Attachment 3 - Groundwater Monitoring

GROUNDWATER MONITORING PLAN

NORTH VALLEY LANDFILL

LOGAN CITY ENVIRONMENTAL DEPARTMENT
153 N 1400 W
LOGAN, UTAH 84321

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1.0 BACKGROUND

1.1 INTRODUCTION

The North Valley landfill site is the proposed site for future solid waste disposal for all of Cache County. The objective of the groundwater monitoring plan is to fulfill requirements given in Utah Administrative Code R315-308 and sample the groundwater under the site to establish background concentrations of parameters listed in Section R315-308-4. Once the background concentrations are established, sampling will continue to detect any changes in the contaminants.

1.2 SITE DESCRIPTION

The North Valley landfill site is 320 acres and located approximately 5 miles north of Clarkston, Utah. Figure 1 shows the location of the site. Figure 2 shows the proposed layout of Phase I of the North Valley landfill consisting of three cells.

1.3 MONITORING WELLS

Prior to the start of landfilling activity investigative monitoring wells were installed at the North Valley Landfill. The locations of monitoring wells are presented on Figure 1. Seven wells (NV-1, NV-2, NV-3, NV-4, NV-5, NV-6, and NV-7) surrounding the landfill site were placed prior to landfill construction. To meet the distance requirements outlined in R315-308-4 additional monitoring wells were installed (NV-8, NV-9, and NV- 10). Monitoring wells currently included in the semiannual sampling plan are NV-8, (upgradient) NV-9, NV-10, and NV-4 (downgradient). Groundwater monitoring requirements under R315-308-2 require the groundwater monitoring system to consist of at least one background or upgradient well and two downgradient wells. The downgradient wells are designated as the point of compliance. Construction details for the existing groundwater wells are summarized in Table 1. The well logs are contained in Appendix C.

2.0 SAMPLING SCHEDULE

In reference to R315-308-29(5)(a), during the first year of facility operation after wells are installed, a minimum of eight independent samples from the upgradient and four independent samples from the downgradient wells will be taken for all parameters listed in Section R315-308-4 to establish background concentrations. A summary of laboratory results is shown in Table 2.

Once the background concentrations are established, a minimum of one sample will be taken semiannually for all parameters listed in R315-308-4. The time between sampling events should be sufficient to allow groundwater to move past the point of compliance so that the samples are “independent”.

3.0 PROCEDURES

This section describes the procedures that will be used for groundwater measurement, sampling, and analysis.

3.1 INTRODUCTION

The wells will be sampled using currently accepted and approved technology. Proper health and safety procedures and the use of personal protective equipment as was proper for well purging, sample collection, and preservation techniques; equipment decontamination methods, and quality assurance/quality control techniques will be followed.

3.2 PRE-SAMPLING PROCEDURES

Upon arrival at the monitoring well, prior to groundwater measurement, purging or sampling, any signs of tampering or well deterioration will be documented. A depth to groundwater measurement shall be taken using a conductivity-based water level meter or equivalent instrument capable of obtaining readings to the nearest 0.01 foot. The following method will be used to measure the groundwater elevation:

1. Verify well identification. Check to ensure proper operation of measurement equipment aboveground. Prior to opening the well, put on personal protective equipment as required.

2. Record well number, top of casing elevation, and surface elevation if available.

3. Lower the probe slowly into the well. Upon contact with water, the buzzer should sound and the indicator light should glow. Raise and lower the probe slightly about the water level a few times to determine accurate point of contact.

4. Measure and record static water level and total depth to the nearest 0.01 ft from the surveyed reference mark on the top edge of the groundwater level measurement tube. If no reference mark is present, record in the logbook where the measurement was taken from and record the depth to groundwater.

5. Record the time and day of the measurement.

6. Raise the water level probe on the spool and decontaminate.

3.3 EQUIPMENT CALIBRATION

All meters shall be calibrated prior to use in accordance with the manufacturer's directions and no meters shall be used unless they are functioning properly.

3.4 WELL PURGING

Prior to sampling, the wells will be purged to obtain fresh groundwater that is representative of formation water. Purging will be done using either: Teflon bottom-filling bailers with single strand stainless steel wire or monofilament such as fishing line; factory-wrapped disposable polyethylene bailers with disposable bailer cord; an approved type of sampling pump (such as a bladder pump) with tubing that will be decontaminated or changed between each well; or equivalent approved purging device. Submersible pumps, which can agitate water in the well, will not be used. Pumps will be configured so as not to introduce contamination through gas exhaust. Any equipment used for evacuating water from the wells will be non-leaching and non-aerating. If dedicated or disposable equipment is not used, all purging and/or sampling equipment will be decontaminated with a non-phosphate wash followed by a distilled water rinse prior to use in each well.

Four well volumes will be purged from each of the wells prior to sample collection. Well volumes shall be calculated as described below in Equation 1.

Equation 1: $V = B \times \left(\frac{D}{2}\right)^2 \times H \times 4 \times 7.48 \; {}^{gallons}/_{ft^3}$

V = Total Purge Volume (gals)

B = Pi (3.1416)

D = Inside diameter of well casing (feet)

H = Feet of water in the well (depth to well bottom minus depth to water)

When wells pump or bail dry the well shall be evacuated to dryness once. Sampling shall be conducted when the well recovers to 85% of the initial water level (or for two hours, whichever occurs sooner). Purge water will be discharged to the ground surface at least 50 feet from the wellhead.

The following method will be used to purge the wells:

Purging with a pump

1. Slowly lower the pump to the middle of the screened area of the well. Securely fasten the power cable and sample tubing. Connect the power source, controller box, gas source, etc., to the pumping equipment.

2. Use Equation 1 to calculate the number of gallons to remove a specific number of required well volumes from the well.

3a. Using a pump to purge and sample the well: Record the "purging time start" and start purging the well. Minimize well drawdown; it should stabilize before sampling. If the water level continues to decline during purging, try using a lower purging rate. Use a graduated beaker, cylinder, calibrated bucket or other device to calculate the flow rate while purging and sampling.

3b. Using a pump to purge the well and then using a grab sampler to sample the well: Record the "purging time start" and start purging the well with the pump's inlet at the top of the water column. As you are purging, slowly lower the pump so that, after the specific number or required well volumes are purged, the pump's inlet is near the bottom of the well (within ~ 1 foot).

4. Record "purging flow rate" as an average, "volume purged," "purging time stop," "purged dry (Y/N)," and any problems purging.

5a. If a pump is used to collect samples, the sampling flow rate should be as low as possible, and preferably less than the purging flow rate.

5b. If a grab sampler is used, try not to disturb the samples. If a bailer is used, use a bottom-emptying device to decant your samples.

6. Collect samples as described under Section 3.6. Record "sample flow rate" as an average, "time sample collected," and any other pertinent information related to the sampling event.

Purging with a bailer

1. Use Equation 1 to calculate the number of gallons needed for removing a specific number of required well volumes. Record this data as "well volumes."

2. Record the "purging time start." Lower and raise a decontaminated bailer in and out of the water column very slowly and purge four well volumes.

3. Use a calibrated bucket or other device to keep track of the volume of water you remove. Purge specific number of required well volumes.

4. Record "volume purged," "purging time stop," "purged dry (Y/N)," and any problems purging.

5. Sample the well by slowly and gently lowering the bailer until it is submerged and in the middle of the well screen. Do not allow the bailer to contact the bottom of the well. Very slowly and carefully raise the bailer out of the water column and to the surface.

6. Collect samples as described under Section 3.6. Use a bottom-emptying device to decant samples from a bailer. Record "time sample collected" and any other pertinent information related to the sampling event.

3.5 FIELD MEASUREMENTS

After each well has been purged, a sample will be collected into a clean beaker for measurement of pH, electrical conductivity, and temperature. These readings will be recorded, along with well I.D. and time. To reduce the potential for cross contamination, monitoring probes will never be placed in containers to be sent to the laboratory for analysis.

3.6 SAMPLE COLLECTION AND PRESERVATION

Samples will be collected with a bailer or an approved sampling pump such as a bladder pump. When using a bailer, care will be taken to not drop the bailer in the well fast enough to cause degassing. The bailer will be slowly lowered into the well. The bailer's contents will be transferred into laboratory supplied sample containers with the minimum amount of agitation possible to reduce aeration of the sample. When using a positive gas displacement bladder pump for volatile analysis collection, the pumping rate will not exceed 100 millimeters/minute.

The sampler will wear a new pair of disposable vinyl gloves to handle sampling equipment and sample containers at each well. Samples will be collected in laboratory supplied sample bottles. Care will be taken to keep sample bottles capped until immediately prior to collecting the sample. Once filled, bottles will immediately be capped to minimize contact with dust and ambient air.

Analytes to be tested Glass bottles with Teflon lined caps will be used for organic samples. For both volatile organic and TOC samples, no headspace will be allowed in the sample container. Polyethylene containers with polypropylene caps will be used for metals analysis. Samples for dissolved metals analysis will be collected without filtering into a non-preserved polyethylene bottle. The sample must be delivered to the laboratory the same day, and the laboratory must be requested to immediately filter and preserve the sample. If needed, groundwater collected for dissolved metals analysis will be field-filtered through a 0.45 micron filter, transferred to a bottle, preserved with nitric acid to a pH less than 2 and analyzed for dissolved metals.

The first samples to be collected will be those for volatilization sensitive parameters (Volatiles, pH). Parameters that are not pH sensitive or subject to volatilization will be drawn last.

The sample collection order will be as follows:

- VOC's
- Dissolved metals
- Inorganics
- TOC
- Ammonia and nitrate

The following procedures shall be used for VOC sample collection:

1. The sample container shall be filled so that a convex meniscus forms over the neck of the opening to eliminate head-space.

2. The cap will be filled with groundwater. The teflon side of septum (in the vial cap) will be positioned against the meniscus, and the cap screwed on tightly.

3. Invert the sample bottle and tap lightly to check for air bubbles. The absence of an air bubble indicates an airtight seal. If an air bubble is observed recollect the sample following the procedures described above. This process shall be continued until the sample for VOCs contains no head space.

The following procedures shall be followed for collection of samples for analyses other than

VOCs:

1. The sample containers shall be filled in order from the least to the most stable compounds as described previously.

2. Sufficient volume shall be collected so that the scheduled analysis can be performed. The sample containers do not need to be filled to eliminate head-space.

3.7 SAMPLE HANDLING

3.7.1 NUMBERING AND LABELING

Each sample will be assigned a unique ID number that does not identify the sample location. The sample ID will be tied to the well location in the field documentation. Sample ID's will take the following format: "NV (Month) (Year) (Number)". For example, the samples collected from the first well in April 2012 would be assigned the ID number NV041201. The second well's sample would be NV041202. If a duplicate sample were collected at the second well it would be numbered NV041203.

Once collected, each sample will be immediately labeled, sealed in a water-tight ziplock baggie, and place in a sample cooler with ice. Pieces of bubble wrap or foam will be used to prevent bottles from knocking together and breaking. Immediately after placing the sample in the cooler, the sample will be recorded on a chain-of-custody.

3.7.2 CHAIN OF CUSTODY

The chain-of-custody will, at minimum, list the time and date of sample collection, sample ID, number of containers making up each sample, name of sampler, and signatures of every person who assumes custody of the sample set along with the date and time that the custody was transferred. Chain-of – custodies may also include instructions to the laboratory on the analysis to be performed.

Samples will remain in the custody of the sampler until they are relinquished to the laboratory or until they are relinquished to a qualified individual for transport to the laboratory. If, after samples are collected, the laboratory is closed, sample personnel will have 24-hour access to a "Laboratory Secure Area" (equipped with a refrigerator) for storing samples until regular laboratory hours, when sample custody can be transferred. Custody, including secure storage areas, will be documented on the chain-of-custody form.

3.7.3 FIELD DOCUMENTATION

The sampler will keep a field logbook that documents for each well sampled the following information.

- Well identification corresponding to well #
- Well depth, well casing stick up
- Static water level depth and measurement technique
- Well yield (volume purged)
- Sample collection methods
- Sample identification numbers
- Preservatives and containers used
- Parameters requested for analysis
- Field analysis data and methods
- Field observations including weather
- Name of collector

3.8 QA/QC SAMPLES

3.8.1 FIELD QA/QC

Field Duplicate

Purpose:
To check reproducibility of laboratory and field procedures and to indicate non-homogeneity.

Collection:
Samples will be taken from area that are known or suspected to be contaminated.

Sample Number:
Two separate (unique) sample numbers will be assigned to the primary and duplicate samples.

Field Blanks

Purpose:
To check cross contamination during sample collection, sample shipment, and in the laboratory. Also to check sample containers.

Collection:
Samples will be collected for each group of samples of similar matrix per day of sampling.

Sample Number:

Separate sample numbers will be assigned to each field blank.

Volatiles Trip Blank
Purpose:
To check contamination during sample handling and shipment from field to laboratory.

Collection:
Sample will be prepared using demonstrated to be free of contaminants of concern (DI water).

Sample Number:
Separate sample numbers will be assigned to each volatile trip blank.

Equipment Blank
Purpose:
To check field decontamination procedures.

Collection:
Samples will be collected when sampling equipment is decontaminated and reused in the field. Deionized water will be used to rinse water into the sample containers.

Sample Number:
Separate sample numbers will be assigned to each equipment blank.

3.8.2 LABORATORY QA/QC

The laboratory will be required to provide results for two types of QA/QC samples: method blanks and matrix spike/matrix spike duplicates.

Method Blank
Purpose:

Method blanks provide an indication of whether an analyte may have been introduced into the sample during laboratory handling and analysis.

Collection:
Method blank results will be provided for each analyte.

Matrix Spike and Matrix Spike Duplicate
Purpose:
Matrix spike/matrix spike duplicates are prepared and analyzed to give an indication of the laboratory accuracy (ability to recover 100% of the analyte) and precision (ability to get repeatable results).

Collection:
Matrix spike and matrix spike duplicates will be analyzed for each metal and inorganic analyte, and for a representative number of volatile organic compounds.

3.9 DATA QUALITY OBJECTIVES

To obtain high quality, consistent data that facilitate tracking long-term variations and trends, several objectives have been developed, including:

- An established detection limit for each analyte
- Target ranges for accuracy and precision in laboratory data
- Target ranges for precision in field duplicates
- Criteria for acceptance of compounds found in method blanks

These objectives are discussed in more detail below.

3.9.1 REPORTING LIMITS

The laboratory will be requested to obtain the detection limits shown on Table 4. These detection limits are below Solid Waste Groundwater Protection Standards for each analyte, and are expected to be low enough to detect naturally occurring concentrations of most inorganics and metals. The laboratory may qualify very low concentrations with "J" (estimated) qualifiers if the detected concentrations are not above the laboratory's established reporting limit. The reporting limit, as required by the Utah Division of Laboratory Services, is normally 5 to 10 times the detection limit, or the lowest concentration standard run during calibration.

If the laboratory cannot meet the requested limit for analyte or group of analytes due to characteristics of the sample, the laboratory will notify the City of Logan immediately, noting the reason and presenting the lowest possible reporting limit. The problem with the sample will be evaluated by the City of Logan and will be corrected, if possible. If changes in the sampling protocol or established reporting limit are necessary, DSHW will be notified immediately.

3.9.2 PRECISION AND ACCURACY IN LABORATORY QA/QC SAMPLES

The laboratory prepares matrix spike and matrix spike duplicate samples by adding a known amount of an analyte, such as arsenic, to two aliquots of the same sample. The matrix spike and matrix spike duplicate are then analyzed. Accuracy for the matrix spike and matrix spike duplicate samples is defined as the recovery, i.e., the amount recovered in the analysis divided by the quantity "known" to be present, time 100%. A result of 100% indicates perfect accuracy. Target recoveries of 80% to 120% are acceptable for most analytes. Arsenic, selenium, and thallium (the GFAA metals) have slightly wider ranges of recovery, usually in the range of 70% to 130%, due to inter-element interferences.

Therefore, recoveries of 80 to 120% will indicate good accuracy (70 to 130% for arsenic, selenium, and thallium). If recoveries for the matrix spike and matrix spike duplicate fall outside that range, the laboratory will be contacted for an explanation so that the data can be qualified as "acceptable", "estimated", or "rejected".

Precision is defined as how close the results are for the matrix spike and matrix spike duplicate samples. Therefore, it is an indication of how well the laboratory is able to repeat a measurement. Precision between two measurements (A and B) is given as the relative percent difference, calculated as follows:

$$RPD = \frac{(A - B) \times 100\%}{\frac{(A + B)}{2}}$$

The laboratory is generally able to repeat results in a water sample within 10%. For matrix spike/matrix spike duplicates with RPDs greater than 10%, the laboratory will be contacted for an explanation so that the data can be qualified as "acceptable", "estimated", or "rejected".

3.9.3 PRECISION IN FIELD DUPLICATE SAMPLES

The RPD between two field samples indicates how repeatable the entire sampling and analysis effort is. It can be affected by slight differences in the water used to fill the two duplicate bottles, slight differences in time that containers are open, slight differences in the amount of preservative in the bottles, and variations in the laboratory analysis. The RPD for two duplicate samples, calculated just as for laboratory samples may easily be as high as 30%. When the quantity of an analyte is very small, relatively small absolute differences (1 to 2 ppm) can result in large RPDs. The person conducting the data validation will apply professional judgment to assess the validity of data with RPDs greater than 30%.

3.9.4 LABORATORY CONTAMINANTS AND ANALYTES IN METHOD BLANKS

If the laboratory reports an analyte in the method blank, such as methylene chloride, it indicates that the analyte may be present in the instrumentation and contaminating samples that are being analyzed on the instrument. Sample results that are less than 10 times the amount reported in the blank should be considered suspect and may be rejected. Additionally, if a common laboratory contaminant like acetone or methylene chloride is reported in the sample but not the blank, the reported concentrations should be compared to the reporting limit for the common laboratory contaminant. Sample results that are less than five times the reporting limit may be suspect and can be rejected if no other data exists to support the presence of the analyte in the samples.

4.0 DATA ANALYSIS PLAN

4.1 DATA VALIDATION

When the laboratory data is received, it will be reviewed to assess data validity. The data package will be checked to insure that:

- Sample IDs match chain-of-custody and field notes and can be matched to sample location, date, and time.
- Samples were analyzed within holding times.
- Analysis reporting limits are acceptable.
- Laboratory method blank results are included and acceptable.
- Laboratory MS/MSD results for representative analytes are included and acceptable.
- Field duplicate sample results are included and acceptable.

If the listed checks indicate potential problems or discrepancies, the laboratory will be notified and requested to help resolve the question. If the cause of the problem cannot be located, the affected data will be qualified or the affected wells will be resembled, depending on the severity of the problem. The person who validates the data will use professional judgment to assign qualifiers to data that do not meet the data quality objectives of section 3.9. If the data appear usable and can be combined with the historical data with no reservations, then no qualifier will be attached. The reasoning will be detailed in the report prepared for the sampling event.

If the data appear to accurately represent the presence or absence of an analyte, but the quantification of the analyte is in question, then a "J" will be assigned to the reported concentration to indicate it is an estimated quantity. An example of this might be a case where arsenic is reported in the sample, but arsenic recoveries in the matrix spike/matrix spike duplicate are very low (such as 50%). The person validating the data may feel that the reported arsenic value is useful information even if the result is probably too low. In this case, a "J" would appear next to the reported result in subsequent tabulations of the data for that well.

If the data for the well appear compromised to the point where the reported result is not useful (such as the appearance of methylene chloride in the method blank and in a sample at similar concentrations), the data will receive an "R" qualifier indicating it is rejected. The reported result will continue to be shown in subsequent tabulations, but the "R" qualifier will flag the user not to include the result in statistical compilations, etc.

In all cases where data receive qualifiers, an explanation of the validator's judgment will be given in the report of the sampling round where the qualified data are first reported.

4.2 DATA ANALYSIS

The data will be analyzed by:

- Looking for the presence of non-naturally occurring compounds in the sample (such as volatile organic compounds), and
- Plotting the concentrations of naturally occurring constituents (metals and minerals) in each well on concentration versus time for that well
- Comparing concentrations to statistically determined control limits using the Intra-well method as approved by Division of Waste Management and Radiation Control.

If non-naturally occurring compounds are reported by the laboratory, the validity of the result(s) will be assessed by reviewing method blank results, raw laboratory data, the compound's potential status as a common laboratory contaminant, and the reported concentration relative to the method detection limit. If the positive results appear potentially valid, the affected well will be resampled to verify the result.

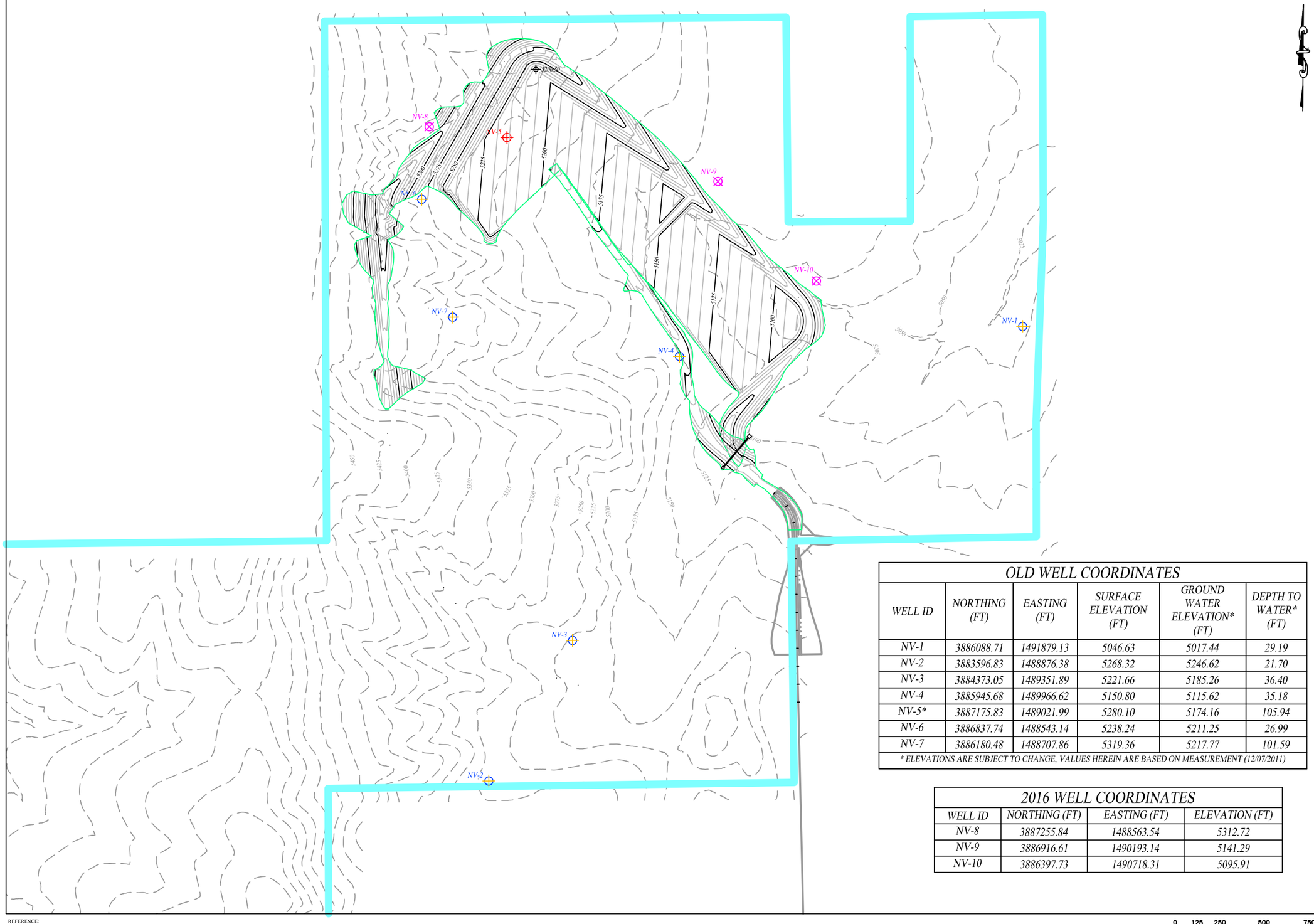
The relative concentrations of naturally-occurring constituents will be analyzed to assess whether the water is impacted. Background water quality will be established by collecting eight independent samples from each well.

4.3 DATA REPORTING

Semi-annual monitoring reports will be prepared. Each report will include a:

- Description of sampling activities
- Discussion of data validity
- Discussion of laboratory QA/QC
- Presentation of water elevation measurements and contour map
- Presentation of field and laboratory data in tables
- Graphical presentation of trends in analyte concentrations over time
- Contours of TDS and TOC for the sampling event
- Statistical analysis of the analytical results

APPENDIX



REFERENCE:
ADAPTED FROM MAP
PROVIDED BY CLIENT.

0 125 250 500 750
SCALE IN FEET

OLD WELL COORDINATES

WELL ID	NORTHING (FT)	EASTING (FT)	SURFACE ELEVATION (FT)	GROUND WATER ELEVATION* (FT)	DEPTH TO WATER* (FT)
NV-1	3886088.71	1491879.13	5046.63	5017.44	29.19
NV-2	3883596.83	1488876.38	5268.32	5246.62	21.70
NV-3	3884373.05	1489351.89	5221.66	5185.26	36.40
NV-4	3885945.68	1489966.62	5150.80	5115.62	35.18
NV-5*	3887175.83	1489021.99	5280.10	5174.16	105.94
NV-6	3886837.74	1488543.14	5238.24	5211.25	26.99
NV-7	3886180.48	1488707.86	5319.36	5217.77	101.59

* ELEVATIONS ARE SUBJECT TO CHANGE, VALUES HEREIN ARE BASED ON MEASUREMENT (12/07/2011)

2016 WELL COORDINATES

WELL ID	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
NV-8	3887255.84	1488563.54	5312.72
NV-9	3886916.61	1490193.14	5141.29
NV-10	3886397.73	1490718.31	5095.91

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PROPERTY BOUNDARY
ORIGINAL GROUND (25' CONTOUR)
NV-# OLD MONITOR WELL (6)
NV-# 2016 MONITOR WELL (3)
NV-# EXISTING MONITOR WELL TO BE ABANDONED (1)

MARK	DATE	DESCRIPTION
	2/10/17	DRAFT

ISSUE:

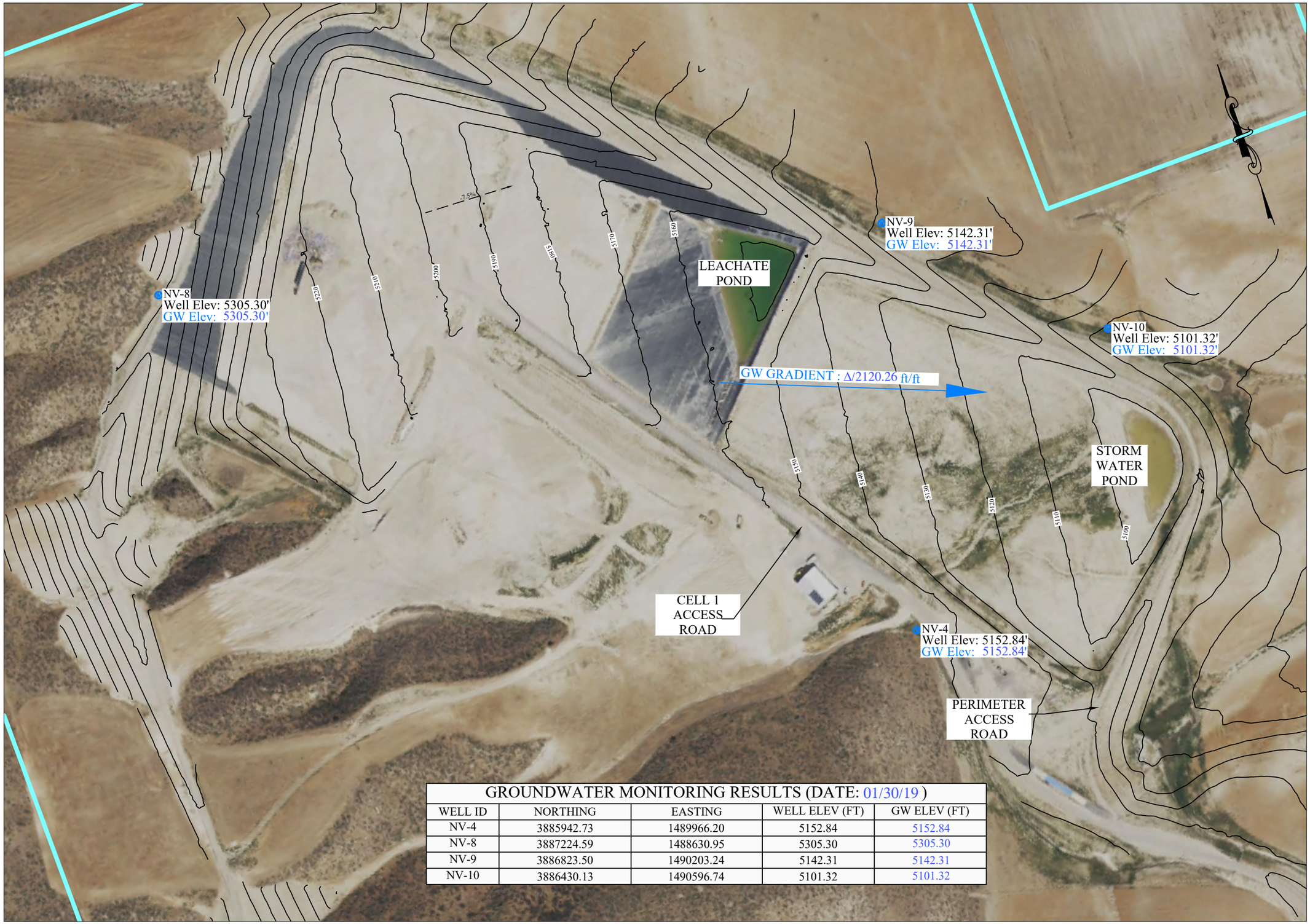
PROJECT NO.:	00386-015
CAD DWG FILE:	00386\015\WELLS 8,9,10\
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	IH
COPYRIGHT:	IGES 2017

SHEET TITLE

NORTH VALLEY LANDFILL

MONITOR WELL LOCATIONS

1



GROUNDWATER MONITORING RESULTS (DATE: 01/30/19)

WELL ID	NORTHING	EASTING	WELL ELEV (FT)	GW ELEV (FT)
NV-4	3885942.73	1489966.20	5152.84	5152.84
NV-8	3887224.59	1488630.95	5305.30	5305.30
NV-9	3886823.50	1490203.24	5142.31	5142.31
NV-10	3886430.13	1490596.74	5101.32	5101.32

REFERENCE:
Background Imagery: 2018 NAIP, Cache County, Utah, Utah AGRC
As-built Topography Data: Whitaker Construction, April 20, 2016

0 200 400 Feet

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PROPERTY BOUNDARY

MARK	DATE	DESCRIPTION

ISSUE:

PROJECT NO.:	00386-015
CAD DWG FILE:	00386\GROUNDWATER MONITORING
DRAWN BY:	JAH
DESIGNED BY:	BDM
CHECKED BY:	TR
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SHEET TITLE

North Valley Landfill

GROUNDWATER MONITORING

1

Table 1 Well Constructon Details North Valley Landfill

Well Number	Year Installed	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft)	Boring (ft,bgs)	Screen Interval (ft, bgs)
NV-1	Aug. 2010	11773.79	11313.902	4997.095	71.5	
NV-2	Aug. 2010	9263.424	8326.592	5230.503	101.5	
NV-3	Aug. 2010	10042.556	8797.301	5180.711	80	60-80
NV-4	Aug. 2010	11618.958	9402.31	5101.68	80	60-80
NV-5	Aug. 2010	12843.253	8450.104	5184.715	80	60-80
NV-6	Aug. 2010	12505.208	7973.355	5230.654	250.5	60-80
NV-7	Aug. 2010	11845.985	8142.124	5271.146	250.3	105-125
NV-8	Oct. 2016	3887224.578	1488630.945	5207.91	140	117-140
NV-9	Oct. 2016	3886823.496	1490203.24	5095.463	80	45-70
NV-10	Oct. 2016	3886430.13	1490596.736	5072.18	40	17-40

Table 2 Summary of Laboratory Analytical Data North Valley Landfill Site

Analyte	Collection Date	Upgradient Wells		Down Gradient Wells			Min. Reporting Limit
		NV6	NV7	NV1	NV3	NV4	
Inorganics (mg/l)							
Ammonia	12/6/2011 to 12/7/2011	0	0	0	0.75	7.06	0.05
Carbonate	12/6/2011 to 12/7/2011	0	0	0	0	0	20
Bicarbonate	12/6/2011 to 12/7/2011	246	240	224	390	568	20
Calcium	12/6/2011 to 12/7/2011	315	187	155	322	117	10
Chloride	12/6/2011 to 12/7/2011	552	103	615	243	93.8	10
Iron	12/6/2011 to 12/7/2011	6.13	2.73	2.77	0.799	8.88	0.1
Magnesium	12/6/2011 to 12/7/2011	77.1	29.3	118	67.6	56.1	10
Manganese	12/6/2011 to 12/7/2011	0.708	0.0919	0.0941	0.0776	0.77	0.0012
Nitrate	12/6/2011 to 12/7/2011	12.4	0.584	8.56	6.22	0.0843	0.01
Potassium	12/6/2011 to 12/7/2011	24.2	11.3	25.5	19.6	25.2	10
Sodium	12/6/2011 to 12/7/2011	75.9	16.6	119	75.5	135	10
Sulfate	12/6/2011 to 12/7/2011	193	40	335	158	146	75
TDS	12/6/2011 to 12/7/2011	1690	536	2040	1080	896	20
TOC	12/6/2011 to 12/7/2011	6.37	1.83	3.59	2.9	9.48	1
COD	12/6/2011 to 12/7/2011	21	0	30	21	40	10
pH @ 25 C	12/6/2011 to 12/7/2011	7.24	7.35	7.28	6.97	7.2	
Heavy Metals (mg/l)							
Antimony	12/6/2011 to 12/7/2011	0	0	0	0.00228	0.00103	0.001
Arsenic	12/6/2011 to 12/7/2011	0.00886	0.00883	0.0182	0.00841	0.0139	0.0006
Barium	12/6/2011 to 12/7/2011	0.239	0.127	0.134	0.0529	0.239	0.0004
Beryllium	12/6/2011 to 12/7/2011	0	0	0	0	0.00112	0.0006
Cadmium	12/6/2011 to 12/7/2011	0	0.000268	0.000471	0	0	0.00018
Chromium	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
Cobalt	12/6/2011 to 12/7/2011	0.00441	0.00152	0.0024	0	0.00608	0.0012
Copper	12/6/2011 to 12/7/2011	0.00773	0.00368	0.00588	0.00396	0.0102	0.0008
Lead	12/6/2011 to 12/7/2011	0.00586	0.00296	0.00372	0.00149	0.0178	0.0004
Mercury	12/6/2011 to 12/7/2011	0	0	0	0	0	0.00015
Nickel	12/6/2011 to 12/7/2011	0.0307	0.0112	0.0288	0.0154	0.0219	0.0008
Selenium	12/6/2011 to 12/7/2011	0.0186	0.0209	0.0346	0.0049	0.00996	0.0008
Silver	12/6/2011 to 12/7/2011	0	0	0	0	0	0.0004
Thallium	12/6/2011 to 12/7/2011	0	0	0	0	0	0.0004
Vanadium	12/6/2011 to 12/7/2011	0.0103	0.00764	0.00801	0	0.00864	0.005
Zinc	12/6/2011 to 12/7/2011	0.193	0.246	0.0482	0.0202	0.362	0.005

Table 2 Summary of Laboratory Analytical Data North Valley Landfill Site

Analyte	Collection Date	Upgradient Wells NV6	Upgradient Wells NV7	Down Gradient Wells NV1	Down Gradient Wells NV3	Down Gradient Wells NV4	Min. Reporting Limit
VOCs (ppb)							
Acetone	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Acrylonitrile	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Benzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromochloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromodichloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Bromoform	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Carbon disulfide	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Carbon tetrachloride	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Chloroform	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Dibromochloromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dibromo-3-chloropropane	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
1,2-Dibromoethane	12/6/2011 to 12/7/2011	0	0	0	0	0	0.01
1,2-Dichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,4-Dichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,4-Dichloro-2-butene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1-Dichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
cis-1,2-Dichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,2-Dichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2-Dichloropropane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
cis-1,3-Dichloropropene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
trans-1,3-Dichloropropene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Ethylbenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
2-Hexanone (Methyl butyl ketone)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Methyl bromide (Bromomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Methyl chloride (Chloromethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	3
Methylene bromide (Dibromomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Methylene chloride (Dichloromethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Methylethylketone (2-Butanone)	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Methyl iodide (Iodomethane)	12/6/2011 to 12/7/2011	0	0	0	0	0	5
4-Methyl-2-pentanone	12/6/2011 to 12/7/2011	0	0	0	0	0	5
Styrene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,2,3-Trichlorobenzene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,1,2-Tetrachloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,2,2-Tetrachloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Tetrachloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Toluene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
1,1,2-Trichloroethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Trichloroethene	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Trichlorofluoromethane	12/6/2011 to 12/7/2011	0	0	0	0	0	2
Vinyl acetate	12/6/2011 to 12/7/2011	0	0	0	0	0	10
Vinyl chloride	12/6/2011 to 12/7/2011	0	0	0	0	0	1
Xylenes, Total	12/6/2011 to 12/7/2011	0	0	0	0	0	2

Table 3 Summary of Proposed Analytes

Inorganics		
Ammonia	Magnesium	Sulfate
Carbonate/Bicarbonate	Manganese	Total Dissolved Solids (TDS)
Calcium	Nitrate	Total Organic Carbon (TOC)
Chloride	Potassium	
Iron	Sodium	
Heavy Metals		
Antimony	Chromium	Nickel
Arsenic	Cobalt	Selenium
Barium	Copper	Silver
Beryllium	Lead	Thallium
Cadmium	Mercury	Vanadium
		Zinc
Organics		
Acetone	Dibromomethane	Iodomethane
Acrylonitrile	1,2-Dibromo-3-chloropropane	Methylene chloride
Benzene	1,2-Dibromoethane	4-Methyl-2-pentanone
Bromochloromethane	1,2-Dichlorobenzene	Styrene
Bromodichloromethane	1,4-Dichlorobenzene	Tetrachloroethene
Bromoform	1,1-Dichloroethane	Toluene
Bromomethane	1,2-Dichloroethane	Trichloroethene
2-Butanone	1,2-Dichloropropane	Trichlorofluoromethane
Carbon disulfide	cis-1,2-Dichloroethene	1,1,1,2-Tetrachloroethane
Carbon tetrachloride	cis-1,3-Dichloropropene	1,1,2,2-Tetrachloroethane
Chlorobenzene	trans-1,2-Dichloroethene	1,1,2-Trichloroethane
Chloroethane	trans-1,3-Dichloropropene	1,2,3-Trichlorobenzene
Chloroform	trans-1,4-Dichloro-2-butene	Vinyl acetate
Chloromethane	Ethylbenzene	Vinyl chloride
Dibromochloromethane	2-Hexanone	Xylenes, Total

Table 4 Requested Laboratory Detection Limits

Metals	**DL (mg/l)**
Antimony	0.003
Arsenic	0.005
Barium	0.005
Beryllium	0.001
Cadmium	0.001
Chromium	0.05
Cobalt	0.03
Copper	0.012
Lead	0.003
Mercury	0.0002
Nickel	0.01
Selenium	0.002
Silver	0.002
Thallium	0.0015
Vanadium	0.03
Zinc	0.03
Inorganics	**DL (mg/l)**
Ammonia	0.1
Cabonate/Bicarbonate	10
Calcium	0.05
Chloride	0.5
Iron	0.013
Magnesium	0.06
Manganese	0.005
Nitrate (as N)	0.05
Potassium	1
Sodium	1
Sulfate	5
Total Dissolved Solids (TDS)	40
Total Organic Carbon (TOC)	2.0

Table 4 Requested Laboratory Detection Limits

Organics	**DL (ug/l)**
Acetone	10
Acrylonitrile	50
Benzene	1
Bromochloromethane	1
Bromodichloromethane	1
Bromoform	1
Carbon disulfide	1
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	1
Chloroform	1
Dibromochloromethane	1
1,2-Dibromo-3-chloropropane	0.01
1,2-Dibromoethane	0.01
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	1
trans-1,4-Dichloro-2-butene	20
1,1-Dichloroethane	1
1,2-Dichloroethane	1
cis-1,2-Dichloroethene	1
trans-1,2-Dichloroethene	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
trans-1,3-Dichloropropene	1
Ethylbenzene	1
2-Hexanone (Methyl butyl ketone)	10
Methyl bromide (Bromomethane)	1
Methyl chloride (Chloromethane)	1
Methylene bromide (Dibromomethane)	1
Methylene chloride (Dichloromethane)	5
Methylethylketone (2-Butanone)	10
Methyl Iodide (Iodomethane)	10
4-Methyl-2-pentanone (MIBK)	10
Styrene	1
1,2,3-Trichlorobenzene	1
1,1,1,2-Tetrachloroethane	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethene	1
Toluene	1
1,1,2-Trichloroethane	1
Trichloroethene	1
Trichlorofluoromethane	1
Vinyl acetate	10
Vinyl chloride	1
Xylenes, Total	1

REQUEST FOR NON-PRODUCTION WELL CONSTRUCTION
UTAH DIVISION OF WATER RIGHTS
(for wells deeper than 30 feet)

Well Type (check one):

Test ( ) Monitoring (X) Cathodic Protection ( ) Closed Loop Heat Exchange* ( )

Piezometer ( ) Inclinometer ( ) Dewatering ( ) Other _____

**This form cannot be used for open loop heat exchange wells. A non-consumptive use water right application must be filed for open loop heat exchange wells.*

Applicant/Owner Name: Logan City

Mailing Address: 290 Noth 100 West Logan, Utah 84321

Project Address: 14200 North Stink Creek Road Clarkston, UT 84305

Contact Person: Tyler Richards Phone: 435-716-9756

Proposed Start Date: 10/31/2016 Anticipated Completion Date: 11/04/2016

Well Driller Name & License #: 745 Proposed # of Wells: 3

PROPOSED LOCATION OF WELLS:

County: Cache Area: 25

NO./SO. DISTANCE (feet)	EAST/WEST DISTANCE (feet)	SECTION CORNER	SECTION	TOWNSHIP	RANGE	BASE	DIAMETER (inches)	DEPTH (feet)	PROPERTY PARCEL NUMBER
S 1135	E 967	N4	34	15N	2W	SL	2	90	
N 431	W 685	E4	34	15N	2W	SL	2	80	
S 149	W 172	E4	34	15N	2W	SL	2	70	

Use back of form or additional paper if more room is needed. If providing well locations in latitude/logitude or UTM coordinates, please also provide the map datum used (e.g., NAD27, NAD83, WGS84, etc.). ***This form must be completed and signed by the owner/applicant and not by the licensed driller.***

EXPLANATORY: monitoring wells to be installed for North Valley Landfill

Signature of Applicant *(attesting to completeness & accuracy)* 24 October, 2016 Date

FOR OFFICE USE ONLY

Approved By: _____ *Approval Date:* _____ *Non-Production Well No.:* _____

GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
Division of Water Rights

MICHAEL R. STYLER
Executive Director
KENT L. JONES
State Engineer/Division Director

October 24, 2016

LOGAN CITY
C/O TYLER RICHARDS
290 NORTH 100 WEST
LOGAN, UT 84321

Dear Applicant:

RE: MONITOR WELL#: 1625005M00

Regarding your request to drill **3 MONITOR WELL(S),** the anticipated drilling depths will exceed the minimum regulated and reporting depth of 30 feet, thereby requiring permission from the Division of Water Rights to proceed with this project.

The specifications outlined in your non-production well project application meet the State Engineer's requirements and permission is **HEREBY GRANTED.** Therefore, this letter is your authorization to proceed with the construction of the well(s) in accordance with those specifications and with respect to the following provisions:

1) Small diameter casing is to be used in the construction of the well(s) and no more water is to be diverted than is necessary to determine the quality of the groundwater by obtaining representative samples as required by the project.

2) The well(s) must be drilled by a currently licensed Utah driller and must be drilled in a manner consistent with the construction standards cited in the Utah State Administrative Rules for Well Drillers (R655-4 UAC).

3) The enclosed Driller (START) Card form must be given to the licensed driller for his submittal prior to commencing well construction. The other enclosed form is the 'Applicant Card.' It is **YOUR RESPONSIBILITY** to sign and return this Applicant Card form to our office upon well completion.

4) At such time as the well(s) are no longer utilized to monitor ground water or the intent of the project is terminated, the well(s) must be permanently abandoned in a manner consistent with the Administrative Rules (R655-4 UAC).

5) **THIS PERMIT MAY NOT BE THE ONLY AUTHORIZATION NEEDED TO DRILL A WELL.** The applicant is responsible for obtaining other permits/authorizations from federal agencies, other state agencies, and/or local jurisdictions as applicable. Moreover, if the applicant is not the landowner, it is the applicant's responsibility to ensure that approvals/permissions have been obtained to trespass and drill a well(s) on the property. **THIS PERMIT DOES NOT GIVE AUTHORIZATION TO TRESPASS ON PRIVATE PROPERTY.**

NOTE: Please be aware that your permission to proceed with the drilling under this authorization expires April 24, 2017.

Sincerely,

Jim V. Goddard, P.G.
Well Drilling Program

DRILLER (START) CARD for MONITOR WELL#: 1625005M00

IMPORTANT: THIS CARD MUST BE RECEIVED BY THE DIVISION OF WATER RIGHTS PRIOR TO THE BEGINNING OF WELL CONSTRUCTION -- REQUIRED ONLY FOR WELLS DEEPER THAN 30 FT.

OWNER/APPLICANT NAME: LOGAN CITY

MAILING ADDRESS: C/O TYLER RICHARDS, 290 NORTH 100 WEST, LOGAN, UT

PHONE NUMBER: 435-716-9756

WELL LOCATION: You are authorized to drill 3 MONITOR WELLs. SEE BELOW.

WELL UTM COORDINATES:

WELL ACTIVITY: NEW (X) REPAIR ( ) REPLACE ( ) ABANDON ( )
CLEAN ( ) DEEPEN ( )

For surface seals in unconsolidated formations (clay, silt, sand, and gravel), will you be using a temporary conductor casing or other formation stabilizer (e.g., drilling mud) in the surface seal interval to maintain the required annular space?

YES or NO (Circle one).

Answering 'NO' suggests that you will be placing the surface seal in an open and unstabilized annular space, which may require onsite inspection of seal placement by the State Engineer's Office.

PROPOSED START DATE: _____

PROJECTED COMPLETION DATE: _____

LICENSE #: _____ LICENSEE/COMPANY: _____

_____ _____

Licensee Signature Date

NOTICE TO APPLICANT: THIS CARD IS TO BE GIVEN TO A UTAH LICENSED WATER WELL DRILLER FOR SUBMITTAL TO THE DIVISION OF WATER RIGHTS PRIOR TO WELL CONSTRUCTION.

STATE OF UTAH DIVISION OF WATER RIGHTS Phone No. 801-538-7416
Fax No. 801-538-7467

MONITOR WELL LOCATIONS:

(1) S 1135 E 967 from the N4 corner, S34 T 15N R 2W SLBM
(2) N 431 W 685 from the E4 corner, S34 T 15N R 2W SLBM
(3) N 149 W 172 from the E4 corner, S34 T 15N R 2W SLBM

APPLICANT CARD for MONITOR WELL#: 1625005M00

IMPORTANT: THIS CARD MUST BE COMPLETED, SIGNED AND RETURNED BY THE WELL OWNER/APPLICANT AS SOON AS THE WELL IS DRILLED BY A LICENSED UTAH WATER WELL DRILLER.

OWNER/APPLICANT NAME: LOGAN CITY

MAILING ADDRESS: C/O TYLER RICHARDS, 290 NORTH 100 WEST, LOGAN, UT

PHONE NUMBER: 435-716-9756

WELL LOCATION: You are authorized to drill 3 MONITOR WELLs. SEE BELOW.

WELL UTM COORDINATES:

WELL ACTIVITY: NEW (X) REPAIR ( ) REPLACE ( ) ABANDON ( )
CLEAN ( ) DEEPEN ( )

WELL COMPLETION DATE: _____

NAME OF DRILLING COMPANY/LICENSEE: _____

_____ _____

Owner/Applicant Signature Date

***COMPLETE, SIGN AND RETURN THIS PORTION UPON FINAL WELL COMPLETION - DO NOT GIVE THIS CARD TO LICENSED WELL DRILLER - YOU MUST RETURN IT.

STATE OF UTAH DIVISION OF WATER RIGHTS Phone No. 801-538-7416
Fax No. 801-538-7467

COMMENTS: _____

MONITOR WELL LOCATIONS:
(1) S 1135 E 967 from the N4 corner, S34 T 15N R 2W SLBM
(2) N 431 W 685 from the E4 corner, S34 T 15N R 2W SLBM
(3) N 149 W 172 from the E4 corner, S34 T 15N R 2W SLBM

START/APPLICANT CARD INSTRUCTIONS: First, for each well, you must give a Driller (Start) Card to the licensed driller with whom you contract to construct the well. Second, it is your responsibility to sign and return this Applicant Card to this office immediately after completion of the well. **CAUTION: There may be local health requirements for the actual siting of your well. Please check with the proper local authority before construction begins. See the enclosed sheet addressing construction information.**

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification

Non-Production Well: 1625005M00 WIN: 440395

Owner *Note any changes*

LOGAN CITY
C/O TYLER RICHARDS
290 NORTH 100 WEST
LOGAN, UT 84321

Contact Person/Engineer: _____

Well Location *Note any changes*

N 149 W 172 from the E4 corner of section 34, Township 15N, Range 2W, SL B&M

Location Description: (address, proximity to buildings, landmarks, ground elevation,local well #)

Drillers Activity Start Date: 10/31/16 Completion Date: 11/2/16

Check all that apply: ☒ New ☐ Repair ☐ Deepen ☐ Clean ☐ Replace ☐ Public Nature of Use: MONITOR WELL

If a replacement well, provide location of new well. _____ feet north/south and _____ feet east/west of the existing well.

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	140	5	AIR ROTORY	AIR

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE High	PERMEABLE Low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTION AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition density, plasticity, shape, cementation, consistancy, water bearing, odor, fracturing, minerology, texture,degree of weathering, hardness, water quality, etc.)
0	140	X			X	X	X							

Static Water Level

Date 11/4/16 Water Level 90 feet Flowing? ☐ Yes ☒ No —
Method of Water Level Measurement TAPE If Flowing, Capped Pressure _____ PSI
Point to Which Water Level Measurement was Referenced GROUND Elevation —
Height of Water Level reference point above ground surface 0 feet Temperature — degrees ☐ C ☐ F

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	☒ SCREEN ☐ PERFORATIONS ☐ OPEN BOTTOM: SCREEN SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	120	PVC SCH. 40		2	120	140	0.010	2	SCH. 40

Well Head Configuration: 4" UPRIGHT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH THREADED Perforator Used: N/A

Was a Surface Seal Installed? ☒ Yes ☐ No Depth of Surface Seal: 117 feet Drive Shoe? ☐ Yes ☐ No

Surface Seal Material Placement Method: TREMMIED PIPE

Was a temporary surface casing used? ☒ Yes ☐ No If yes, depth of casing: 140 feet diameter: 5 inches

DEPTH (feet) FROM	TO	SURFACE SEAL / INTERVAL SEAL / FILTER PACK / PACKER INFORMATION: SEAL MATERIAL, FILTER PACK and PACKER TYPE and DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	112	BENTONITE GROUT	400 #	75 lbs/ft³
112	117	1/4 BENTONITE PELLETS	50 #	
117	140	10/20 SILICA SAND (PRE-PACK SCREEN)	50 #	

Well Development and Well Yield Test Information

DATE	METHOD	YIELD	Units Check One GPM	CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate Maximum Pumping Rate: Well Disinfected upon Completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary Circumstances, abandonment procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled and constructed under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name CONETEC INC (Person, Firm, or Corporation - Print or Type) License No. 745

Signature (Licensed Well Driller) Date 11/12/16

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification

Non-Production Well: 1625005M00 WIN: 440394

Owner *Note any changes*

LOGAN CITY
C/O TYLER RICHARDS
290 NORTH 100 WEST
LOGAN, UT 84321

Contact Person/Engineer: _____

Well Location *Note any changes*

N 431 W 685 from the E4 corner of section 34, Township 15N, Range 2W, SL B&M

Location Description: (address, proximity to buildings, landmarks, ground elevation,local well #) B-9

Drillers Activity Start Date: 11/2/16 Completion Date: 11/3/16

Check all that apply: [X] New [ ] Repair [ ] Deepen [ ] Clean [ ] Replace [ ] Public Nature of Use: MONITOR WELL

If a replacement well, provide location of new well. _____ feet north/south and _____ feet east/west of the existing well.

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	80	5	AIR ROTARY	AIR

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE High	PERMEABLE Low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTION AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition density, plasticity, shape, cementation, consistancy, water bearing, odor, fracturing, minerology, texture,degree of weathering, hardness, water quality, etc.)
0	80	-			X		X							

Static Water Level

Date 11/4/16 Water Level 108 feet Flowing? [ ] Yes [X] No

Method of Water Level Measurement TAPE If Flowing, Capped Pressure — PSI

Point to Which Water Level Measurement was Referenced GROUND Elevation _____

Height of Water Level reference point above ground surface 0 feet Temperature _____ degrees [ ] C [ ] F

Well Log

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	☑ SCREEN ☐ PERFORATIONS ☐ OPEN BOTTOM: SCREEN SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	45	PVC SCH. 40		2	45	70	0.010	2	SCH. 40
70	80	PVC SCH 40		2			(PRE-PACKED)		

Well Head Configuration: 4" UPRIGHT Access Port Provided? ☑ Yes ☐ No

Casing Joint Type: FLUSH THREADED Perforator Used: N/A

Was a Surface Seal Installed? ☑ Yes ☐ No Depth of Surface Seal: 42 feet Drive Shoe? ☐ Yes ☒ No

Surface Seal Material Placement Method: TREMMIE

Was a temporary surface casing used? ☑ Yes ☐ No If yes, depth of casing: 80 feet diameter: 5 inches

DEPTH (feet) FROM	TO	SURFACE SEAL / INTERVAL SEAL / FILTER PACK / PACKER INFORMATION: SEAL MATERIAL, FILTER PACK and PACKER TYPE and DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	37	HIGH SOLIDS BENTONITE GROUT	200 #	75 lbs/43
37	42	1/4 BENTONITE PELLETS	50 #	
42	80	10/20 SAND	450 #	

Well Development and Well Yield Test Information

DATE	METHOD	YIELD	Units Check One: GPM	CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate Maximum Pumping Rate: Well Disinfected upon Completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary Circumstances, abandonment procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled and constructed under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name CONETEC INC (Person, Firm or Corporation - Print or Type) License No. 745

Signature (Licensed Well Driller) Date 11/12/16

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification

Non-Production Well: 1625005M00 WIN: 440393

Owner *Note any changes*

LOGAN CITY
C/O TYLER RICHARDS
290 NORTH 100 WEST
LOGAN, UT 84321

Contact Person/Engineer: _____

Well Location *Note any changes*

S 1135 E 967 from the N4 corner of section 34, Township 15N, Range 2W, SL B&M

Location Description: (address, proximity to buildings, landmarks, ground elevation,local well #) B-10

Drillers Activity Start Date: 11/3/16 Completion Date: 11/3/16

Check all that apply: ☒ New ☐ Repair ☐ Deepen ☐ Clean ☐ Replace ☐ Public Nature of Use: MONITOR WELL

If a replacement well, provide location of new well. _____ feet north/south and _____ feet east/west of the existing well.

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	40	5	AIR ROTARY	AIR

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE High	PERMEABLE Low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTION AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition density, plasticity, shape, cementation, consistancy, water bearing, odor, fracturing, minerology, texture,degree of weathering, hardness, water quality, etc.)
0	40	X			XXX									

Static Water Level

Date 11/4/16 Water Level 27 feet Flowing? ☐ Yes ☒ No

Method of Water Level Measurement TAPE If Flowing, Capped Pressure — PSI

Point to Which Water Level Measurement was Referenced GROUND Elevation _____

Height of Water Level reference point above ground surface 0 feet Temperature _____ degrees ☐ C ☐ F

Well Log

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	☒ SCREEN ☐ PERFORATIONS ☐ OPEN BOTTOM: SCREEN SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	20	PVC SCH.40		2	20	40	0.010	2	SCH.40

Well Head Configuration: 4" UPRIGHT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH THREADED Perforator Used: N/A

Was a Surface Seal Installed? ☒ Yes ☐ No Depth of Surface Seal: 17 feet Drive Shoe? ☐ Yes ☒ No

Surface Seal Material Placement Method: TREMMIE

Was a temporary surface casing used? ☒ Yes ☐ No If yes, depth of casing: 40 feet diameter: 5 inches

DEPTH (feet) FROM	TO	SURFACE SEAL / INTERVAL SEAL / FILTER PACK / PACKER INFORMATION: SEAL MATERIAL, FILTER PACK and PACKER TYPE and DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	12	HOLE SEALS BENTONITE CHIPS	50 lb	75 16/43
12	17	1/4 BENTONITE PLUG	50 #	
17	40	10/20 SILICA SAND	300 #	

Well Development and Well Yield Test Information

DATE	METHOD	YIELD	Units Check One: GPM	CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate Maximum Pumping Rate: Well Disinfected upon Completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary Circumstances, abandonment procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled and constructed under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name CONETEC INC (Person, Firm, or Corporation - Print or Type) License No. 745

Signature (Licensed Well Driller) Date 11/12/16

North Valley Sanitary Landfill- Groundwater

WELL NO.:	Date:
Sampler:	
Field Observations:	
Well Information	
Total Depth:	
Casing Diameter:	
Casing Stick-up:	
Static Depth to Water:	
Measuring Method:	Conductivity based water level meter
Field Analysis	
Water Quality Parameters:	***Instrument:***
pH:	
Temperature:	
Conductivity:	
TDS:	
Dissolved Oxygen:	
Well Purge Information	
Purge Method:	
Purge Volume:	
Recovery Data (if purged dry):	
Water Sample Information	
Sample Method:	
Sample Number:	
Time of Collection:	
Laboratory:	
Transporter:	

Sample Sequence

Sample Order	*Analysis*	*Container*	*Preservative*
1	VOC	40 mL clear glass	HCl
2	TOC, Nutrients	500 mL amber glass	4 C
3	Dissolved Metals		
4	TDS, Minerals	64 oz. plastic	4 C