020	0	0.001	1.01	0.2474345	0.000000	0.000247	0.249909
SeepArea32&L104 9082720_96	1174259	3177941	A	787.7	25.2	8/27/2020	0	0	1.165	0.2469369	0.000000	0.000000	0.287681
SeepArea32&L104 9082720_97	1174300	3177861	A	787.7	25.8	8/27/2020	0	0	0.638	0.2464412	0.000000	0.000000	0.157230
SeepArea32&L104 9082720_98	1174382	3177749	A	787.5	26.5	8/27/2020	0	-0.003	0.459	0.2458031	0.000000	0.000000	0.112824
SeepArea32&L104 9082720_99	1174414	3177654	A	787.5	27.3	8/27/2020	4.965	0.008	4.488	0.2451486	1.217163	0.001961	1.100227
SeepArea32&L104 9082820_197	1174651	3176446	A	787.5	20.1	8/28/2020	-1.721	-0.011	0.023	0.2511676	0.000000	0.000000	0.005777
SeepArea32&L104 9082820_198	1174661	3176345	A	787.5	20.5	8/28/2020	0	-0.002	0.192	0.2508255	0.000000	0.000000	0.048158
SeepArea32&L104 9082820_199	1174579	3176357	A	787.7	20.9	8/28/2020	0	-0.001	0.266	0.2505479	0.000000	0.000000	0.066646
SeepArea32&L104 9082820_200	1174552	3176264	A	787.6	21.2	8/28/2020	0	-0.001	0.412	0.2502608	0.000000	0.000000	0.103107
SeepArea32&L104 9082820_201	1174488	3176251	A	787.6	21.4	8/28/2020	0	-0.002	0.64	0.2500908	0.000000	0.000000	0.160058

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082820_202	1174552	3176170	A	787.9	21.6	8/28/2020	-0.09	-0.001	0.57	0.2500163	0.000000	0.000000	0.142509
SeepArea32&L104 9082820_203	1174463	3176150	A	788.0	21.8	8/28/2020	-0.184	-0.001	0.566	0.2498785	0.000000	0.000000	0.141431
SeepArea32&L104 9082820_204	1174362	3176170	A	788.2	22.0	8/28/2020	-0.282	-0.004	0.321	0.2497726	0.000000	0.000000	0.080177
SeepArea32&L104 9082820_205	1174341	3176255	A	788.0	22.2	8/28/2020	-0.359	-0.001	0.635	0.2495401	0.000000	0.000000	0.158458
SeepArea32&L104 9082820_206	1174350	3176352	A	790.3	22.4	8/28/2020	-0.067	-0.002	0.146	0.2500991	0.000000	0.000000	0.036514
SeepArea32&L104 9082820_207	1174452	3176367	A	788.0	22.6	8/28/2020	-0.784	-0.003	0.717	0.2492026	0.000000	0.000000	0.178678
SeepArea32&L104 9082820_208	1174558	3176453	A	788.0	22.8	8/28/2020	0	-0.008	0.082	0.2490342	0.000000	0.000000	0.020421
SeepArea32&L104 9082820_209	1174565	3176531	A	788.0	23.0	8/28/2020	-0.258	-0.015	0.128	0.248866	0.000000	0.000000	0.031855
SeepArea32&L104 9082820_210	1174643	3176578	A	787.8	23.1	8/28/2020	0	0	0.116	0.2487189	0.000000	0.000000	0.028851
SeepArea32&L104 9082820_211	1174637	3176655	A	787.8	23.3	8/28/2020	0	-0.004	0.479	0.2485511	0.000000	0.000000	0.119056
SeepArea32&L104 9082820_212	1174552	3176651	A	787.8	23.4	8/28/2020	0	-0.003	0.141	0.2484673	0.000000	0.000000	0.035034
SeepArea32&L104 9082820_213	1174657	3176748	A	788.0	23.6	8/28/2020	0	-0.007	1.067	0.2483628	0.000000	0.000000	0.265003
SeepArea32&L104 9082820_214	1174564	3176758	A	788.0	23.7	8/28/2020	0	-0.004	0.329	0.2482792	0.000000	0.000000	0.081684
SeepArea32&L104 9082820_215	1174450	3176762	A	788.1	23.9	8/28/2020	-0.444	-0.002	0.247	0.2481435	0.000000	0.000000	0.061291
SeepArea32&L104 9082820_216	1174357	3176762	A	788.3	24.1	8/28/2020	0	-0.007	0.15	0.2480395	0.000000	0.000000	0.037206
SeepArea32&L104 9082820_217	1174343	3176856	A	788.4	24.3	8/28/2020	0	0	0.429	0.2479041	0.000000	0.000000	0.106351

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082820_218	1174451	3176859	A	788.6	24.5	8/28/2020	0	-0.012	0.006	0.2478004	0.000000	0.000000	0.001487
SeepArea32&L104 9082820_219	1174553	3176856	A	788.0	24.6	8/28/2020	0	-0.004	0.846	0.2475287	0.000000	0.000000	0.209409
SeepArea32&L104 9082820_220	1174624	3176849	A	788.0	24.8	8/28/2020	0	-0.004	0.094	0.2473625	0.000000	0.000000	0.023252
SeepArea32&L104 9082820_221	1174550	3176961	A	788.0	25.0	8/28/2020	-2.04	-0.009	2.84	0.2471966	0.000000	0.000000	0.702038
SeepArea32&L104 9082820_222	1174455	3176949	A	788.2	25.2	8/28/2020	0	-0.002	0.049	0.2470936	0.000000	0.000000	0.012108
SeepArea32&L104 9082820_223	1174358	3176943	A	788.4	25.4	8/28/2020	0	-0.007	0.593	0.2469907	0.000000	0.000000	0.146465
SeepArea32&L104 9082820_224	1174249	3176956	A	788.5	25.6	8/28/2020	0	-0.002	0.349	0.2468567	0.000000	0.000000	0.086153
SeepArea32&L104 9082820_225	1174156	3176949	A	788.8	25.8	8/28/2020	0	-0.004	0.113	0.2467854	0.000000	0.000000	0.027887
SeepArea32&L104 9082820_226	1174057	3176967	A	788.8	26.0	8/28/2020	0	-0.004	0.033	0.2466204	0.000000	0.000000	0.008138
SeepArea32&L104 9082820_227	1174045	3177075	A	788.8	26.2	8/28/2020	0	-0.008	0.239	0.2464556	0.000000	0.000000	0.058903
SeepArea32&L104 9082820_228	1174060	3177164	A	789.0	26.4	8/28/2020	0	-0.006	0.111	0.2463535	0.000000	0.000000	0.027345
SeepArea32&L104 9082820_229	1174177	3177148	A	788.8	26.6	8/28/2020	-0.021	-0.001	0.329	0.2461268	0.000000	0.000000	0.080976
SeepArea32&L104 9082820_230	1174159	3177049	A	788.7	26.8	8/28/2020	-0.082	-0.001	1.36	0.2459315	0.000000	0.000000	0.334467
SeepArea32&L104 9082820_231	1174248	3177052	A	788.5	27.0	8/28/2020	0	-0.001	4.52	0.2457053	0.000000	0.000000	1.110588
SeepArea32&L104 9082820_232	1174250	3177158	A	788.5	27.3	8/28/2020	0	-0.002	0.16	0.2454599	0.000000	0.000000	0.039274
SeepArea32&L104 9082820_233	1174363	3177169	A	788.4	27.5	8/28/2020	0	-0.007	0.432	0.2452655	0.000000	0.000000	0.105955



## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082820_234	1174353	3177046	A	788.3	27.8	8/28/2020	0	-0.008	0.21	0.24499	0.000000	0.000000	0.051448
SeepArea32&L104 9082820_235	1174442	3177055	A	788.4	28.0	8/28/2020	0	-0.003	0.244	0.2448583	0.000000	0.000000	0.059745
SeepArea32&L104 9082820_236	1174544	3177059	A	788.2	28.3	8/28/2020	-0.171	-0.005	0.61	0.2445526	0.000000	0.000000	0.149177
SeepArea32&L104 9082820_237	1174469	3177175	A	788.2	28.5	8/28/2020	0	-0.003	0.092	0.2443904	0.000000	0.000000	0.022484
SeepArea32&L104 9082820_238	1174459	3177256	A	788.2	28.8	8/28/2020	0	-0.001	0.042	0.2441476	0.000000	0.000000	0.010254
SeepArea32&L104 9082820_239	1174413	3177358	A	787.9	29.2	8/28/2020	-0.602	-0.003	3.501	0.2437318	0.000000	0.000000	0.853305
SeepArea32&L104 9082820_240	1174368	3177351	A	788.2	29.4	8/28/2020	-0.42	-0.004	0.194	0.2436634	0.000000	0.000000	0.047271
SeepArea32&L104 9082820_241	1174344	3177265	A	788.3	29.7	8/28/2020	0	-0.004	0.201	0.243453	0.000000	0.000000	0.048934
SeepArea32&L104 9082820_242	1174250	3177341	A	788.4	30.0	8/28/2020	0	-0.013	0.51	0.2432429	0.000000	0.000000	0.124054
SeepArea32&L104 9082820_243	1174258	3177441	A	788.3	30.2	8/28/2020	0	-0.002	0.07	0.2430517	0.000000	0.000000	0.017014
SeepArea32&L104 9082820_244	1174370	3177463	A	788.2	30.4	8/28/2020	0	-0.003	3.696	0.2428607	0.000000	0.000000	0.897613
SeepArea32&L104 9082820_245	1174326	3177564	A	788.2	30.6	8/28/2020	-0.276	0	6.407	0.2427008	0.000000	0.000000	1.554984
SeepArea32&L104 9082820_246	1174259	3177549	A	788.2	30.8	8/28/2020	0	-0.005	0.566	0.2425411	0.000000	0.000000	0.137278
SeepArea32&L104 9082820_247	1174150	3177560	A	788.3	30.9	8/28/2020	0	-0.006	0.387	0.2424921	0.000000	0.000000	0.093844
SeepArea32&L104 9082820_248	1174059	3177568	A	788.5	31.1	8/28/2020	0	-0.008	0.373	0.2423942	0.000000	0.000000	0.090413
SeepArea32&L104 9082820_249	1173959	3177559	A	789.0	31.3	8/28/2020	0	-0.005	0.773	0.2423886	0.000000	0.000000	0.187366

## Individual Flux Measurements and Calculations (Continued)

Site Point ID	Northing	Easting	Accum Chamber	Pressure (HPa)	Temp (DegC)	Date	CH4 slope	H2S slope	CO2 slope	AcK factor	CH4 flux (moles/day/m^2)	H2S flux (moles/day/m^2)	CO2 flux (moles/day/m^2)
SeepArea32&L104 9082820_250	1173865	3177561	A	789.0	31.4	8/28/2020	-0.341	-0.002	0.285	0.242309	0.000000	0.000000	0.069058

## **APPENDIX C**

# **VOLUMETRIC FLUX CALCULATIONS**

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# Grid Volume Computations

---

Thu Sep 03 13:04:44 2020

## Upper Surface

Grid File Name:	C:\LTE\Rule608\2020\Surfer\L1021_CH4notail.grd
Grid Size:	41 rows x 39 columns
X Minimum:	3178513.192
X Maximum:	3178963.249
X Spacing:	11.843605263159
Y Minimum:	1173813.811
Y Maximum:	1174292.424
Y Spacing:	11.965325000003
Z Minimum:	-2.463445717155
Z Maximum:	9.1498895269954

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

Z Scale Factor:	0.0929
-----------------	--------

### Total Volumes by:

Trapezoidal Rule:	1597.9247768047
Simpson's Rule:	1579.7346700404
Simpson's 3/8 Rule:	1594.0579485509

### Cut & Fill Volumes

Positive Volume [Cut]:	3114.699315004
Negative Volume [Fill]:	1516.7745381992
Net Volume [Cut-Fill]:	1597.9247768047

## Areas

### Planar Areas

Positive Planar Area [Cut]:	45224.670251028
Negative Planar Area [Fill]:	83379.50167596



Blanked Planar Area:	86798.959014083
Total Planar Area:	215403.13094107

### **Surface Areas**

Positive Surface Area [Cut]:	45225.621275195
Negative Surface Area [Fill]:	83379.791020837

---

# Grid Volume Computations

---

Thu Sep 03 12:59:26 2020

## Upper Surface

Grid File Name:	C:\LTE\Rule608\2020\Surfer\L1030_CH4notail.grd
Grid Size:	32 rows x 27 columns
X Minimum:	3164608.173
X Maximum:	3164923.056
X Spacing:	12.110884615381
Y Minimum:	1146034.967
Y Maximum:	1146409.216
Y Spacing:	12.072548387099
Z Minimum:	-2.2545834955008
Z Maximum:	7.7645972603874

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

Z Scale Factor:	0.0929
-----------------	--------

### Total Volumes by:

Trapezoidal Rule:	2152.031715574
Simpson's Rule:	2196.2421602966
Simpson's 3/8 Rule:	2148.1904245821

### Cut & Fill Volumes

Positive Volume [Cut]:	4039.9321694032
Negative Volume [Fill]:	1887.9004538291
Net Volume [Cut-Fill]:	2152.031715574

## Areas

### Planar Areas

Positive Planar Area [Cut]:	33658.505467868
Negative Planar Area [Fill]:	47048.995304562

Blanked Planar Area:	37137.14709456
Total Planar Area:	117844.64786699

### **Surface Areas**

Positive Surface Area [Cut]:	33659.649260856
Negative Surface Area [Fill]:	47049.203732889

---

# Grid Volume Computations

---

Thu Sep 03 12:59:54 2020

## Upper Surface

Grid File Name:	C:\LTE\Rule608\2020\Surfer\SA32L1049_CH4notail.grd
Grid Size:	63 rows x 100 columns
X Minimum:	3175727.831
X Maximum:	3178664.863
X Spacing:	29.666989898991
Y Minimum:	1173655.171
Y Maximum:	1175576.774
Y Spacing:	30.993596774192
Z Minimum:	-0.85800028322972
Z Maximum:	13.204409066925

## Lower Surface

Level Surface defined by  $Z = 0$

## Volumes

Z Scale Factor:	0.0929
-----------------	--------

### Total Volumes by:

Trapezoidal Rule:	45087.536731962
Simpson's Rule:	44878.361148253
Simpson's 3/8 Rule:	45213.253207063

### Cut & Fill Volumes

Positive Volume [Cut]:	51802.868519877
Negative Volume [Fill]:	6715.331787915
Net Volume [Cut-Fill]:	45087.536731962

## Areas

### Planar Areas

Positive Planar Area [Cut]:	1100922.4638039
Negative Planar Area [Fill]:	2206011.5334277

Blanked Planar Area:	2336875.5050644
Total Planar Area:	5643809.5022959

**Surface Areas**

Positive Surface Area [Cut]:	1100925.8394898
Negative Surface Area [Fill]:	2206011.6128635



## **APPENDIX D**

# **NATURAL SPRINGS LABORATORY ANALYTICAL REPORTS**

The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*  
*Automated Report*

## Technical Report for

### LT Environmental

2020 Rule 608

081520001

SGS Job Number: DA28424

Sampling Date: 08/26/20

#### Report to:

LT Environmental  
848 E 2nd Ave Suite #3  
Durango, CO 81301  
dhencmann@ltenv.com; cmginn@ltenv.com

ATTN: Devin Hencmann

Total number of pages in report: 65



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



**Jason Savoie**  
General Manager

**Client Service contact: Carissa Cumine 303-425-6021**

Certifications: CO (CO00049), NE (NE-OS-06-04), ND (R-027), UT (NELAP CO00049)  
LA (LA150028), TX (T104704511), WY (8TMS-L)

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Test results relate only to samples analyzed.

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Sample Summary

LT Environmental

Job No: DA28424

2020 Rule 608  
Project No: 081520001

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
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This report contains results reported as ND = Not detected. The following applies:  
Organics ND = Not detected above the MDL

DA28424-1	08/26/20	07:45	CM/TS08/27/20	AQ	Water	CHAVEZ 01
DA28424-1A	08/26/20	07:45	CM/TS08/27/20	AQ	Water	CHAVEZ 01
DA28424-1B	08/26/20	07:45	CM/TS08/27/20	AQ	Water	CHAVEZ 01
DA28424-1F	08/26/20	07:45	CM/TS08/27/20	AQ	Water Filtered	CHAVEZ 01
DA28424-2	08/26/20	08:22	CM/TS08/27/20	AQ	Water	CHAVEZ 02
DA28424-2A	08/26/20	08:22	CM/TS08/27/20	AQ	Water	CHAVEZ 02
DA28424-2B	08/26/20	08:22	CM/TS08/27/20	AQ	Water	CHAVEZ 02
DA28424-2F	08/26/20	08:22	CM/TS08/27/20	AQ	Water Filtered	CHAVEZ 02

## CASE NARRATIVE / CONFORMANCE SUMMARY

**Client:** LT Environmental

**Job No:** DA28424

**Site:** 2020 Rule 608

**Report Date** 9/14/2020 2:44:03 PM

On 08/27/2020, 2 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 0.7 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA28424 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

### GC Volatiles By Method RSK175 MOD

**Matrix:** AQ

**Batch ID:** GFK116

- All samples were analyzed within the recommended method holding time.
- Sample(s) DA19417-4MS, DA19417-4MSD were used as the QC samples indicated.
- All method blanks for this batch meet method specific criteria.

### Metals Analysis By Method EPA 200.7

**Matrix:** AQ

**Batch ID:** MP31056

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28440-1MS, DA28440-1MSD were used as the QC samples for the metals analysis.
- MP31056-MB1 for Iron: All sample results < RL or > 10x MB1 concentration.

**Matrix:** AQ

**Batch ID:** MP31098

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28608-4MS, DA28608-4MSD were used as the QC samples for the metals analysis.

### Metals Analysis By Method EPA 200.8

**Matrix:** AQ

**Batch ID:** MP31064

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28470-1MS, DA28470-1MSD were used as the QC samples for the metals analysis.

### Metals Analysis By Method SW846 6010C

**Matrix:** AQ

**Batch ID:** MP31061

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28424-1AMS, DA28424-1AMSD, DA28424-1ASDL were used as the QC samples for the metals analysis.
- The serial dilution RPD(s) for Sodium are outside control limits for sample MP31061-SD1. Probable cause due to sample homogeneity.

Monday, September 14, 2020

Page 1 of 3



## General Chemistry By Method EPA300.0/SW846 9056A

**Matrix:** AQ **Batch ID:** GP27632

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28439-2MS, DA28439-2MSD were used as the QC samples for the Bromide, Chloride, Fluoride, Nitrogen, Nitrate, Nitrogen, Nitrite, Sulfate, Bromide analysis.

**Matrix:** AQ **Batch ID:** R52237

- The data for EPA300.0/SW846 9056A meets quality control requirements.
- DA28424-1 for Nitrogen, Nitrate + Nitrite: Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

**Matrix:** AQ **Batch ID:** R52238

- The data for EPA300.0/SW846 9056A meets quality control requirements.
- DA28424-2 for Nitrogen, Nitrate + Nitrite: Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

## General Chemistry By Method HACH IRB-BART

**Matrix:** AQ **Batch ID:** MB1349

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

## General Chemistry By Method HACH SLYM-BART

**Matrix:** AQ **Batch ID:** MB1350

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

## General Chemistry By Method HACH SRB-BART

**Matrix:** AQ **Batch ID:** MB1351

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

## General Chemistry By Method SM 2320B-2011

**Matrix:** AQ **Batch ID:** GN51149

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28344-2DUP, DA28361-1MS, DA28361-1MSD were used as the QC samples for the Alkalinity, Total as CaCO<sub>3</sub> analysis.

**Matrix:** AQ **Batch ID:** GN51150

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

**Matrix:** AQ **Batch ID:** GN51152

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.

## General Chemistry By Method SM 2510B-2011

**Matrix:** AQ **Batch ID:** GP27698

- Sample(s) DA28412-1DUP were used as the QC samples for the Specific Conductivity analysis.

## General Chemistry By Method SM 2540C-2011

**Matrix:** AQ

**Batch ID:** GN51137

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA28424-2DUP were used as the QC samples for the Solids, Total Dissolved analysis.

## General Chemistry By Method SM4500HB+-2011/9040C

**Matrix:** AQ

**Batch ID:** GN51186

- The data for SM4500HB+-2011/9040C meets quality control requirements.
- The following samples were run outside of holding time for method SM4500HB+-2011/9040C: DA28424-1, DA28424-2
- DA28424-1 for pH: Field parameter analyzed by the laboratory upon request.
- DA28424-2 for pH: Field parameter analyzed by the laboratory upon request.

## General Chemistry By Method USDA HANDBOOK 60

**Matrix:** AQ

**Batch ID:** MP31061

- DA28424-1A for Sodium Adsorption Ratio: Calculated as:  $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L}) + (\text{Mg meq/L})/2]}$
- DA28424-2A for Sodium Adsorption Ratio: Calculated as:  $(\text{Na meq/L}) / \sqrt{[(\text{Ca meq/L}) + (\text{Mg meq/L})/2]}$

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

## Summary of Hits

**Job Number:** DA28424  
**Account:** LT Environmental  
**Project:** 2020 Rule 608  
**Collected:** 08/26/20

Lab Sample ID	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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### DA28424-1 CHAVEZ 01

Alkalinity, Bicarbonate as CaCO <sub>3</sub>	115	5.0			mg/l	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	115	5.0			mg/l	SM 2320B-2011
Chloride	2.0	0.50			mg/l	EPA300.0/SW846 9056A
Fluoride	0.21	0.10			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.027	0.010			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate + Nitrite <sup>a</sup>	0.027	0.014			mg/l	EPA300.0/SW846 9056A
Solids, Total Dissolved	166	10			mg/l	SM 2540C-2011
Specific Conductivity	289	1.0			umhos/cm	SM 2510B-2011
Sulfate	22.5	0.50			mg/l	EPA300.0/SW846 9056A
pH <sup>b</sup>	7.89				su	SM4500HB+ -2011/9040C

### DA28424-1A CHAVEZ 01

Calcium	52.3	2.0			mg/l	SW846 6010C
Magnesium	9.14	1.0			mg/l	SW846 6010C
Sodium	12.6	2.0			mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>c</sup>	0.422				ratio	USDA HANDBOOK 60

### DA28424-1B CHAVEZ 01

Iron-Related Bacteria	35000	25			CFU/ml	HACH IRB-BART
Slime Forming Bacteria	440000	500			CFU/ml	HACH SLYM-BART
Sulfate Reducing Bacteria	27000	200			CFU/ml	HACH SRB-BART

### DA28424-1F CHAVEZ 01

Calcium	37600	400			ug/l	EPA 200.7
Magnesium	6790	200			ug/l	EPA 200.7
Manganese	2.5	2.0			ug/l	EPA 200.8
Sodium	9680	400			ug/l	EPA 200.7

### DA28424-2 CHAVEZ 02

Alkalinity, Bicarbonate as CaCO <sub>3</sub>	165	5.0			mg/l	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	165	5.0			mg/l	SM 2320B-2011
Chloride	2.4	0.50			mg/l	EPA300.0/SW846 9056A
Fluoride	0.22	0.10			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.12	0.050			mg/l	EPA300.0/SW846 9056A
Nitrogen, Nitrate + Nitrite <sup>a</sup>	0.12	0.054			mg/l	EPA300.0/SW846 9056A
Solids, Total Dissolved	222	10			mg/l	SM 2540C-2011
Specific Conductivity	346	1.0			umhos/cm	SM 2510B-2011
Sulfate	25.2	0.50			mg/l	EPA300.0/SW846 9056A
pH <sup>b</sup>	7.99				su	SM4500HB+ -2011/9040C

## Summary of Hits

Page 2 of 2

**Job Number:** DA28424  
**Account:** LT Environmental  
**Project:** 2020 Rule 608  
**Collected:** 08/26/20



Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
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### DA28424-2A CHAVEZ 02

Calcium	56.2	2.0		mg/l	SW846 6010C
Magnesium	10.3	1.0		mg/l	SW846 6010C
Sodium	11.4	2.0		mg/l	SW846 6010C
Sodium Adsorption Ratio <sup>c</sup>	0.367			ratio	USDA HANDBOOK 60

### DA28424-2B CHAVEZ 02

Iron-Related Bacteria	35000	25		CFU/ml	HACH IRB-BART
Slime Forming Bacteria	1750000	500		CFU/ml	HACH SLYM-BART
Sulfate Reducing Bacteria	27000	200		CFU/ml	HACH SRB-BART

### DA28424-2F CHAVEZ 02

Calcium	49200	400		ug/l	EPA 200.7
Iron	76.5	10		ug/l	EPA 200.7
Magnesium	9200	200		ug/l	EPA 200.7
Manganese	5.6	2.0		ug/l	EPA 200.8
Potassium	1360	1000		ug/l	EPA 200.7
Sodium	10900	400		ug/l	EPA 200.7

- (a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)  
(b) Field parameter analyzed by the laboratory upon request.  
(c) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]



Wheat Ridge, CO

Section 4

4

Sample Results

Report of Analysis



Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ 01	<b>Date Sampled:</b>	08/26/20
<b>Lab Sample ID:</b>	DA28424-1	<b>Date Received:</b>	08/27/20
<b>Matrix:</b>	AQ - Water	<b>Percent Solids:</b>	n/a
<b>Method:</b>	RSK175 MOD		
<b>Project:</b>	2020 Rule 608		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FK1652.D	1	08/28/20 11:48	JB	n/a	n/a	GFK116
Run #2							

Run #	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	20.3 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00070	mg/l	

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
RL = Reporting Limit      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

## Report of Analysis

Client Sample ID: CHAVEZ 01

Lab Sample ID: DA28424-1

Matrix: AQ - Water

Project: 2020 Rule 608

Date Sampled: 08/26/20

Date Received: 08/27/20

Percent Solids: n/a

## General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Bicarbonate as CaC	115	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	115	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Bromide	< 0.050	0.050	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Chloride	2.0	0.50	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Fluoride	0.21	0.10	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.027	0.010	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate + Nitrite <sup>a</sup>	0.027	0.014	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
Solids, Total Dissolved	166	10	mg/l	1	08/31/20	SK	SM 2540C-2011
Specific Conductivity	289	1.0	umhos/cm	1	09/09/20	SK	SM 2510B-2011
Sulfate	22.5	0.50	mg/l	1	08/27/20 11:32	JB	EPA300.0/SW846 9056A
pH <sup>b</sup>	7.89		su	1	09/03/20	SR	SM4500HB+ -2011/9040C

(a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

(b) Field parameter analyzed by the laboratory upon request.

RL = Reporting Limit

Report of Analysis

Client Sample ID: CHAVEZ 01  
Lab Sample ID: DA28424-1A  
Matrix: AQ - Water  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	52.3	2.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Magnesium	9.14	1.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Sodium	12.6	2.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>

(1) Instrument QC Batch: MA13022  
(2) Prep QC Batch: MP31061

RL = Reporting Limit

4.2  
4

Report of Analysis

Client Sample ID: CHAVEZ 01  
Lab Sample ID: DA28424-1A  
Matrix: AQ - Water  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	0.422		ratio	1	08/28/20 10:00	SJ	USDA HANDBOOK 60

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

RL = Reporting Limit

4.2  
4

Report of Analysis

Client Sample ID: CHAVEZ 01  
Lab Sample ID: DA28424-1B  
Matrix: AQ - Water  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Iron-Related Bacteria	35000	25	CFU/ml	1	08/28/20 15:30	JD	HACH IRB-BART
Slime Forming Bacteria	440000	500	CFU/ml	1	08/28/20 15:30	JD	HACH SLYM-BART
Sulfate Reducing Bacteria	27000	200	CFU/ml	1	08/28/20 15:30	JD	HACH SRB-BART

RL = Reporting Limit



Report of Analysis

Client Sample ID: CHAVEZ 01  
Lab Sample ID: DA28424-1F  
Matrix: AQ - Water Filtered  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	37600	400	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>3</sup>
Iron	< 10	10	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>3</sup>
Magnesium	6790	200	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>3</sup>
Manganese	2.5	2.0	ug/l	2	08/31/20	08/31/20 JD	EPA 200.8 <sup>1</sup>	EPA 200.8 <sup>4</sup>
Potassium	< 1000	1000	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>3</sup>
Selenium	< 0.80	0.80	ug/l	2	08/31/20	08/31/20 JD	EPA 200.8 <sup>1</sup>	EPA 200.8 <sup>4</sup>
Sodium	9680	400	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>3</sup>

- (1) Instrument QC Batch: MA13029
- (2) Instrument QC Batch: MA13032
- (3) Prep QC Batch: MP31056
- (4) Prep QC Batch: MP31064

RL = Reporting Limit

4.4  
4

Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ 02	
<b>Lab Sample ID:</b>	DA28424-2	<b>Date Sampled:</b> 08/26/20
<b>Matrix:</b>	AQ - Water	<b>Date Received:</b> 08/27/20
<b>Method:</b>	RSK175 MOD	<b>Percent Solids:</b> n/a
<b>Project:</b>	2020 Rule 608	

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FK1653.D	1	08/28/20 12:00	JB	n/a	n/a	GFK116
Run #2							

	Initial Volume	Headspace Volume	Volume Injected	Temperature
Run #1	39.0 ml	4.0 ml	500 ul	20.3 Deg. C
Run #2				

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00070	mg/l	

ND = Not detected      MDL = Method Detection Limit      J = Indicates an estimated value  
RL = Reporting Limit      B = Indicates analyte found in associated method blank  
E = Indicates value exceeds calibration range      N = Indicates presumptive evidence of a compound

4.5  
4

## Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ 02	<b>Date Sampled:</b>	08/26/20
<b>Lab Sample ID:</b>	DA28424-2	<b>Date Received:</b>	08/27/20
<b>Matrix:</b>	AQ - Water	<b>Percent Solids:</b>	n/a
<b>Project:</b>	2020 Rule 608		

## General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Alkalinity, Bicarbonate as CaC	165	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Alkalinity, Carbonate	< 5.0	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Alkalinity, Total as CaCO <sub>3</sub>	165	5.0	mg/l	1	09/01/20	JD	SM 2320B-2011
Bromide	< 0.050	0.050	mg/l	1	08/27/20 11:45	JB	EPA300.0/SW846 9056A
Chloride	2.4	0.50	mg/l	1	08/27/20 11:45	JB	EPA300.0/SW846 9056A
Fluoride	0.22	0.10	mg/l	1	08/27/20 11:45	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate	0.12	0.050	mg/l	5	08/27/20 17:21	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrate + Nitrite <sup>a</sup>	0.12	0.054	mg/l	1	08/27/20 17:21	JB	EPA300.0/SW846 9056A
Nitrogen, Nitrite	< 0.0040	0.0040	mg/l	1	08/27/20 11:45	JB	EPA300.0/SW846 9056A
Solids, Total Dissolved	222	10	mg/l	1	08/31/20	SK	SM 2540C-2011
Specific Conductivity	346	1.0	umhos/cm	1	09/09/20	SK	SM 2510B-2011
Sulfate	25.2	0.50	mg/l	1	08/27/20 11:45	JB	EPA300.0/SW846 9056A
pH <sup>b</sup>	7.99		su	1	09/03/20	SR	SM4500HB+ -2011/9040C

(a) Calculated as: (Nitrogen, Nitrate) + (Nitrogen, Nitrite)

(b) Field parameter analyzed by the laboratory upon request.

RL = Reporting Limit

Report of Analysis

Client Sample ID: CHAVEZ 02  
Lab Sample ID: DA28424-2A  
Matrix: AQ - Water  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

SAR Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	56.2	2.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Magnesium	10.3	1.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>
Sodium	11.4	2.0	mg/l	1	08/28/20	08/28/20 SJ	SW846 6010C <sup>1</sup>	SW846 3010A/M <sup>2</sup>

(1) Instrument QC Batch: MA13022  
(2) Prep QC Batch: MP31061

RL = Reporting Limit

4.6  
4

Report of Analysis

Client Sample ID: CHAVEZ 02  
Lab Sample ID: DA28424-2A  
Matrix: AQ - Water  
Project: 2020 Rule 608

Date Sampled: 08/26/20  
Date Received: 08/27/20  
Percent Solids: n/a

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Sodium Adsorption Ratio <sup>a</sup>	0.367		ratio	1	08/28/20 10:25	SJ	USDA HANDBOOK 60

(a) Calculated as: (Na meq/L) / sqrt [(Ca meq/L)+ (Mg meq/L)/2]

RL = Reporting Limit

Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ 02	<b>Date Sampled:</b>	08/26/20
<b>Lab Sample ID:</b>	DA28424-2B	<b>Date Received:</b>	08/27/20
<b>Matrix:</b>	AQ - Water	<b>Percent Solids:</b>	n/a
<b>Project:</b>	2020 Rule 608		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed	By	Method
Iron-Related Bacteria	35000	25	CFU/ml	1	08/28/20 15:30	JD	HACH IRB-BART
Slime Forming Bacteria	1750000	500	CFU/ml	1	08/28/20 15:30	JD	HACH SLYM-BART
Sulfate Reducing Bacteria	27000	200	CFU/ml	1	08/28/20 15:30	JD	HACH SRB-BART

RL = Reporting Limit

4.7  
4



Report of Analysis

<b>Client Sample ID:</b>	CHAVEZ 02	<b>Date Sampled:</b>	08/26/20
<b>Lab Sample ID:</b>	DA28424-2F	<b>Date Received:</b>	08/27/20
<b>Matrix:</b>	AQ - Water Filtered	<b>Percent Solids:</b>	n/a
<b>Project:</b>	2020 Rule 608		

Dissolved Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed By	Method	Prep Method
Calcium	49200	400	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>4</sup>
Iron	76.5	10	ug/l	1	09/03/20	09/04/20 SJ	EPA 200.7 <sup>3</sup>	EPA 200.7 <sup>6</sup>
Magnesium	9200	200	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>4</sup>
Manganese	5.6	2.0	ug/l	2	08/31/20	08/31/20 JD	EPA 200.8 <sup>1</sup>	EPA 200.8 <sup>5</sup>
Potassium	1360	1000	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>4</sup>
Selenium	< 0.80	0.80	ug/l	2	08/31/20	08/31/20 JD	EPA 200.8 <sup>1</sup>	EPA 200.8 <sup>5</sup>
Sodium	10900	400	ug/l	1	08/31/20	09/01/20 JD	EPA 200.7 <sup>2</sup>	EPA 200.7 <sup>4</sup>

- (1) Instrument QC Batch: MA13029
- (2) Instrument QC Batch: MA13032
- (3) Instrument QC Batch: MA13048
- (4) Prep QC Batch: MP31056
- (5) Prep QC Batch: MP31064
- (6) Prep QC Batch: MP31098

RL = Reporting Limit

4.8  
4

## Misc. Forms

5

### Custody Documents and Other Forms

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Includes the following where applicable:

- Chain of Custody

## CHAIN OF CUSTODY

**SGS North America Inc. - Wheat Ridge**  
4036 Youngfield Street, Wheat Ridge, CO 80033  
TEL: 303-425-6021 FAX: 303-425-6854  
[www.sgs.com/ehsusa](http://www.sgs.com/ehsusa)

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EHS-A-QAC-0027-00-FORM-Wheat Ridge - DW COC Rev. Date: 4/10/18

## DA28424: Chain of Custody

Page 1 of 3

## SGS Sample Receipt Summary

**Job Number:** DA28424      **Client:** LT ENVIRONMENTAL      **Project:** 2020 RULE 608  
**Date / Time Received:** 8/27/2020 9:45:00 AM      **Delivery Method:**      **Airbill #s:** FX  
**Cooler Temps (Initial/Adjusted):** #1: (0.7/0.7):

<u>Cooler Security</u>		<u>Y</u>	<u>or</u>	<u>N</u>	<u>Y</u>		<u>or</u>	<u>N</u>
1. Custody Seals Present:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	3. COC Present:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	
2. Custody Seals Intact:	<input checked="" type="checkbox"/>		<input type="checkbox"/>	4. Smpl Dates/Time OK	<input checked="" type="checkbox"/>		<input type="checkbox"/>	

<u>Cooler Temperature</u>	<u>Y</u>	<u>or</u>	<u>N</u>
1. Temp criteria achieved:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Cooler temp verification:	IR Gun		
3. Cooler media:	Ice (Bag)		
4. No. Coolers	1		

<u>Quality Control Preservation</u>	<u>Y</u>	<u>N</u>	<u>N/A</u>
1. Trip Blank present / cooler:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Trip Blank listed on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Samples preserved properly:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4. VOCs headspace free:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<u>Sample Integrity - Documentation</u>	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample labels present on bottles:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. Container labeling complete:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Sample container label / COC agree:	<input checked="" type="checkbox"/>		<input type="checkbox"/>

<u>Sample Integrity - Condition</u>	<u>Y</u>	<u>or</u>	<u>N</u>
1. Sample recvd within HT:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
2. All containers accounted for:	<input checked="" type="checkbox"/>		<input type="checkbox"/>
3. Condition of sample:	Intact		

<u>Sample Integrity - Instructions</u>	<u>Y</u>	<u>N</u>	<u>N/A</u>
1. Analysis requested is clear:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2. Bottles received for unspecified tests	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3. Sufficient volume recvd for analysis:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4. Compositing instructions clear:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Filtering instructions clear:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comments Metals not listed on COC.

**DA28424: Chain of Custody**  
**Page 2 of 3**

Sample Receipt Summary - Problem Resolution

Job Number: DA28424

Initiator: TMP

CSR: Larisa DiMarco

Response Date: 8/28/2020

Response: Per Caitlin McGinn log dissolved metals as Ca,Fe,K,Mg,MnMS,Na, and SeMS.

## GC Volatiles

### QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries



Method Blank Summary

Job Number: DA28424  
Account: LTENCODU LT Environmental  
Project: 2020 Rule 608

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK116-MB	FK1645.D	1	08/28/20	JB	n/a	n/a	GFK116

The QC reported here applies to the following samples: Method: RSK175 MOD  
DA28424-1, DA28424-2

CAS No.	Compound	Result	RL	MDL	Units	Q
74-82-8	Methane	ND	0.00080	0.00070	mg/l	

Blank Spike Summary

Job Number: DA28424  
Account: LTENCODU LT Environmental  
Project: 2020 Rule 608

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GFK116-BS	FK1644.D	10	08/28/20	JB	n/a	n/a	GFK116

The QC reported here applies to the following samples: Method: RSK175 MOD

DA28424-1, DA28424-2

CAS No.	Compound	Spike mg/l	BSP mg/l	BSP %	Limits
74-82-8	Methane	0.512	0.579	113	70-130

\* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: DA28424  
Account: LTENCODU LT Environmental  
Project: 2020 Rule 608

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
DA19417-4MS	FK1647.D	10	08/28/20	JB	n/a	n/a	GFK116
DA19417-4MSD	FK1648.D	10	08/28/20	JB	n/a	n/a	GFK116
DA19417-4	FK1646.D	1	08/28/20	JB	n/a	n/a	GFK116

The QC reported here applies to the following samples: Method: RSK175 MOD

DA28424-1, DA28424-2

CAS No.	Compound	DA19417-4 mg/l	Spike Q mg/l	MS mg/l	MS %	Spike mg/l	MSD mg/l	MSD %	RPD	Limits Rec/RPD
74-82-8	Methane	ND	0.512	0.596	116	0.512	0.577	113	3	15-200/30

\* = Outside of Control Limits.

## Metals Analysis

### QC Data Summaries

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Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	46	30		
Antimony	30	14	10		
Arsenic	25	22	7		
Barium	10	.3	2		
Beryllium	10	1	1.3		
Boron	50	3.3	7.4		
Cadmium	10	1.9	1.6		
Calcium	400	6.6	53	18.6	<400
Chromium	10	1.1	1.7		
Cobalt	5.0	2.7	2.3		
Copper	10	4.6	2.3		
Iron	10	8.9	3.1	7.1	* (a)
Lead	50	13	6.3		
Lithium	5.0	.6	4		
Magnesium	200	50	31	26.8	<200
Manganese	5.0	.5	1.1		
Molybdenum	10	8.5	4.3		
Nickel	30	6.2	6.1		
Phosphorus	100	91	24		
Potassium	1000	84	250	1.6	<1000
Selenium	50	30	21		
Silicon	50	41	45		
Silver	30	.6	4		
Sodium	400	13	51	16.1	<400
Strontium	5.0	.1	.6		
Thallium	10	17	7.5		
Tin	60	41	51		
Titanium	10	.5	1.9		
Uranium	50	3.9	8.5		
Vanadium	10	.9	.7		
Zinc	30	9	3.8		

Associated samples MP31056: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested

(a) All sample results < RL or > 10x MBL concentration.



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	DA28440-1 Original MS		SpikeLot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium	anr				
Calcium	1260	25600	25000	100.1	70-130
Chromium	anr				
Cobalt					
Copper	anr				
Iron	15400	20300	5000	98.0	70-130
Lead	anr				
Lithium					
Magnesium	156	24100	25000	95.8	70-130
Manganese	anr				
Molybdenum					
Nickel	anr				
Phosphorus					
Potassium	1140	27600	25000	105.6	70-130
Selenium					
Silicon					
Silver	anr				
Sodium	4940	31100	25000	105.0	70-130
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc	anr				

Associated samples MP31056: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

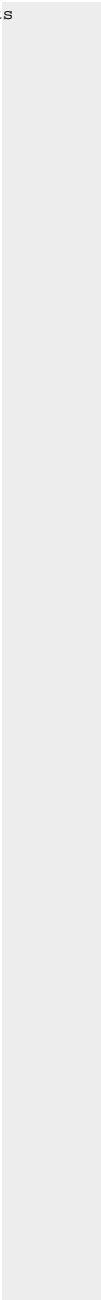
QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	DA28440-1 Original MS	Spike ICPAL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

	DA28440-1		Spikelot		MSD	QC
Metal	Original	MSD	ICPALL2	% Rec	RPD	Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium	anr					
Calcium	1260	25200	25000	98.5	1.6	20
Chromium	anr					
Cobalt						
Copper	anr					
Iron	15400	20400	5000	100.0	0.5	20
Lead	anr					
Lithium						
Magnesium	156	24200	25000	96.2	0.4	20
Manganese	anr					
Molybdenum						
Nickel	anr					
Phosphorus						
Potassium	1140	27500	25000	105.2	0.4	20
Selenium						
Silicon						
Silver	anr					
Sodium	4940	31100	25000	105.0	0.0	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc	anr					

Associated samples MP31056: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
 Account: LTENCODU - LT Environmental  
 Project: 2020 Rule 608

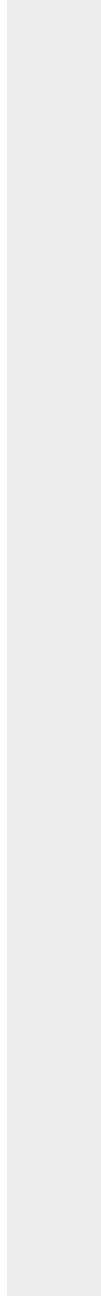
QC Batch ID: MP31056  
 Matrix Type: AQUEOUS

Methods: EPA 200.7  
 Units: ug/l

Prep Date: 08/31/20

Metal	DA28440-1 Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested



## SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium	anr			
Calcium	24000	25000	96.0	85-115
Chromium	anr			
Cobalt				
Copper	anr			
Iron	5010	5000	100.2	85-115
Lead	anr			
Lithium				
Magnesium	23600	25000	94.4	85-115
Manganese	anr			
Molybdenum				
Nickel	anr			
Phosphorus				
Potassium	25800	25000	103.2	85-115
Selenium				
Silicon				
Silver	anr			
Sodium	25000	25000	100.0	85-115
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc	anr			

Associated samples MP31056: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

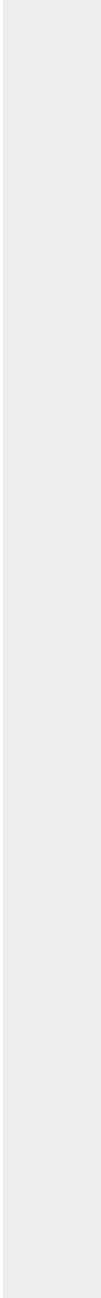
QC Batch ID: MP31056  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 08/31/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested





BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	RL	IDL	MDL	MB raw	final
Aluminum	500	55	75		
Antimony	150	11	34		
Arsenic	130	19	23		
Barium	50	1	6.5		
Beryllium	50	4.5	6.5		
Boron	250	4	32		
Cadmium	50	1	6.5		
Calcium	2000	12	250	16.5	<2000
Chromium	50	1.5	6.5		
Cobalt	25	2.5	3.2		
Copper	50	4	6.5		
Iron	350	7.5	60		
Lead	250	11	32		
Lithium	25	2	6.5		
Magnesium	1000	34	130	70.5	<1000
Manganese	25	2.5	3.2		
Molybdenum	50	2	14		
Nickel	150	2.5	19		
Phosphorus	500	75	80		
Potassium	5000	500	630		
Selenium	250	36	110		
Silicon	250	24	75		
Silver	150	1.5	19		
Sodium	2000	37	250	365	<2000
Strontium	25	.05	3.2		
Thallium	50	9	22		
Tin	300	60	260		
Titanium	50	.5	6.5		
Uranium	250	15	43		
Vanadium	50	2	6.5		
Zinc	150	2	19		

Associated samples MP31061: DA28424-1A, DA28424-2A

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

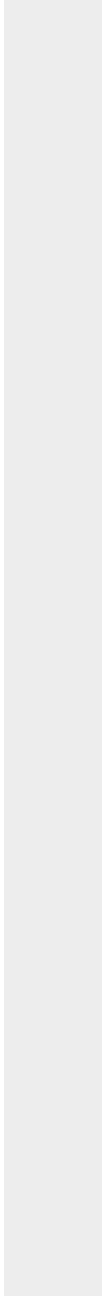
QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	DA28424-1A Original MS		Spikelot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium	52300	188000	125000	108.6	75-125
Chromium					
Cobalt					
Copper					
Iron					
Lead					
Lithium					
Magnesium	9140	135000	125000	100.7	75-125
Manganese					
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium	12600	139000	125000	101.1	75-125
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP31061: DA28424-1A, DA28424-2A

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
 Account: LTENCODU - LT Environmental  
 Project: 2020 Rule 608

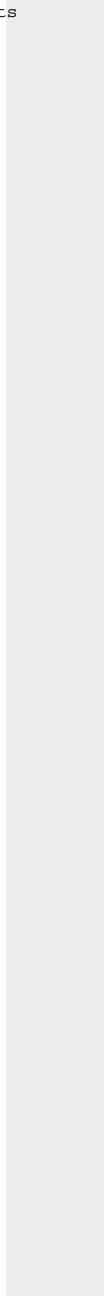
QC Batch ID: MP31061  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 08/28/20

Metal	DA28424-1A Original MS	Spike lot ICPAL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested



MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	DA28424-1A		Spikelot		MSD	QC
	Original	MSD	ICPALL2	% Rec	RPD	Limit
Aluminum						
Antimony						
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Calcium	52300	184000	125000	105.4	2.2	20
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Lithium						
Magnesium	9140	136000	125000	101.5	0.7	20
Manganese						
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium						
Silicon						
Silver						
Sodium	12600	139000	125000	101.1	0.0	20
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP31061: DA28424-1A, DA28424-2A

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

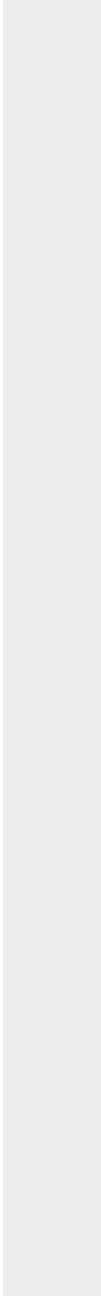
Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS  
Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	DA28424-1A Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested





## SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	139000	125000	111.2	80-120
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	127000	125000	101.6	80-120
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	127000	125000	101.6	80-120
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP31061: DA28424-1A, DA28424-2A

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

## SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424

Account: LTENCODU - LT Environmental

Project: 2020 Rule 608

QC Batch ID: MP31061

Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60

Units: ug/l

Prep Date:

08/28/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested

# SERIAL DILUTION RESULTS SUMMARY

Login Number: DA28424  
 Account: LTENCODU - LT Environmental  
 Project: 2020 Rule 608

QC Batch ID: MP31061  
 Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
 Units: ug/l

Prep Date: 08/28/20

Metal	DA28424-1A Original	SDL 1:5	%DIF	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium	10500	10900	3.9	0-10
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Lithium				
Magnesium	1830	1870	2.4	0-10
Manganese				
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium	2520	2850	13.2*(a)	0-10
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP31061: DA28424-1A, DA28424-2A

Results < IDL are shown as zero for calculation purposes  
 (\*) Outside of QC limits

SERIAL DILUTION RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31061  
Matrix Type: AQUEOUS

Methods: SW846 6010C, USDA HANDBOOK 60  
Units: ug/l

Prep Date: 08/28/20

	DA28424-1A		QC
Metal	Original SDL 1:5	%DIF	Limits

(anr) Analyte not requested  
(a) Serial dilution indicates possible matrix interference.

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31064  
Matrix Type: AQUEOUS

Methods: EPA 200.8  
Units: ug/l

Prep Date: 08/31/20

Metal	RL	IDL	MDL	MB raw	final
Aluminum	50	1.1	18		
Antimony	0.40	.0022	.07		
Arsenic	0.20	.017	.07		
Barium	2.0	.016	.27		
Beryllium	0.30	.016	.21		
Boron	40	.49	14		
Cadmium	0.15	.036	.11		
Calcium	400	5.6	78		
Chromium	2.0	.053	.72		
Cobalt	0.20	.0049	.024		
Copper	2.0	.06	.31		
Iron	10	3.5	7.8		
Lead	0.50	.0079	.027		
Magnesium	100	1.3	16		
Manganese	1.0	.12	.15	0.11	<1.0
Molybdenum	1.0	.049	.54		
Nickel	2.0	.0088	.29		
Phosphorus	60	2.6	40		
Potassium	200	2.9	43		
Selenium	0.40	.06	.34	-0.099	<0.40
Silver	0.10	.0019	.016		
Sodium	500	4.9	61		
Strontium	20	.01	1.3		
Thallium	0.20	.0024	.013		
Tin	10	.063	1.4		
Titanium	2.0	.059	.23		
Uranium	0.20	.0017	.12		
Vanadium	20	.037	5		
Zinc	10	.21	2		

Associated samples MP31064: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits  
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31064  
Matrix Type: AQUEOUS

Methods: EPA 200.8  
Units: ug/l

Prep Date: 08/31/20

Metal	DA28470-1 Original MS	Spikelot ICPAL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium	anr			
Beryllium				
Boron				
Cadmium				
Calcium	anr			
Chromium				
Cobalt				
Copper				
Iron				
Lead				
Magnesium				
Manganese	0.59	103	100	102.4 70-130
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium	1.3	199	200	98.9 70-130
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP31064: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits  
(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31064  
Matrix Type: AQUEOUS

Methods: EPA 200.8  
Units: ug/l

Prep Date: 08/31/20

Metal	DA28470-1 Original	MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum						
Antimony						
Arsenic						
Barium	anr					
Beryllium						
Boron						
Cadmium						
Calcium	anr					
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Magnesium						
Manganese	0.59	103	100	102.4	0.0	20
Molybdenum						
Nickel						
Phosphorus						
Potassium						
Selenium	1.3	205	200	101.9	3.0	20
Silver						
Sodium						
Strontium						
Thallium						
Tin						
Titanium						
Uranium						
Vanadium						
Zinc						

Associated samples MP31064: DA28424-1F, DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits  
(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested





BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	RL	IDL	MDL	MB raw	final
Aluminum	100	11	30		
Antimony	30	2.1	10		
Arsenic	25	3.8	7		
Barium	10	.2	2		
Beryllium	10	.9	1.3		
Boron	50	.8	7.4		
Cadmium	10	.2	1.6		
Calcium	400	2.4	53		
Chromium	10	.3	1.7		
Cobalt	5.0	.5	2.3		
Copper	10	.8	2.3		
Iron	10	1.5	3.1	-2.4	<10
Lead	50	2.1	6.3		
Lithium	5.0	.4	4		
Magnesium	200	6.8	31		
Manganese	5.0	.5	1.1		
Molybdenum	10	.4	4.3		
Nickel	30	.5	6.1		
Phosphorus	100	15	24		
Potassium	1000	84	250		
Selenium	50	7.1	21		
Silicon	50	4.7	45		
Silver	30	.3	4		
Sodium	400	7.3	51		
Strontium	5.0	.01	.6		
Thallium	10	1.8	7.5		
Tin	60	12	51		
Titanium	10	.1	1.9		
Uranium	50	2.9	8.5		
Vanadium	10	.4	.7		
Zinc	30	.4	3.8		

Associated samples MP31098: DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

BLANK RESULTS SUMMARY  
Part 2 - Method Blanks

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	RL	IDL	MDL	MB raw	final
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(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	DA28608-4 Original MS		Spikelot ICPAL2	% Rec	QC Limits
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium	anr				
Cobalt					
Copper					
Iron	104	5660	5000	111.2	70-130
Lead					
Lithium					
Magnesium					
Manganese	anr				
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP31098: DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	DA28608-4 Original MS	Spike ICPALL2	% Rec	QC Limits
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(N) Matrix Spike Rec. outside of QC limits  
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	DA28608-4 Original MSD	Spikelot ICPAL2	% Rec	MSD RPD	QC Limit
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Boron					
Cadmium					
Calcium					
Chromium	anr				
Cobalt					
Copper					
Iron	104	5670	5000	111.4	0.2 20
Lead					
Lithium					
Magnesium					
Manganese	anr				
Molybdenum					
Nickel					
Phosphorus					
Potassium					
Selenium					
Silicon					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium					
Uranium					
Vanadium					
Zinc					

Associated samples MP31098: DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA28424  
 Account: LTENCODU - LT Environmental  
 Project: 2020 Rule 608

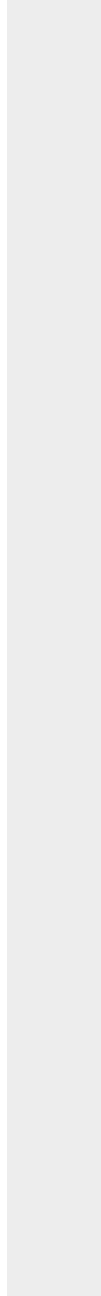
QC Batch ID: MP31098  
 Matrix Type: AQUEOUS

Methods: EPA 200.7  
 Units: ug/l

Prep Date: 09/03/20

Metal	DA28608-4 Original MSD	SpikeLot ICPALL2 % Rec	MSD RPD	QC Limit
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(N) Matrix Spike Rec. outside of QC limits  
 (anr) Analyte not requested





SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium	anr			
Cobalt				
Copper				
Iron	5560	5000	111.2	85-115
Lead				
Lithium				
Magnesium				
Manganese	anr			
Molybdenum				
Nickel				
Phosphorus				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Uranium				
Vanadium				
Zinc				

Associated samples MP31098: DA28424-2F

Results < IDL are shown as zero for calculation purposes  
(\*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

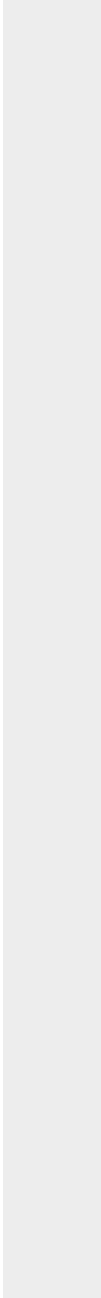
QC Batch ID: MP31098  
Matrix Type: AQUEOUS

Methods: EPA 200.7  
Units: ug/l

Prep Date: 09/03/20

Metal	BSP Result	Spikelot ICPALL2	% Rec	QC Limits
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(anr) Analyte not requested



## General Chemistry

### QC Data Summaries



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Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Alkalinity, Bicarbonate as CaC	GN51150	5.0	2.5	mg/l	100	105	105.0	90-110%
Alkalinity, Carbonate	GN51152	5.0	0.0	mg/l	100	105	105.0	80-120%
Alkalinity, Total as CaCO3	GN51149	5.0	2.5	mg/l	100	105	105.0	90-110%
Bromide	GP27632/GN51132	0.050	0.0	mg/l	0.5	0.512	102.4	90-110%
Chloride	GP27632/GN51132	0.50	0.0	mg/l	5	5.22	104.4	90-110%
Fluoride	GP27632/GN51132	0.10	0.0	mg/l	1	0.985	98.5	90-110%
Iron-Related Bacteria	MB1349	25	<25	CFU/ml				
Nitrogen, Nitrate	GP27632/GN51132	0.010	0.0	mg/l	0.1	0.0988	98.8	90-110%
Nitrogen, Nitrite	GP27632/GN51132	0.0040	0.0	mg/l	0.05	0.0497	99.4	90-110%
Slime Forming Bacteria	MB1350	500	<500	CFU/ml				
Solids, Total Dissolved	GN51137	10	0.0	mg/l	250	257	102.8	90-110%
Specific Conductivity	GP27698/GN51239			umhos/cm	9985	9740	97.5	90-110%
Specific Conductivity	GP27698/GN51239			umhos/cm	998	969	97.1	90-110%
Specific Conductivity	GP27698/GN51239			umhos/cm	100	96.5	96.5	90-110%
Sulfate	GP27632/GN51132	0.50	0.0	mg/l	5	5.13	102.6	90-110%
Sulfate Reducing Bacteria	MB1351	200	<200	CFU/ml				

Associated Samples:

Batch MB1349: DA28424-1B, DA28424-2B  
Batch MB1350: DA28424-1B, DA28424-2B  
Batch MB1351: DA28424-1B, DA28424-2B  
Batch GN51137: DA28424-1, DA28424-2  
Batch GN51149: DA28424-1, DA28424-2  
Batch GN51150: DA28424-1, DA28424-2  
Batch GN51152: DA28424-1, DA28424-2  
Batch GP27632: DA28424-1, DA28424-2  
Batch GP27698: DA28424-1, DA28424-2  
(\*) Outside of QC limits

DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total as CaCO3	GN51149	DA28344-2	mg/l	143	145	1.7	0-20%
Solids, Total Dissolved	GN51137	DA28424-2	mg/l	222	226	1.8	0-5%
Specific Conductivity	GP27698/GN51239	DA28412-1	umhos/cm	1050	1070	2.1	0-20%

Associated Samples:

Batch GN51137: DA28424-1, DA28424-2

Batch GN51149: DA28424-1, DA28424-2

Batch GP27698: DA28424-1, DA28424-2

(\*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Alkalinity, Total as CaCO <sub>3</sub>	GN51149	DA28361-1	mg/l	97.5	100	188	90.0	80-120%
Bromide	GP27632/GN51132	DA28439-2	mg/l	1.3 U	25	24.7	98.8	80-120%
Bromide	GP27632/GN51132	DA28439-2	mg/l	0.057	25	24.7	98.8	80-120%
Chloride	GP27632/GN51132	DA28439-2	mg/l	51.5	250	296	97.8	80-120%
Chloride	GP27632/GN51132	DA28439-2	mg/l	40.4	250	296	97.8	80-120%
Fluoride	GP27632/GN51132	DA28439-2	mg/l	2.5 U	50	48.9	97.8	80-120%
Fluoride	GP27632/GN51132	DA28439-2	mg/l	0.25	50	48.9	97.8	80-120%
Nitrogen, Nitrate	GP27632/GN51132	DA28439-2	mg/l	9.1	5	14.0	98.0	80-120%
Nitrogen, Nitrite	GP27632/GN51132	DA28439-2	mg/l	0.029	2.5	2.6	104.0	80-120%
Sulfate	GP27632/GN51132	DA28439-2	mg/l	21.0	250	270	108.0	80-120%
Sulfate	GP27632/GN51132	DA28439-2	mg/l	20 U	250	270	108.0	80-120%

Associated Samples:

Batch GN51149: DA28424-1, DA28424-2

Batch GP27632: DA28424-1, DA28424-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits



MATRIX SPIKE DUPLICATE RESULTS SUMMARY  
GENERAL CHEMISTRY

Login Number: DA28424  
Account: LTENCODU - LT Environmental  
Project: 2020 Rule 608

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Alkalinity, Total as CaCO3	GN51149	DA28361-1	mg/l	97.5	100	185	1.3	20%
Bromide	GP27632/GN51132	DA28439-2	mg/l	1.3 U	25	24.4	1.2	20%
Bromide	GP27632/GN51132	DA28439-2	mg/l	0.057	25	24.4	1.2	20%
Chloride	GP27632/GN51132	DA28439-2	mg/l	51.5	250	293	1.0	20%
Chloride	GP27632/GN51132	DA28439-2	mg/l	40.4	250	293	1.0	20%
Fluoride	GP27632/GN51132	DA28439-2	mg/l	2.5 U	50	48.3	1.2	20%
Fluoride	GP27632/GN51132	DA28439-2	mg/l	0.25	50	48.3	1.2	20%
Nitrogen, Nitrate	GP27632/GN51132	DA28439-2	mg/l	9.1	5	13.9	0.7	20%
Nitrogen, Nitrite	GP27632/GN51132	DA28439-2	mg/l	0.029	2.5	2.5	3.9	20%
Sulfate	GP27632/GN51132	DA28439-2	mg/l	21.0	250	266	1.5	20%
Sulfate	GP27632/GN51132	DA28439-2	mg/l	20 U	250	266	1.5	20%

Associated Samples:

Batch GN51149: DA28424-1, DA28424-2

Batch GP27632: DA28424-1, DA28424-2

(\*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

8.4

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