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WELL INSTALLATION PLAN

Mineral County Landfill
Creede, Colorado

Prepared for Mineral County, Colorado
File 4656.20
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1.0 INTRODUCTION

On behalf of Mineral County, Colorado (County), Sanborn Head & Associates, Inc. (Sanborn Head) prepared this Groundwater Monitoring Well Installation Plan (Plan) for the Mineral County Landfill near Creede, Colorado.

2.0 BACKGROUND

The County has performed solid waste landfilling at the Landfill starting circa 1971, and has leased land for landfilling operations from the United States Forest Service (USFS) starting in 1971. In 2020, the County will purchase approximately 80 acres, to encompass existing and future proposed expansion landfill area, from the USFS.

The Landfill generally is on an open vegetated parcel with topography generally sloping from east to west on the eastern half and from west to east on the western half.

2.1 Site Location

The Landfill is located on Dump Ground Road (a.k.a., County Road 801) in Creede, Colorado. The Landfill's entrance geospatial coordinates are 37.833439 degrees (°) North latitude and –106.908202° West longitude. The legal description of the facility is the Northeast ¼ of the Northeast ¼ of Section 6, Township 41 North, Range 1 East of the New Mexico Prime Meridian. The Landfill lies at an elevation of approximately 8,840 to 8,920 feet above mean sea level (a.m.s.l.) and overlooks the confluence of Willow Creek and the Rio Grande River. The Landfill primarily is surrounded by Forest Service land, with one adjacent parcel owned by the Wason Ranch Corporation. See the attached Subsurface Exploration Locations Plan.

2.2 Groundwater Monitoring Network

The Landfill's groundwater monitoring network includes four new monitoring wells (MW-1, MW-2, MW-3, and MW-4). Trihydro, a contractor to the Department, installed the wells in October 2018 and developed the wells in November 2018. Trihydro observed no apparent water-bearing zones during drilling in any of the bore holes for the new monitoring wells. At 18 to 20 feet below ground surface (b.g.s.), Trihydro observed solid waste in the bore hole for MW-4. Since this indicated the presence of historic solid waste placement, Trihydro notified the Department.

The first round of groundwater sampling was scheduled for November 2018 and did not occur due to insufficient water in the monitoring wells.

The second round of groundwater sampling occurred in May 2019. Each of the four wells contained measurable quantities of water, though, after following field sampling procedures Trihydro measured MW-2 for field parameters; sampled MW-1, MW-2, and MW-4 for volatile organic compounds (VOCs); and sampled MW-1 and MW-2 for inorganic analytes.

Based on laboratory analyses of the groundwater samples, VOCs were detected in three locations and did not exceed the Department's Regulation No. 41 – Table A standards. VOC detections that did not exceed Regulation No. 41 – Table A standards are as follows:

- MW-1: 1,1-dichloroethane, tetrachloroethene, and 1,1,1-trichloroethane;
- MW-2: 1,1,1-trichloroethane; and
- MW-4: chloroform, tetrachloroethene.

Based on laboratory analyses of the groundwater samples, inorganic analytes were detected in two locations and exceeded the Regulation 41 – Table 1, 2, or 3 standards in two locations. Inorganic analyte detections that did exceed Regulation No. 41 – Table 1, 2, or 3 standards are as follows:

- MW-1: sulfate and thallium
- MW-2: sulfate and thallium

Based on historic site knowledge, the conditions observed during drilling and installation of the new groundwater monitoring wells, and the results of groundwater sampling and testing, the preliminary general consensus among the County, the Department, and Sanborn Head is that these groundwater monitoring wells will remain dry during typical weather conditions, and might produce water during years when precipitation is significantly above average (as happened during the winter of 2018-2019). Snowfall at the Landfill over the winter of 2019-2020 was below average. Therefore, we believe the advancement of bore holes to a maximum depth of 80 feet b.g.s., as discussed below, will encounter no groundwater.

2.3 Site Characteristics

The Landfill is located approximately 2.5 miles southeast from Creede, Colorado. Based on information provided in the Trihydro report, the subsurface consists of unconsolidated material associated with lacustrine deposits and the finely laminated shale. The unconsolidated materials consisted of silty clays, clayey silts, clayey silty gravel, and clayey sandy gravel.

3.0 GEOTECHNICAL EXPLORATION

This Plan describes the program to be followed to provide a geotechnical exploration of the eastern half of the site, to determine its suitability for a proposed lateral expansion of the existing Mineral County Landfill, and within a portion of the existing landfill footprint, to determine approximate extent and depth of overburden above historic solid waste placement (as indicated by the solid waste encountered while drilling MW-4).

This Plan includes several tasks:

- Mobilizing a drilling contractor to the site, and demobilizing the drilling contractor from the site.
- Advancing deeper bore holes (no more than 80 feet b.g.s.) in the proposed lateral expansion area. Sanborn Head consulted with Mr. McClure about the number and

locations of proposed bore holes. After consulting with Mr. McClure, we are proposing six (6) bore holes along the perimeter of the proposed lateral expansion area. Based on Mr. McClure's recommendations, we are proposing the bore holes along the perimeter to minimize leachate infiltration to groundwater.

- Advancing shallower bore holes (no more than an estimated 20 feet b.g.s.) within the existing landfill footprint and in the general vicinity of MW-4. Sanborn Head is proposing two (2) bore holes (one approximately 100 feet generally to the north of MW-4 and one approximately 100 feet generally to the south of MW-4).
- Advancing one borehole approximately 45 feet b.g.s. generally northwest of MW-3.
- Logging the bore holes and collecting samples, as needed, for testing at a soils laboratory, to allow a determination of the suitability of the on-site soil for use as daily cover, intermediate cover, final cover, or any or all of these. We understand that Mr. McClure will be on site during drilling operations and will observe and log the sub-surface conditions in each borehole, collect soil samples, and measure groundwater levels if encountered during drilling. Sanborn Head will visit the site during the initial stages of drilling to provide program oversight and will maintain communication with Mr. McClure during drilling operations.

  For each soil sample, we will have the soils laboratory test for the following:

  - Moisture content (ASTM D 2216 / D 4643);
  - Particle-size analysis (ASTM D 6913 / D 7928 [with Hydrometer]);
  - Atterberg limits (ASTM D 4318);
  - Specific gravity (ASTM D 854);
  - Standard Proctor (ASTM D 698); and
  - Hydraulic conductivity (ASTM D 5084, re-molded).
- Preparing a geotechnical engineering report that will describe the sub-surface exploration program, the sub-surface conditions encountered, and our geotechnical engineering recommendations regarding the suitability of the sub-surface soils for future on-site use (e.g., as the basis for demonstrating the continued suitability of the trench-fill method on site, as well as for use as structural fill, daily cover, intermediate cover, final cover, etc.). Sanborn Head's geotechnical engineering report also will include the boring logs, a Subsurface Exploration Locations Plan, and the soils laboratory test reports. A Sanborn Head Professional Engineer licensed in the State of Colorado will stamp and seal the report. We will provide our geotechnical engineering report as an electronic submittal in portable document format (PDF).

The Landfill, the approximate locations of existing groundwater monitoring wells, and the approximate locations of proposed bore holes, are shown on the attached Subsurface Exploration Locations Plan.

4.0 FIELD ACTIVITIES

The following sections provide details on field activities identified in the Final SOW. Field activities tentatively planned to be performed include:

- Advance soil borings;
- Install and develop two groundwater monitoring wells to approximately 80 feet bgs;
- Slug test at least one new well twice at the Site (no slug testing was performed on previously installed groundwater monitoring wells because of insufficient water quantities in those wells);
- Survey the two newly installed groundwater monitoring wells; and
- Containerize, transport, and dispose of IDW from drilling and sampling activities if impacted, otherwise the stockpiled material will be used at the discretion of the facility.

4.1 Groundwater Monitoring Well Installation

The County plans to install two monitoring wells into the uppermost WBZ of the Site, as shown on Figure 3-1. (Previous installation of groundwater monitoring wells indicated no observation of WBZs to a drilling depth of approximately 75 feet b.g.s., which might indicate that shallow groundwater flow in the area might be discontinuous or limited and that the well likely will not be installed into the uppermost Site WBZ.) The County selected proposed well locations based on field reconnaissance and meetings with CDPHE, Randy McClure, and Sanborn Head. The County stake the proposed locations. In the event that waste is encountered at the proposed location, the Driller will stop drilling, the Field Geologist will notify CDPHE, the Driller will abandon the borehole, and the County will choose an approved off-set location in an area close to the original proposed location.

The rationale for installation of these borings/wells includes:

- Identify the presence or absence of perched water zones and the uppermost WBZ;
- Determine uppermost WBZ groundwater flow direction (if extant, as discussed above) and hydraulic conductivity (limited volumes of groundwater in previously installed monitoring wells led to hydraulic conductivity not being tested, and, therefore, this likely will be the case with the two new wells; and
- Collect bulk geotechnical soil samples from the dominant soil horizon in the upper 20 feet of each boring unless otherwise directed by CDPHE.

The County will use the installed wells to identify the presence or absence of perched water zones and the uppermost WBZ. Alternative monitoring systems are allowed, which means that a perched water bearing zone, depending on its saturated thickness and lithologic characteristics, may constitute a preferred monitoring zone of interest for the project. The perched water zone might be identified through the presence of moisture in the bore hole. If minimal water is observed, the Driller will pause drilling long enough for water to accumulate. After approximately 30 minutes, the Field Geologist will measure the water column and inform. In addition to presence of water, a perched zone might be identified by the following:

- Lithology observed and logged; and
- Encountering a zone of greater permeability overlying a less permeable soil unit or the contact of soil to rock.

A wet/dry well network might be considered acceptable if technically justified based on the observed lithology and approved by CDPHE.

The Field Geologist will use the drilling decision tree to guide in the completion of wells for the following scenarios:

- Shallow perched water;
- Unconfined aquifer;
- Deep aquifer; and
- A combination of the above scenarios.

4.1.1 Drilling Methodology for Soil Borings and Soil Sampling

General requirements for drilling activities will be in accordance with ASTM D 6286 (Standard Guide for Selection of Drilling Methods for Environmental Site Characterization) including the following components:

- Driller will provide the drill rig at the on-set of work in a clean, leak free, and OSHA-compliant condition. The Driller will inspect the drill rig and provide inspection records (Drill Rig Inspection Checklist, Appendix A) to the Field Geologist. Comprehensive maintenance records documenting structural changes or corrected structural damage will accompany the drill rig on site;
- The drilling contractor will coordinate the public utility clearance service, Colorado 811, and verify that all utilities have been marked prior to drilling. The contractor will contact the Field Geologist to confirm contact with Colorado 811 and provide the cleared ticket once available. The Driller will request on-site meetings with all utilities. The Driller also will work with the County to identify known utilities on site;
- A well Driller licensed in Colorado will conduct drilling operations;
- The Driller will prepare necessary certification documentation for well construction materials and provide the documentation to the Field Geologist; and
- Monitoring wells will be permitted through the State of Colorado, Forms GWS-51, GWS-31, and GWS-46. The Driller will submit Form GWS-51 to the Colorado Division of Water Resources (DWR) at least three calendar days prior to construction. The Driller will submit Form GWS-31 to the State Engineer's Office within 60 calendar days after completing the well, or seven days after the expiration date, whichever is earlier. The Driller will submit Form GWS-46 to the DWR with the required filing fee.

For the Site, the driller will perform drilling using Sonic methodology with a Prosonic, PS 600T drill rig or equivalent. The Sonic method is a type of rotary vibratory drilling that includes rotary motion and oscillation, which causes a high frequency force to be superimposed on the drill string. The sonic technique involves advancing a 6-inch core barrel and an 8-inch override casing to prevent the bore hole from collapsing when the core is retrieved.

The technique involves advancing the core barrel at 10-foot intervals telescoping from below the override casing. The technique uses the rotating and vibrating core barrel and override casing simultaneously to drill a clean borehole minimizing the amount of drill cuttings. The diameter of the borehole and override casing will be a minimum of 4 inches greater than the diameter of the installed well casing and screen, thus the technique involves using a minimum of 6-inch core barrel and 8-inch override casing size. The Driller will minimize the addition of potable water during sonic drilling during the drilling. The Driller may use a petroleum hydrocarbon-free and VOC-free thread lubricant on the core and case joints.

The Driller will advance soil borings until groundwater is encountered and then continue a minimum of 5 feet below the groundwater interface, or, in the event groundwater is not encountered, will drill to a depth of approximately 80 feet (or refusal, whichever occurs first) and stop drilling. The target depth of each boring is approximately 5 to 10 feet below the top of the uppermost WBZ, depending on the length of the well screen, which is anticipated to occur within the upper 200 feet b.g.s. Soils will be collected continuously, and the Field Geologist will log the bore hole cores and record the soil lithology, including particle size, soil texture, color, moisture, odor, staining, and plasticity on a boring log, Appendix A. The Field Geologist will perform oil classifications in accordance with the Unified Soil Classification System (USCS, ASTM D 2487).

The Field Geologist will photograph significant lithologic changes and other appropriate observations. To evaluate potential VOC impacts, the Field Geologist will place an aliquot of soil from each 5-foot sample interval in a sealable plastic bag and allow the aliquot to equilibrate at ambient conditions. The sample interval will include sections of the bore hole cores that might be stained, discolored, or odorous. If ambient temperatures are below 60° F, the Field Geologist will elevate the sealed sample temperature slowly by placing the sample in gentle heat for at least five minutes in a vehicle. The Field Geologist will allow the sample to equilibrate and will screen the sample once the vehicle is not running to prevent against interference with engine exhaust. The Field Geologist will field-screen the bag headspace for total organic vapors (TOV) using a photoionization detector (PID) and record the results on the drilling log or in the project field book. An equipment calibration report form is included in Appendix B.

The Field Geologist will screen bore hole and soil cores continuously with a PID or four-gas meter to determine whether the air quality is safe for continued operations or has been impacted by the presence of contaminants below the surface. The four-gas meter will include analysis for methane (lower explosive limit), carbon dioxide, carbon monoxide, and oxygen. If the Field Geologist observes elevated levels of landfill gases or VOCs, the Field Geologist will notify CDPHE. Specific action levels will be included in the project HASP. Daily calibration sheets for the four-gas and PID meters are included in Appendix B.

The Field Geologist will contact CDPHE and provide recommendations if the following situations arise;

- Debris or solid waste material is encountered while drilling; Section 3.10 of this Plan outlines the procedures to follow if solid waste material is encountered;
- Favorable lithology for water-bearing formations overlying bedrock is encountered;
- Boreholes are 50 feet below the target depth selected for the Site;
- Tight soils for greater than or equal to 20 feet, indicating a potential confining layer, aquitard, or aquiclude, with wells completed in tight formations potentially requiring several days to make water; and
- Equipment refusal.

The County anticipates that drilling will include the following equipment:

- Prosonic PS 600T or equivalent;
- Skid loader; and
- Various support vehicles and trailers.

The Field Geologist will collect soil samples for laboratory analysis based on the PID readings obtained during soil screening along with visual and olfactory observations. If the Field Geologist observes no elevated PID readings or field indications of impacts, the field geologies will collect no soil samples for laboratory analysis. If the Field Geologist notes impacted soils, the Field Geologist will collect a soil sample from the potentially impacted zone. The Field Geologist will take care during sample collection to minimize potential headspace and place the samples immediately in an insulated opaque cooler and preserved with ice.

The Field Geologist will submit soil samples for laboratory analysis to an approved testing facility.

Table 3-1 includes the analytical method, sample container, preservation, and holding times for soil sample collection. The Field Geologist will record the transfer of samples to the laboratory through a Chain-of-Custody (C-o-C) form and include the date and time of custody transfer. Sample collection, packaging, and shipping requirements are specified in the Driller's Quality Assurance Project Plan (QAPP), and the QAPP will be available on-site during drilling and groundwater sampling activities.

4.1.2 Geotechnical Soil Samples

The Field Geologist will collect and analyze geotechnical soil samples to verify soil classifications using the following methodology:

- The Field Geologist will log and photograph continuous soil core samples during drilling, and collect disturbed composite bulk samples from the core or auger cuttings during the advancement of the bore holes;

- The Field Geologist will collect a composite sample for each dominant soil horizon, as identified by the Field Geologist, with a minimum of one composite sample in the upper 20 feet and one composite sample in the WBZ for each well. A dominant soil horizon is defined as a soil horizon equal to or greater than 5 feet;
- The Field Geologist will collect samples in 1-gallon or larger, sealable, heavy-duty plastic bags (particle-size analysis and Atterberg limits) or 5-gallon buckets (laboratory compaction) and labeled with the site name, well identification, and range in soil depth. (All three analyses can be performed from one 5-gallon bucket sample);
- The Field Geologist will collect discrete composite samples for similar soil horizons or WBZs encountered in multiple wells, though these samples might not be analyzed;
- The Field Geologist will not collect samples from competent rock formations;
- The Field Geologist will coordinate with CDPHE to determine which samples are submitted to the geotechnical laboratory for analysis based on the completed boring logs, well completion forms, and similarity of the soil horizons between boreholes;
- The Field Geologist will select the appropriate particle-size analysis (i.e., with or without hydrometer) depending on the estimated percentage of fine-grained soils (i.e., the percentage passing the Number 200 sieve). In addition, the soils laboratory will perform Atterberg limits analysis (ASTM D 4318) on soils that are fine-grained. The soils laboratory will plot the Atterberg limit analysis results on a Liquid Limit Chart (also referred to as a Plasticity Chart, a Casagrande Chart, or an A-chart) to verify the field classification;
- The soils laboratory will perform one laboratory compaction analysis (standard Proctor, ASTM D 698) on a composite sample from the upper 20 feet for each bore hole;
- The Field Geologist will store geotechnical soil samples at an off-site location until selected the specific sample intervals for laboratory analysis. The Field Geologist will store the remaining soil samples until CDPHE approves the final report for the Site; and
- Once soils laboratory analysis is complete, the Field Geologist will revise the boring logs and well completion forms to reflect the results of the soils laboratory analysis with these revisions clearly noted.

4.1.3 Well Construction

The Driller will construct the two groundwater monitoring wells at the Site in accordance with the 2 CCR 402-2, Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Well /Hole Construction. A monitoring well development form in Appendix C.

The Driller will construct monitoring wells generally of 4-inch-inner diameter (ID), Schedule-80, flush-threaded polyvinyl chloride (PVC) pipe with 0.010-inch, factory-slotted, Schedule-80, PVC screens. The screen lengths for each well will be a minimum of 10 feet to intersect the uppermost WBZ, as determined in the field. In general, the Driller may place the screen at 8 feet below the water table, although this might need to be adjusted based on field observations. Local geology might dictate use of a 15- or 20-foot screen interval. The Driller will place a Schedule-80, flush-threaded, PVC end cap on the bottom of the monitoring well screen. The Driller will place a Schedule-80, flush-threaded, PVC riser above the screen to a height of approximately 3 feet above grade. The Driller will seal each groundwater monitoring well with a waterproof cap.

Filter pack material surrounding the screen generally will consist of 10- to 20- or 12- to 20-mesh silica sand, depending upon market availability. The Driller will extent the top of the filter pack at least 2 feet above the top of the well screen. The Driller will cap the filter pack with approximately 2 feet of bentonite (chips for a dry hole or coated pellets if constructed in water) used to form a hydraulic seal. If used, the Driller will hydrate bentonite chips with potable water and allowed to rest a minimum of 1 hour before applying grout to the annular space. The Driller will measure the surface of the bentonite seal with a clean measuring tape to document the thickness of the seal. The Driller will fill the remaining annulus above the seal with cement-bentonite grout (a slurry of cement, bentonite, and potable water). The amount of bentonite added will not exceed 8 percent bentonite per dry weight of cement. The volume of additional water used in preparing these slurries will be limited to three-quarters of a gallon per 94-pound sack of cement for each 1 percent of bentonite added. The Driller will place the cement bentonite grout in lifts to the surface. The Driller will place the grout via tremie pipe into the annular space to within approximately 3 feet of ground surface. After allowing the grout has to settle, the Driller will place additional grout to the surface. As described below, the Driller will seal the remaining annular space with concrete during surface completion.

4.1.4 Surface Completion

As described above, the Driller will construct the well with a target riser height of 3 feet. After well construction is complete, the Driller will add a protective outer casing. Protective outer metal casings will include an 8-inch-diameter or 8-inch-square well protective casing buried at least 18 inches into the ground with the top of the protective casing 36 inches above the top of the concrete pad. Accurate placement of the protective casing is critical to ensure ease of access and compatibility with sampling equipment. The Driller will equip the steel casings with a locking cap and rust-resistant lock, with all well locks keyed alike.

The Driller will construct surface well pads of concrete, 4 inches thick (approximately 2 inches below ground surface and 2 inches above ground surface), with a surface dimension of 3 feet by 3 feet. The Driller will slope the concrete pads slightly away (at approximately 2 percent slope) from the protective outer metal casings to the edge of the pad to drain precipitation. The Driller will orient well pads with one edge parallel with surrounding roads or fences or with one edge of the pad trending north.

The Driller will install protective bollards around the well pad to protect the well. The bollards will be 4-inch-diameter steel pipe buried at least 18 inches below ground, completely filled and capped with concrete. The Driller will set the bollards so they are equidistant from the edges of the pad (and each other), vertical, and painted yellow using an oil-based exterior paint to provide high visibility to each well.

4.1.5 Well Development

Proper well development will:

- Ensure that groundwater enters the well screen freely, thus yielding representative groundwater samples and water level measurements;
- Remove water that might have been introduced during drilling and well installation;
- Remove very fine-grained sediment in the filter pack to minimize groundwater sample turbidity and silting of the well; and
- Maximize the efficiency of the filter pack.

No sooner than 48 hours after grouting is completed, the Driller/Field Geologist will develop the monitoring wells by mechanically surging the well, followed by pumping. Surging will consist of forcing water into and out of the formation using a surge block, with the surging action being relatively gentle to avoid slumping formation material into the screen. The Driller/Field Geologist will concentrate surging over 5-foot intervals, starting at the top of the screen, to avoid sand-locking the surge block.

Immediately following surging activities, the Driller/Field Geologist will evacuate groundwater and sediment in the bottom of the well using a bailer or pump. The Driller/Field Geologist will record the volume evacuated from each well, and physical characteristics of the purge water (color, relative turbidity, sediments, etc.) during regular intervals during development activities. If natural recharge rates are adequate, the Driller/Field Geologist will continue development activities until the extracted water is visibly free of sediment, or until parameters (pH, temperature, and conductivity) are stable. If natural recharge rates are insufficient to attain the well development objectives, the Driller/Field Geologist will document the rational for discontinuing well development. The addition of water to aid in well development is not anticipated though might be necessary if water is limited. If water should need to be added, the Driller/Field Geologist will use potable water. The Driller/Field Geologist will measure water levels and total depths before and after well development and document the measurements on the monitoring well development form.

4.2 Well Survey

A Professional Land Surveyor (PLS) licensed in Colorado will complete a well survey at the site. Surveyed well data will include: Northing, Easting, top of casing (riser pipe) elevation, and ground surface elevation. The PLS will input the collected well survey data into the state's Well Directory. Spatial information requirements for each surveyed well:

- Northing and Easting, reported to 0.5 feet, US Survey Feet;
- Top of well casing, reported to 0.01 feet, North American Vertical Datum of 1988 (NAVD 88) Datum;
- Ground surface elevation, reported to 0.01 feet, NAVD 88 Datum; and
- All coordinates reported in North American Datum of 1983 (NAD 83), Colorado North State Plane Coordinates, and Universal Transverse Mercator (UTM) Coordinates.

In conjunction with the PLS, Sanborn Head will submit the collected well survey data to CDPHE in Environmental Systems Research Institute (ESRI)-compatible format as a shapefile or geodatabase. The survey will include installation of two permanent on-site control points, development of a topographic map of the Site, and horizontal and vertical control of the two monitoring well locations. The PLS will base the survey on National Geodetic Survey monuments located near the Site.

4.3 Well Inspection

Prior to the second groundwater sampling event, the Sampler will physically inspect the wells. The Sampler will record condition of each well on the well inspection field forms located in Appendix A. Observations include the presence and type of protective casing, presence and condition of the concrete pad, well cover condition, and condition of the visible portion of the well casing.

4.4 Groundwater Level Monitoring

The Sampler will gauge groundwater levels using an electronic water level meter. The Sampler will measure groundwater level and total depth to the nearest 0.01 feet for each of the wells and record the measurements on fluid level data sheets. The Sampler will decontaminate the water level meter between locations.

4.5 Groundwater Sampling and Analysis

Once the monitoring wells have been developed, the Sampler will initiate groundwater sampling no sooner than 24 hours after well development and the groundwater has re-equilibrated to static levels measured at the on-set of development. The Sampler will gauge and sample the wells in the order from least- to most-impacted based on suspected potential for impact, past analytical results, if applicable, and observations from development. The Sampler will use a bladder pump with a controller and compressed nitrogen for sampling, with the specific model and size of the sampling pump used in the field depending on the availability of resources at the time sampling is authorized to proceed). The Sampler will sample the wells using low-flow sampling methodology pursuant to the Region 1 United States Environmental Protection Agency (USEPA) guidance document Low-Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells (USEPA 2017). An SOP for implementation of the low flow sampling approach and other applicable field procedures is provided in Appendix B. For monitoring wells with slow re-charge that result in significant drawdown (greater than 0.33 feet) while purging at the lowest available rate, the Sampler will pump at a rate between 100 milliliters per minute (mL/min) to 200 mL/min (0.03 to 0.05 gallons per minute [gpm]) for a minimum of one hour, unless draw-down exceeds 2 feet. If a draw-down of greater than 2 feet occurs in a monitoring well, the Sampler will stop purging to allow the well to recover before sampling. The Sampler will notify CDPHE if any wells produce less than 100 mL/min or water quality parameters cannot stabilize within a reasonable time, to discuss alternate sampling strategies. The Sampler will monitor indicator field parameters (temperature, pH, specific electrical conductance [SEC], oxidation reduction potential [ORP], dissolved oxygen [DO], and turbidity) using a water quality meter with a flow-through cell.

The Sampler will submit groundwater samples to an approved testing facility. Table 3-2 includes the analytical method, sample container, preservation, and holding times for groundwater sample collection. The Sampler will record the transfer of the samples to the laboratory a C-o-C form that includes the date and time of custody transfer. Sample collection, packaging, and shipping requirements are specified in the QAPP.

4.6 Quality Assurance / Quality Control Samples

The Sampler will collect samples during this project for QA/QC purposes under EPA standards SW-846, Test Methods for Evaluating Solid Waste. The types and frequencies of QA/QC samples are specified in the QAPP. During each sampling, the Sampler will collect an equipment blank, field blank, matrix spike/matrix spike duplicate, and duplicate sample as specified in Table 3-3.

For soil samples, the Sampler will conduct QA/QC sampling at the following frequency, in accordance with the QAPP:

- Blind Duplicate Samples: One per 20 field samples;
- Equipment Blanks: One per sampling;
- Field Blanks: One per sampling event for VOCs.;
- Trip Blanks: One within each cooler containing soil samples for VOCs; and
- Matrix Spike/ Matrix Spike Duplicate: One per 20 samples.

4.7 Slug Testing

If there is sufficient groundwater, the Sampler will perform slug testing in accordance with Appendix C to evaluate hydrologic properties in the immediate vicinity of the wells. The Sampler will test each of the newly installed two wells at least once and one of the wells twice. The Sampler will introduce a solid slug into the monitoring well (falling head test) while recording fluid levels using a pressure transducer. The Sampler then will remove the solid slug (rising head test) after the well has equilibrated as recorded by the transducer. For QA, the Sampler will slug-test each twice in order to compare results. If the well has low conductivity based on results of the first test, the Sampler will test the well one time. The Sampler will use discretion in determining whether to repeat testing and will document the rationale for re-testing in field notes. The Sampler will compensate transducer data for barometric pressure and evaluate the data using the appropriate solutions in AQTESOLV. If performed (see discussion above), Sanborn Head will present hydraulic conductivity testing results in the final report.

4.8 Drilling Equipment Decontamination

Prior to arriving at the Site, the Driller will decontaminate drill rigs, tools, and accessories. The Driller will manually wash and rinse down-hole drilling tools and non-disposable sampling equipment (e.g., fluid level probe, water quality meter, bladder pump, etc.) prior to use and between each drilling and sampling location. The decontamination procedure will include washing with non-phosphate-based detergent such as Alconox (or similar), a tap-water rinse, and a distilled (or de-ionized) water rinse. The Driller will collect on-site decontamination/rinse water in buckets, and containerize that water in 55-gallon drums for subsequent proper disposal.

4.9 Investigation-Derived Waste

IDW includes soil cuttings generated during drilling and sampling activities, groundwater generated during well development and sampling, and decontamination water. During the drilling activities, the Driller will stockpile potential non-impacted soil IDW at an on-site location specified by Site personnel. For Soil IDW suspected to be impacted, the Driller will drum, label, sample for characterization, and stage the soil at an on-site location specified by Site personnel. If analytical results confirm no impacts from potential contaminants, the Driller will dispose of the cuttings at an approved location on site. The Driller will containerize groundwater IDW in separate, labeled 55-gallon drums, with the drums staged at an on-site location specified by Site personnel, pending the receipt of groundwater analytical results from the monitoring well sampling.

The Driller will use the analytical results to classify the soil and groundwater IDW so that they can be managed in accordance with local, state and federal regulations. If impacted, the Driller will handle the IDW in accordance with the Corrective Action Guidance Document, May 2002, Appendix 2 and Appendix 3, and dispose of the material at an approved waste handling facility. The Driller will dispose of solid waste, including PPE and disposable equipment generated during the sampling activities, as municipal solid waste.

There is a potential for landfilled solid waste material to contain construction and demolition debris and materials suspected of containing asbestos [suspect Asbestos Containing Material (ACM)]. If solid waste is encountered during drilling operations, the Driller will implement the following:

1. A Certified Asbestos Building Inspector (CABI), who meets the training requirements of Section 5.5.3(D) of the Colorado Solid Waste Regulations, will be present to evaluate the presence of suspect ACM(s) in the solid waste encountered;
2. If a CABI is not present, the Driller will consider solid waste encountered to be suspect ACM(s);
3. The Driller will assume the suspect ACM(s) encountered to be ACM(s);
4. The Driller will stop the generation of solid waste if suspect ACM(s) is encountered;
5. The Driller will use available water and adequately wet the encountered suspect ACM(s);
6. The Driller will place the solid-waste-containing suspect ACM(s) on a minimum of 6-mil-thick polyethylene sheeting and cover the material with a minimum of 6-mil-thick polyethylene sheeting until the material can be returned to the hole;
7. The Driller will place the generated solid-waste materials back in the hole whence they came;
8. The Driller will decontaminate the impacted drilling equipment using wet methods and until the equipment is completely clean of all soil and debris prior to resuming drilling operations in another location. To the extent possible, the Driller must perform

decontamination operations over the generated waste material to prevent cross contamination of additional ground surfaces;

9. After the Driller has returned the material to the hole, the Driller will cap the hole with a minimum of 6 inches of clean fill material (topsoil or bentonite). If it is not possible to replace all generated materials in the hole, the Driller will package the materials appropriately and have them disposed of at a facility approved to accept asbestos waste;
10. The Driller will noted the location(s) of all encountered solid waste/ACM(s) on a figure to be provided to CDPHE; and
11. Although not regulated by the State of Colorado, compliance with OSHA air monitoring requirements for work involving the disturbance of ACM(s) should be considered.

5.0 REPORTING

Sanborn Head will submit preliminary and final reports based on the field activities outlined above, the data collected from the first round of groundwater sampling, and the completion of the final round of sampling. The following sections detail the procedures Sanborn Head will use the generation and submittal of project deliverables.

5.1 Preliminary Data Report

In the preliminary data report prepared for the Site, Sanborn Head will document the procedures, field methods, and data gathered during installation, development, and survey of the two newly installed WBZ monitoring wells on the facility. Sanborn Head will submit a draft report 30 days after the completion of preliminary sampling and submit the final report 10 days after receiving CDPHE's comments.

The preliminary report will provide a summary description of the work performed and, at a minimum, will include the following

- A chronological summary of activities;
- A description of aquifer characteristics, especially potential aquitards;
- Figures illustrating well locations and groundwater elevation contours;
- Boring logs and well construction logs/details;
- Well development logs;
- Field sampling data sheets;
- Tables summarizing analytical and geotechnical data collected;
- Analytical laboratory reports and electronic data deliverables from the laboratory; and
- An updated schedule for the second groundwater sampling.

The preliminary data report prepared for the Site will include an electronic working file; a PDF file of including tables, figures, and appendices; and a hard copy.

5.2 Final Data Report

In the final data report prepared for the Site, Sanborn Head will document the procedures, field methods, and data gathered during groundwater monitoring, and tabulated results of the initial event for the two newly installed WBZ monitoring wells on the facility. Sanborn Head will submit the draft version of the report 30 days after the completion of the final sampling and submit the final report 10 days after receiving CDPHE's comments.

The report will provide a summary description of the work performed and include:

- A description of site activities completed;
- A description of site-specific conditions including:
  - Site geology and geotechnical soil characteristics;
  - Depths to groundwater and groundwater flow direction;
  - Groundwater sampling methods and results;
  - Evaluation of detected contaminants compared to CDPHE standards;
  - QA/QC data; amd
  - Slug test methods and results;
- A description and documentation of IDW outcomes;
- Recommendations and conclusions;
- Figures:
  - Site location;
  - Well locations;
  - Well construction details and detailed lithology;
  - Groundwater elevation contours;
  - Groundwater flow direction; and
  - Other pertinent site data for the landfill;
- Tables:
  - Groundwater parameters;
  - Groundwater quality;
- Groundwater testing results for each well tested;
- Appendices:
  - Soil boring logs;
  - Well construction details;
  - Well development data;
  - Field sampling data sheets;

- Field equipment calibration logs;
- Slug test data sheets;
- Photos and photo log;
- Laboratory analytical data reports; and
- Approved Monitoring/Observation Water Well Permit Applications (GWS-46).

The final data report prepared for the Site will include an electronic working file; a PDF file including tables, figures, and appendices; and a hard copy.

6.0 REFERENCES

2 CCR 402-2. Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Well /Hole Construction.

5 CCR 1002-4. 2016. Regulation No. 41 - The Basic Standards for Ground Water. 6 CCR 1007-2. Solid Waste Regulations.

29 CFR Part 1910.120. Hazardous waste operations and emergency response.

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SW-846. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015).

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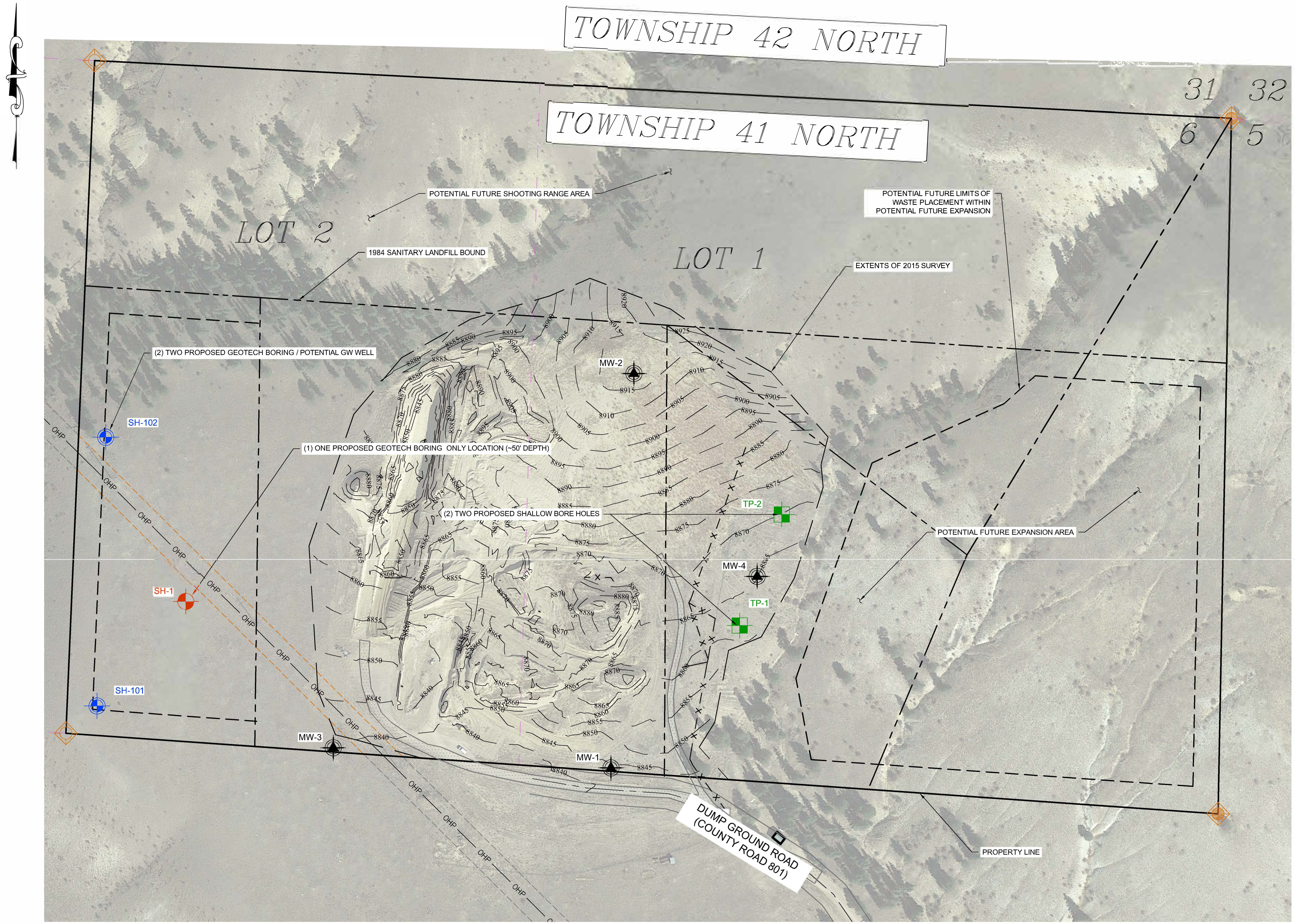
FIGURES



NOTES:

1. THE EXISTING CONDITIONS / TOPOGRAPHY SHOWN IS BASED ON SURVEY PROVIDED BY RUSSELL SURVEYORS & ASSOCIATES OF ALAMOSA, CO AND WAS PROVIDED TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD) IN DIGITAL FORMAT ON JUNE 8, 2020 IN A FILE TITLED "R02337 MINERAL COUNTY TOPO email.dwg".
2. THE PROPERTY LINES SHOWN ARE BASED ON SURVEY PROVIDED BY RUSSELL SURVEYORS & ASSOCIATES OF ALAMOSA, CO AND WAS PROVIDED TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD) IN DIGITAL FORMAT ON JUNE 4, 2020 IN A FILE TITLED "R02337 MINERAL COUNTY email.dwg".
3. 1984 SANITARY LANDFILL BOUND DIGITALIZED FROM A MAP AND PLAN NAMED "MINERAL COUNTY DUMP SITE, PREPARED OCTOBER 1984" BY DAVIS ENGINEERING SERVICES, INC. AND ARE APPROXIMATE ONLY.
4. THE MONITORING WELLS SHOWN ARE DIGITALIZED FROM "SITE MAP WITH WELL LOCATION" ,PAGE 44 OF 210 OF TRIHYDRO FINAL DATA REPORT JULY 19, 2019. WAS PROVIDED TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD) IN DIGITAL FORMAT IN A FILE TITLED "201907_Mineral_Final_v02_RPT_R.pdf".
5. AERIAL IMAGERY SHOWN IS TAKEN FROM GOOGLE IMAGES AND IS FOR PRESENTATION PURPOSES ONLY IMAGE IS INTENDED TO SHOW APPROXIMATE TOPOGRAPHY.

LEGEND:

- 8870 — 2015 5-FOOT CONTOUR
- ROAD
- X — X — FENCE
- EXTENTS OF 2015 TOPOGRAPHY SURVEY
- PROPOSED LIMIT OF WASTE
- OHP — OVERHEAD POWER LINE
- PROPERTY LINE
- LOT LINE
- 1984 SANITARY LANDFILL BOUND
- POTENTIAL FUTURE SHOOTING RANGE LOT LINE
- UTILITY EASEMENT LINE
- SECTION CORNER
- TRACT ANGLE POINT
- MW-1 — EXISTING MONITORING WELLS (BY OTHERS)
- SH-101 — PROPOSED GEOTECH BORING / POTENTIAL GW WELL LOCATIONS
- SH-1 — PROPOSED GEOTECH BORING
- TP-2 — PROPOSED SHALLOW BORE HOLES

Bore Hole Table		
Bore Hole	Approximate Depth (feet)	Remarks
SH-1	50	Exercise Caution Around Overhead Power Lines
SH-101	75 - 85	Proposed Groundwater Monitoring Well
SH-102	75 - 85	Proposed Groundwater Monitoring Well
TP-1	20	Potential Municipal Solid Waste in This Location
TP-2	20	Potential Municipal Solid Waste in This Location

SANBORN HEAD

GRAPHICAL SCALE
100' 50' 0' 100' 200'

For Bid Purposes Only

NO	DATE	DESCRIPTION	BY

DRAWN BY: J. ABESAMRA
DESIGNED BY: J. ABESAMRA
REVIEWED BY: D. EAGLETON / T. REED
PROJECT MGR: D. EAGLETON
PIC: T. REED
DATE: OCTOBER 2021

GEOTECHNICAL EXPLORATION
MINERAL COUNTY LANDFILL
CREEDE, COLORADO

SUBSURFACE EXPLORATION LOCATIONS PLAN

PROJECT NUMBER: 4656.20

SHEET NUMBER: 1 OF 1

APPENDIX A

BORING LOG

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project:
Location:
Project No.:

Log of Monitoring Well

Ground Elevation:

Drilling Method:

Sampling Method:

Drilling Company:
Foreman:
Date Started: Date Finished:
Logged By: Checked By:

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time

Depth (ft)	Sample Information					Stratum		Geologic Description	Well Diagram	Well Description
	Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description			
0							-----0'-----			
2										
4										
6										
8										
10										
12										
14										
16										
18										
20										
22										
24										

BORING LOG S:\CONDATA\GINT\BLANK.GPJ 2010 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V1.GDT 10/24/10

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project:
Location:
Project No.:

Log of Monitoring Well

Ground Elevation:

Drilling Method:

Sampling Method:

Drilling Company:
Foreman:
Date Started: **Date Finished:**
Logged By: **Checked By:**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time

Depth (ft)	Sample Information					Stratum		Geologic Description	Well Diagram	Well Description
	Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description			
26										
28										
30										
32										
34										
36										
38										
40										
42										
44										
46										
48										
50										

BORING LOG S:\CONDATA\GINT\BLANK.GPJ 2010 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V1.GDT 10/24/10

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project:
Location:
Project No.:

Log of Monitoring Well

Ground Elevation:

Drilling Method:

Sampling Method:

Drilling Company:
Foreman:
Date Started: Date Finished:
Logged By: Checked By:

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time

Depth (ft)	Sample Information					Stratum		Geologic Description	Well Diagram	Well Description
	Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Log	Description			
50										
52										
54										
56										
58										
60										
62										
64										
66										
68										
70										
72										
74										

BORING LOG S:\CONDATA\GINT\BLANK.GPJ 2010 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V1.GDT 10/24/10

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project:
Location:
Project No.:

Log of Monitoring Well

Ground Elevation:

Drilling Method:

Sampling Method:

Drilling Company:
Foreman:
Date Started: Date Finished:
Logged By: Checked By:

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Well Diagram	Well Description
76										
78										
80										
82										
84										
86										
88										
90										
92										
94										
96										
98										
100										

BORING LOG S:\CONDATA\GINT\BLANK.GPJ 2010 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V1.GDT 10/24/10

APPENDIX B

EQUIPMENT CALIBRATION AND TEST FORM

Soil Gas Field Sampling Summary

SANBORN HEAD	Project Number:	Date:
	Project Name:	
	Project Location:	

Equipment:	Project Manager:
	Collector(s):
	Weather:

Field Measurements

Sample ID	Sample Depth (in)	Concrete Thickness (in)	Sample Collection		Sample Volume (L)	Purge Volume (mL)	PID (ppm)	CH_4 (%)	O_2 (%)	CO_2 (%)	Note Number
			Date	Time							

Notes

1.
2.
3.
4.
5.

APPENDIX C

MONITORING WELL DEVELOPMENT FORM

SANBORN | HEAD

Summary of Monitoring Well Development

Well	Water Volume Added During Drilling (gal)	Date Development Performed	Development Water Level (ft)	Pumping Data	Approximate Pumping Rate (gal/min)	Pumping Duration (min)	Approximate Volume Purged (gal)	Silt @ Bottom of Well	Visual Indicators			pH Pre- & Post-Development (s.u.)		Specific Conductance Pre- & Post-Development	
									Turbid	Cloudy	Clear	Pre-	Post-	Pre-	Post-
Approximate Total Volume of Water Purged (gallons):															

Comments
1. 2. 3.