CITY OF EDINBURG SOLID WASTE MANAGEMENT

PERMIT AMENDMENT APPLICATION

Part III, Attachment 5

GROUNDWATER CHARACTERIZATION AND MONITORING REPORT

Edinburg Regional Disposal Facility

Edinburg, Hidalgo County, Texas

TCEQ Permit MSW-956C

Submitted To: City of Edinburg
Department of Solid Waste Management
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Table of Contents

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List of Tables

List of Figures

List of Appendices

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EXECUTIVE SUMMARY

This Groundwater Characterization and Monitoring Report is prepared in accordance with 30 TAC §§330.63(f) and 330.403. This report summarizes available data related to the occurrence and distribution of groundwater, establishes a groundwater monitoring system, and provides a Groundwater Sampling and Analysis Plan (GWSAP).

1.0 GROUNDWATER CHARACTERIZATION

Part III4, Geology Report summarizes available data related to regional and local geology and aquifers in the vicinity of the facility where its appendixes and figures contained within are used to support the following groundwater characterization discussion.

1.1 Regional Hydrogeology

1.1.1 Generalized Stratigraphic Column

The generalized stratigraphic column of the area beneath the facility is presented to a depth of approximately 1,600 ft-bgs, which is the base of the Evangeline Aquifer. The Goliad Formation outcrops in the vicinity and is overlain by a veneer of Holocene eolian deposits.

1.1.2 Evangeline Aquifer

Underlying the facility is the Evangeline Aquifer which overlies the Burkeville Confining Unit. The Evangeline Aquifer is composed primarily of the Goliad Sand, but may also contain sections of sand and clay from the Upper Lagarto Formation. It is approximately 1,600 feet thick under the facility and dips towards the coast approaching thicknesses greater than 2,300 ft.

The Evangeline Aquifer generally exhibits under water table conditions, however successions of clay may cause portions to behave as a semi-confined aquifer. Transmissivity values are observed to range from 3,000 to 15,000 ft^2/day (Chowdhury and Mace, 2007). Average horizontal and vertical hydraulic conductivities are 80 feet/day and 1 x 10^{-3} feet/day, for horizontal and vertical, respectively (Ryder, 1988).

1.2 Local Hydrogeology

1.2.1 Subsurface Stratigraphy

The results of a subsurface investigation demonstrate the facility is underlain by three distinct strata, identified below in order from ground surface down:

- Stratum I: sandy clays or clayey sands, with layers of silty clay, silty sand, or clayey silt.
- Stratum II: sands/silty sands, fine, poorly graded, and is the uppermost water-bearing unit (uppermost aquifer).
- Stratum III: predominantly clay, with some amounts of sandy clay or silty clay, high plasticity, hard, brown, and dry, and is the confining unit underlying the uppermost water-bearing unit (lower confining unit).

1.2.2 Uppermost Aquifer

The second stratigraphic layer, Stratum II, which is composed of sands/silty sands, is the upper water bearing unit at the site (uppermost aquifer). The thickness of the unit varies from 5 to 30 feet, except in portions of the northwest corner of the proposed expansion area where it was not encountered. The extent of this stratum can be seen in Figures III4-12, Interpretive Geology Cross-Sections which depicts the monitoring wells, borings and sub-surface profiles obtained from the soil investigations at the site.

Groundwater occurs primarily within Stratum II, separated from lower aquifers by underlying Stratum III, which acts as an aquiclude. The groundwater within Stratum II is also locally, partially confined by the clayey soils encountered in Stratum I. In other areas, recharge could occur through vertical flows through overlying sandy soils.

1.3 Hydraulic Characteristics

1.3.1 Groundwater Flow Direction

Figures III4-13A through III4-13N, Potentiometric Surfaces demonstrate groundwater flow direction across the facility. Groundwater within the currently permitted area of TCEQ Permit MSW-956B has a very low hydraulic gradient with variable flow directions. Within the expansion area to be included in TCEQ Permit MSW-956C, groundwater flow is predominantly towards the east, northeast, or southeast in subdued conformance to topography.

1.3.2 Groundwater Flow Rate

Groundwater flow rates were estimated for the uppermost aquifer, using estimated average hydraulic gradients, estimated hydraulic conductivities, and effective porosity for silty sand. The estimated groundwater flow rate is 7.4 feet per year within the currently permitted area of TCEQ Permit MSW-956B and 2.0 feet per year within the expansion area to be included in TCEQ Permit MSW-956C.

1.4 Groundwater Quality

1.4.1 Regional Groundwater Quality

Typical range of values for total dissolved solids content of groundwater, mineral constituents dissolved from rocks and soils within the Evangeline Aquifer is 632 – 8,774 mg/L (Young, 2010). A general classification of water based on dissolved solids content is as follows; waters containing less than 1,000 mg/L of dissolved solids are considered fresh; 1,000 to 3,000 mg/L, slightly saline; 3,000 to 10,000 mg/L, moderately saline; 10,000 to 35,000 mg/L, very saline, and more than 35,000 mg/L, brine (Winslow and Kister, 1956, p.5).

1.4.2 Local Groundwater Quality

Groundwater quality data from the facility's monitoring wells and piezometers indicate that total dissolved solids content ranges from 690-25,500 mg/L. Therefore, the facility's groundwater quality is considered fresh to saline.

1.4.3 Groundwater Monitoring Data

A tabulation of all relevant groundwater monitoring data from wells on site is presented in Part III4F, Historic Groundwater Quality Testing Data. The groundwater monitoring data includes results of all semi-annual and applicable quarterly groundwater monitoring events since 2005.

2.0 GROUNDWATER MONITORING

30 TAC §330.401(d)-(f)

To ensure both a conservative approach to groundwater monitoring at the facility and ensure the detection of any contaminants that may potentially be released to the uppermost aquifer, the facility currently monitors the groundwater present in Stratum II at the point of compliance with a well spacing of approximately 600 feet. Once established at a solid waste management unit, groundwater monitoring must be conducted throughout the active life and any required post-closure care period of that solid waste management unit as specified in 30 TAC §330.463.

Groundwater monitoring requirements under 30 TAC §§330.403, 330.405, 330.407, and 330.409 may be suspended by the TCEQ for a solid waste management unit if the City can demonstrate that there is no potential for migration of hazardous constituents from that solid waste management unit to the uppermost aquifer during the active life and the closure and post-closure care period of the unit. This demonstration shall be certified by a qualified groundwater scientist and approved by the TCEQ, and must be based upon:

- site-specific field-collected measurements, sampling, and analysis of physical, chemical, and biological processes affecting contaminant fate and transport; and
- contaminant fate and transport predictions that maximize contaminant migration and consider impacts on human health and the environment.

2.1 Groundwater Monitoring Compliance Certification

30 TAC §§330.401(e) & 330.403(e)

For new solid waste management units, the City must submit to the TCEQ a documented certification signed by a qualified groundwater scientist that the facility is in compliance with the groundwater monitoring requirements specified in 30 TAC §§330.403, 330.405, 330.407, and 330.409 prior to waste placement in the unit. The qualified groundwater scientist must also certify the groundwater monitoring system design, including the number, spacing, and depths of monitoring wells and submit the plan for the monitoring system and all supporting data to the TCEQ for review and approval prior to construction of the unit. Within 14 days of the certification, the City shall submit the certification to the TCEQ and place a copy of the certification

QUALIFIED GROUNDWATER SCIENTIST STATEMENT

I, Chad E. Ireland, am a licensed professional geological engineer in the State of Texas (PE 99293) and a qualified groundwater scientist as defined in 30 TAC §330.3(120); and have reviewed the groundwater monitoring system design (including the number, spacing, and depths of monitoring wells), groundwater sampling and analysis requirements, detection monitoring program, and assessment monitoring program including supporting data contained herein. In my professional opinion, the Edinburg Regional Disposal Facility TCEQ Permit MSW-956C located in Hidalgo County, Texas is in compliance with the groundwater monitoring requirements specified in 30 TAC §§330.403, 330.405, 330.407, and 330.409. The only warranty made by me in connection with this document is that I have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of my profession, practicing in the same or similar locality. No other warranty expressed or implied, is intended.

Signature: _____ Date: 11/7/17

Chad E. Ireland, Texas PE 99293

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2.2 Groundwater Monitoring System

30 TAC §§330.63(f)(4), 330.63(f)(5)(A), 330.63(f)(6)(D), 330.403(a), 330.403(a)(1)-(2), and 330.403(d)

The proposed groundwater monitoring system is designed with of a sufficient number of groundwater monitoring wells located at the point of compliance in accordance to 40 CFR §258.51(a)(2), spaced less than 600 ft apart, and installed at a depth to yield representative groundwater samples from the uppermost aquifer identified as the saturated zone within Stratum II. The point of compliance monitoring system is designed to allow determination of the quality of groundwater passing the point of compliance as defined by 30 TAC §330.3(106) and to ensure the detection of groundwater contamination. As a result of the varying groundwater flow conditions, all of the groundwater monitoring wells are considered to be point of compliance wells and the quality of background groundwater will be determined at each groundwater monitoring well that has not been affected by leakage from a unit. All parts of a groundwater monitoring system shall be operated and maintained so that they perform at least to design specifications through the life of the groundwater monitoring program.

2.2.1 Design Considerations

30 TAC §330.403(e)(1)

2.2.1.1 Bottom of Waste Disposal Units Relative to Uppermost Aquifer

The subgrade elevation of the waste disposal units are designed primarily within Stratum I, though it may penetrate into Stratum II, the uppermost aquifer, in portions of Unit 7. Groundwater is encountered at approximately 5 to 35 ft-bgs (elevation of 74 ft-msl to 54 ft-msl), depending on topography and season. Although unlikely, if a release from the Subtitle D waste disposal unit were to occur, the most probable location would be the leachate collection sumps, the lowest excavation point.

2.2.1.2 Groundwater Flow

30 TAC §330.403(e)(3)

Landfill construction and site development activities have modified groundwater flow as an inward gradient towards cell construction activities may modify the groundwater flow direction which is discussion in § 1.3.1 and 1.3.2. The City shall promptly notify the TCEQ, and any local pollution agency with jurisdiction that has requested to be notified, in writing of changes in facility construction or operation or changes in adjacent property that affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from a solid waste management unit and that may require the installation of additional monitoring wells or sampling points and that such additional wells or sampling points require a modification of the site development plan.

2.2.1.3 Potential Contaminant Pathways

30 TAC §330.63(f)(3)

Although unlikely, if a release from the Subtitle D waste disposal unit were to occur, the most probable contaminant pathway would be either along the interface of the waste disposal unit lining system and the soil interface or downward into Stratum II. In the event that any contaminants were to reach the groundwater, the miscible contaminants would be diluted by the groundwater and would move laterally because of the underlying aquiclude. The direction of lateral movement may fluctuate because of the varying groundwater flow conditions resulting from ongoing construction activities; however any contaminants will be detected by the point of compliance monitoring wells prior to reaching any potential receptors. No critical receptors were identified based on review of the adjacent properties surrounding the facility.

2.2.2 Groundwater Monitoring Well Locations

30 TAC §§330.63(f)(1) & 330.403(b)(1)-(5)

As a result of the bottom of the waste disposal units relative to the uppermost aquifer, groundwater monitoring wells will be screened to include the saturated zone within Stratum II interface allowing for monitoring of groundwater elevations and contaminant levels in the groundwater in the uppermost water-bearing unit. Groundwater monitoring in the low-permeability Stratum III clay is not necessary because migration rates of potential contamination will be very slow and water will preferentially flow within the higher permeability Stratum II. Because of the varying groundwater flow conditions and potential contaminant pathways, all of the groundwater monitoring wells are considered to be point of compliance wells and the quality of background groundwater will be determined at each groundwater monitoring well that has not been affected by leakage from a unit. All monitoring wells have a spacing along the point of compliance of 600 ft. or less.

The layout of the groundwater monitoring system is presented on Figure III5-1, Proposed Groundwater Monitoring System and includes topographic contours of existing conditions, a delineation of the waste management area, the property boundary, the point of compliance, and location of groundwater monitoring wells. The plan depicts groundwater monitoring wells, spaced less than 600 ft apart, along the point of compliance located not greater than 500 ft from the joined solid waste management units within the overall waste management area to effectively monitor groundwater from large portions of the facility.

2.2.2.1 Previously Permitted Groundwater Monitoring Well Network

The monitoring well network of TCEQ Permit MSW-956B included 14 wells (MW-1 through MW-14) screened in the upper water-bearing unit. MW-1 through MW-4 were installed in 1993 and MW-5 through MW-8 in 1996. MW-9 through MW-12 and MW-14 were installed in 2000. In 2003, replacement wells MW-1R through MW-4R were installed, followed by further reinstallation of well MW-3RA. In 2005, MW-15 and MW-18 were added to the existing monitoring well system. In 2009, the following wells were replaced/relocated – MW-3A, MW-4A, MW-7R, MW-8R, MW-9R, MW-10R, MW-15R, and MW-18R. In addition, MW-16 and MW-22 through MW-24 were installed in 2009. The Edinburg Sanitary Landfill TCEQ Permit MSW-956B and Type IV Landfill TCEQ Permit MSW-2302 share a common permit boundary along the southwestern portion of the facility. In 2013, wells MWD-6 and MWD-7 were installed along this southern boundary to monitor the same groundwater unit as the Type IV Landfill. These wells are located 30 feet of the southern permit boundary of the Type I landfill. Apart from the wells which were relocated or replaced, wells MW-5, MW-6, and MW-14 were plugged in 2004, 2008, and 2000 respectively. MW-13, MW-14R, MW-17, MW-19, MW-20, and MW-21 are part of the current monitoring well network that are permitted for future installation.

Table III5-1 lists the monitoring wells that are part of the monitoring well network of TCEQ Permit MSW-956B. Appendix III5A, Existing Monitoring Well Information presents the available well installation records for the current and historic monitoring wells.

Table III5-1: Previously Permitted Groundwater Monitoring Well Network

Well ID	Northing (ft)[1]	Easting (ft)[1]	Ground Elevation	Top of Casing	Depth of Screened Interval		Elevation of Screened Interval	
			ft-msl	ft-msl	ft-bgs		ft-msl	
					Top	Bottom	Top	Bottom
MW-1R	16,670,451.01	1,104,162.79	84.7	87.5	20	25	64.7	59.7
MW-2R	16,668,465.10	1,103,816.69	86.5	89.4	25	30	61.5	56.5
MW-3A	16,668,167.98	1,105,587.63	95.7	98.4	31	41	64.7	54.7
MW-4A	16,670,162.92	1,105,941.09	87.3	90.0	27	37	60.3	50.3
MWD-6	16,667,949.81	1,106,763.82	90.6	93.5	35	45	55.6	45.6
MWD-7	16,670,250.28	1,105,347.96	85.0	87.7	21	31	65.0	55.0
MW-7R	16,667,810.34	1,107,955.19	86.4	89.2	26	36	60.4	50.4
MW-8R	16,670,347.68	1,104,753.77	85.1	88.3	26	36	59.1	49.1
MW-9R	16,669,023.33	1,103,878.53	86.8	89.8	27	37	59.8	49.8
MW-10R	16,669,618.10	1,103,965.73	88.2	91.0	26	36	62.2	52.2
MW-11	16,670,058.17	1,106,488.44	88.4	91.1	27	37	61.4	51.4
MW-12	16,668,084.93	1,106,178.78	89.8	92.3	30.1	40.1	59.8	49.8
MW-13*	16,667,722.74	1,108,566.75	90.4	-	-	-	-	-

Well ID	Northing (ft)[1]	Easting (ft)[1]	Ground Elevation	Top of Casing	Depth of Screened Interval		Elevation of Screened Interval	
			ft-msl	ft-msl	ft-bgs		ft-msl	
					Top	Bottom	Top	Bottom
MW-14R*	16,669,889.35	1,108,856.78	96.9	-	-	-	-	-
MW-15R	16,670,041.53	1,107,087.42	88.3	91.3	26.5	36.5	61.8	51.8
MW-16	16,669,923.37	1,107,650.60	85.8	88.4	22	32	63.8	53.8
MW-17*	16,668,909.26	1,108,747.81	83.1	-	-	-	-	-
MW-18R	16,667,902.08	1,107,362.25	85.3	88.1	22	32	63.3	53.3
MW-19*	16,669,975.70	1,108,263.02	102.6	-	-	-	-	-
MW-20*	16,669,502.20	1,108,839.55	84.1	-	-	-	-	-
MW-21*	16,668,316.32	1,108,656.07	94.0	-	-	-	-	-
MW-22	16,668,253.10	1,104,999.75	93.0	95.2	28	38	65.0	55.0
MW-23	16,668,353.05	1,104,406.40	87.9	90.7	17	27	70.9	60.9
MW-24	16,670,208.81	1,104,062.92	87.2	90.4	25	35	62.2	52.2

Note: *These wells are part of the groundwater monitoring well network approved under TCEQ Permit MSW-956B, but haven't been installed as of the date of this report.
1. Coordinates provided in Texas State Plane South Zone NAD83

2.2.2.2 Groundwater Monitoring Well Network

The groundwater monitoring system will consist of a total of 38 groundwater monitoring wells requiring modifications to the approved network of monitoring well of TCEQ Permit MSW-956B; retain 12 wells, plug and abandon 12 wells, and install 26 additional wells as depicted on Figure III5-1, Proposed Groundwater Monitoring System. The twelve existing monitoring wells to be properly plugged and abandoned are MW-1R, MW-4A, MW-7R, MW-8R, MW-11, MW-14R, MW-15R, MW-16, MW-17, MW-19, MW-20, and MW-21. The additional 26 monitoring wells to be installed are MW-101 through MW-115 along the northern permit boundary, MW-116 through MW-122 along the eastern permit boundary; and MW-123 through MW-126 along the southern permit boundary. The removal of existing monitoring wells and installation of the additional wells will be sequenced to coincide with the schedule of site development outlined in Part II, Facility Layout. Wells will be installed prior to waste placement in the adjacent disposal unit.

Table III5-2: Groundwater Monitoring Well Network

Well ID	Northing (ft)[1]	Easting (ft)[1]	Ground Elevation	Top of Casing	Depth of Screened Interval		Elevation of Screened Interval	
			ft-msl	ft-msl	ft-bgs		ft-msl	
					Top	Bottom	Top	Bottom
Monitoring Wells to Remain								
MW-2R	16,668,465.10	1,103,816.69	86.5	89.4	25	30	61.5	56.5

Well ID	Northing (ft)[1]	Easting (ft)[1]	Ground Elevation	Top of Casing	Depth of Screened Interval		Elevation of Screened Interval	
			ft-msl	ft-msl	ft-bgs		ft-msl	
					Top	Bottom	Top	Bottom
MW-3A	16,668,167.98	1,105,587.63	95.7	98.4	31	41	64.7	54.7
MWD-6	16,667,949.81	1,106,763.82	90.6	93.5	35	45	55.6	45.6
MWD-7	16,670,250.28	1,105,347.96	85.0	87.7	21	31	65.0	55.0
MW-9R	16,669,023.33	1,103,878.53	86.8	89.8	27	37	59.8	49.8
MW-10R	16,669,618.10	1,103,965.73	88.2	91.0	26	36	62.2	52.2
MW-12	16,668,084.93	1,106,178.78	89.8	92.3	30.1	40.1	59.8	49.8
MW-13*	16,667,722.74	1,108,566.75	90.4	-	-	-	-	-
MW-18R	16,667,902.08	1,107,362.25	85.3	88.1	22	32	63.3	53.3
MW-22	16,668,253.10	1,104,999.75	93.0	95.2	28	38	65.0	55.0
MW-23	16,668,353.05	1,104,406.40	87.9	90.7	17	27	70.9	60.9
MW-24	16,670,208.81	1,104,062.92	87.2	90.4	25	35	62.2	52.2
Additional Monitoring Wells to be Installed								
MW-101	16,670,791.71	1,104,169.10	83.4	-	20	30	63.4	53.4
MW-102	16,670,787.29	1,104,623.01	83.6	-	20	30	63.6	53.6
MW-103	16,670,705.22	1,105,156.73	84.0	-	20	30	64.0	54.0
MW-104	16,670,622.82	1,105,690.41	85.3	-	18	28	67.3	57.3
MW-105	16,670,540.42	1,106,224.08	86.9	-	18	28	68.9	58.9
MW-106	16,670,458.17	1,106,757.78	87.5	-	18	28	69.5	59.5
MW-107	16,670,385.39	1,107,290.48	92.2	-	20	30	72.2	62.2
MW-108	16,670,836.34	1,107,371.57	98.7	-	25	35	73.7	63.7
MW-109	16,671,423.26	1,107,462.38	93.5	-	30	40	63.5	53.5
MW-110	16,671,972.46	1,107,598.57	95.9	-	25	35	70.9	60.9
MW-111	16,671,885.23	1,108,177.04	92.1	-	25	35	67.1	57.1
MW-112	16,671,798.19	1,108,752.57	90.6	-	34	44	56.6	46.6
MW-113	16,671,708.81	1,109,334.62	95.3	-	33	43	62.3	52.3
MW-114	16,671,620.14	1,109,912.86	85.8	-	28	38	57.8	47.8
MW-115	16,671,531.11	1,110,492.95	82.2	-	25	35	57.2	47.2
MW-116	16,670,961.59	1,110,572.09	88.4	-	25	35	63.4	53.4
MW-117	16,670,387.13	1,110,597.01	87.6	-	30	40	57.6	47.6
MW-118	16,669,812.67	1,110,621.93	88.7	-	20	30	68.7	58.7
MW-119	16,669,402.58	1,110,842.39	92.6	-	35	45	57.6	47.6
MW-120	16,668,987.79	1,111,045.55	93.8	-	40	50	53.8	43.8
MW-121	16,668,413.22	1,111,067.56	96.3	-	40	50	56.3	46.3
MW-122	16,667,838.65	1,111,089.58	99.4	-	40	50	59.4	49.4
MW-123	16,667,379.28	1,110,767.39	98.7	-	43	53	55.7	45.7
MW-124	16,667,461.31	1,110,228.55	97.6	-	43	53	54.6	44.6

Well ID	Northing (ft)[1]	Easting (ft)[1]	Ground Elevation	Top of Casing	Depth of Screened Interval		Elevation of Screened Interval	
			ft-msl	ft-msl	ft-bgs		ft-msl	
					Top	Bottom	Top	Bottom
MW-125	16,667,549.21	1,109,660.31	93.7	-	43	53	50.7	40.7
MW-126	16,667,637.14	1,109,092.08	96.8	-	45	55	51.8	41.8

Note:
*These wells are part of the groundwater monitoring well network approved under TCEQ Permit MSW-956B, but haven't been installed as of the date of this report.
- Anticipated construction details are provided for additional monitoring wells to be installed and are estimates inferred from cross-sections presented in Part III4, Geology Report. Actual screen depths need to be determined based on field observations during borehole drilling.
1. Coordinates provided in Texas State Plane South Zone NAD83

2.2.3 Monitoring Well Construction

30 TAC §330.421(a)

Monitoring well construction shall provide for maintenance of the integrity of the bore hole, collection of representative groundwater samples from the water-bearing zone of concern, and prevention of migration of groundwater and surface water within the bore hole. The following specifications must be used for the installation of groundwater monitoring wells at municipal solid waste landfills. Equivalent alternatives to these specifications may be used if prior written approval is obtained in advance from the TCEQ. Figure III5-2, Proposed Monitoring Well Construction Details present the required specifications for installation of a monitoring well.

Damaged monitoring wells that are no longer usable will be reported to the TCEQ Executive Director for a determination whether to replace or repair the well. In accordance with 30 TAC §305.70(j), if a compromised well requires replacement, a permit modification request will be submitted within 45 days of the discovery. Plugging and abandoning of monitoring wells will be performed in accordance with 16 TAC §76.104. No abandonment will be performed without prior written authorization from the TCEQ.

2.2.3.1 Drilling

30 TAC §330.421(a)(1)(A)-(D)

Monitoring wells must be drilled by a Texas-licensed driller who is qualified to drill and install monitoring wells. The installation and development shall be supervised by a licensed professional geoscientist or engineer who is familiar with the geology of the area and a log of the boring shall be completed, sealed, signed, and dated by the licensed professional.

The well shall be drilled by a method that will allow installation of the casing, screen, etc., and that will not introduce contaminants into the borehole or casing. Drilling techniques used for boring shall take into account the materials to be drilled, depth to groundwater, total depth of the hole, adequate soil sampling, and other such factors that affect the selection of the drilling method. The diameter of the boring shall be at least four inches larger than the diameter of the casing. In the event that a boring is advanced through hard rock, a smaller annulus may be approved by the TCEQ.

If any fluids are necessary in drilling or installation, then clean, treated city water shall be used; other fluids must be approved in writing by the TCEQ before use. If city water is used, a current chemical analysis of the city water shall be provided with the monitor-well report.

2.2.3.2 Casing, Screen, Filter Pack, and Seals

30 TAC §330.421(a)(2)

2.2.3.2.1 Casing

30 TAC §330.421(a)(2)(A)

The well casing shall be: two to four inches in diameter; National Science Foundation-certified polyvinyl chloride (PVC) Schedule 40 or 80 pipe, flush-thread, screw joint (no glue or solvents); polytetrafluorethylene (PTFE, such as Teflon) tape or O-rings in the joints; no collar couplings. The top of the casing shall be at least two feet above ground level. Where high levels of volatile organic compounds or corrosive compounds are anticipated, stainless steel or PTFE casing and screen may be used, subject to approval by the TCEQ. A two- inch to four-inch diameter casing is recommended. The casing shall be cleaned and packaged at the place of manufacture; the packaging shall include a PVC wrapping on each section of casing to keep it from being contaminated prior to installation. The casing shall be free of ink, labels, or other markings. The casing (and screen) shall be centered in the hole to allow installation of a good filter pack and annular seal. Centralizers are recommended on wells over six meters (20 feet) in length, but may not be needed if the wells are installed through hollow-stem augers. The top of the casing shall be protected by a threaded or slip-on top cap or by a sealing cap or screw-plug seal inserted into the top of the casing. The cap shall be vented to prevent buildup of methane or other gases and shall be designed to prevent moisture from entering the well.

2.2.3.2.2 Screen

30 TAC §330.421(a)(2)(B)

The well screen shall be compatible with the casing and should generally be of the same material. The screen shall not involve the use of any glues or solvents for construction. A wire-wound screen is

recommended to provide maximum inflow area. Field-cut slots are not permitted for well screen. Filter cloth shall not be used. A blank-pipe sediment trap, typically one to two feet, should be installed below the screen. A bottom cap will be placed on the bottom of the sediment trap. The sediment trap shall not extend through the lower confining layer of the water-bearing zone being monitored. Screen sterilization methods are the same as those for casing. Selection of the size of the screen opening should be done by a person experienced with such work and shall include consideration of the distribution of particle sizes both in the water-bearing zone and in the filter pack surrounding the screen. The screen opening shall not be larger than the smallest fraction of the filter pack.

2.2.3.2.3 Filter Pack

30 TAC §330.421(a)(2)(C)

The filter pack, placed between the screen and the well bore, shall consist of prepackaged, inert, clean silica sand or glass beads; it shall extend from one to four feet above the top of the screen. Open stockpile sources of sand or gravel are not permitted. The filter pack usually has a 30% finer grain size that is about four to ten times larger than the 30% finer grain size of the water-bearing zone; the filter pack should have a uniformity coefficient less than 2.5.

2.2.3.2.4 Annular Seal

30 TAC §330.421(a)(2)(D)

The annular seal shall be placed on top of the filter pack and shall be at least two feet thick. It should be placed in the zone of saturation to maintain hydration. The seal should be composed of coarse-grain sodium bentonite, coarse-grit sodium bentonite, or bentonite grout. Special care should be taken to ensure that fine material or grout does not plug the underlying filter pack. Placement of one foot of prepackaged clean fine sand on top of the filter pack will help to prevent migration of the annular seal material into the filter pack. The bentonite shall be hydrated with clean water prior to any further activities on the well and left to stand until hydration is complete (eight to 12 hours, depending on the grain size of the bentonite). If a bentonite-grout (without cement) casing seal is used in the well bore, then it may replace the annular seal described in this paragraph.

2.2.3.2.5 Casing Seal

30 TAC §330.421(a)(2)(E)

A casing seal shall be placed on top of the annular seal to prevent fluids and contaminants from entering the borehole from the surface. The casing seal shall consist of a commercial bentonite grout or a cement-bentonite mixture. Drilling spoil, cuttings, or other native materials are not permitted for use as

a casing seal. Quick-setting cements are not permitted for use because contaminants may leach from them into the groundwater. The top of the casing seal shall be between five and two feet from the surface.

2.2.3.3 Concrete Pad

30 TAC §330.421(a)(3)

High-quality structural-type concrete shall be placed from the top of the casing seal (two to five feet below the surface) continuously to the top of the ground to form a pad at the surface. This formed surface pad shall be at least six inches thick and not less than four (preferably six) feet square or five (preferably six) feet in diameter. The pad shall contain sufficient reinforcing steel to ensure its structural integrity in the event that soil support is lost. The top of the pad shall slope away from the well bore to the edges to prevent ponding of water around the casing or collar.

2.2.3.4 Protective Collar

30 TAC §330.421(a)(4)

A steel or aluminum protective pipe collar shall be placed around the casing "stickup" to protect it from damage and unwanted entry. The collar shall be set at least one foot into the surface pad during its construction and should extend at least three inches above the top of the well casing (and top cap, if present). The top of the collar shall have a lockable hinged top flap or cover. A sturdy lock shall be installed, maintained in working order, and kept locked when the well is not being bailed/purged or sampled. The well number or other designation shall be marked permanently on the protective steel collar; it is useful to mark the total depth of the well and its elevation on the collar.

2.2.3.5 Protective Barrier

30 TAC §330.421(a)(5)

Where monitoring wells are likely to be damaged by moving equipment or are located in heavily traveled areas, a protective barrier shall be installed. A typical barrier is three or four six- to 12-inch diameter pipes set in concrete just off the protective pad. The pipes can be joined by pipes welded between them, but consideration must be given to well access for sampling and other activities. Separation of such a pipe barrier from the pad means that the barrier can be damaged without risk to the pad and well. Other types of barriers may be approved by the TCEQ.

2.2.3.6 Unusual Conditions

30 TAC §330.421(b)

Where monitoring wells are installed in unusual conditions, all aspects of the installation shall be approved in writing in advance by the TCEQ. Such aspects include, for example, the use of cellar-type enclosures for the top-well equipment or multiple completions in a single hole.

2.2.3.7 Development

30 TAC §330.421(c)

After a monitoring well is installed, it shall be developed to remove artifacts of drilling (clay films, bentonite pellets in the casing, etc.) and to open the water-bearing zone for maximum flow into the well. Development should continue until all of the water used or affected during drilling activities has been removed and field measurements of pH, specific conductance, and temperature have stabilized. Failure to develop a well properly may result in improper monitoring of the water-bearing zone or in adequate water for sampling even though the water-bearing zone is prolific.

2.2.3.8 Location and Elevation

30 TAC §330.421(d)

Upon completion of installation of a monitoring well, the location of the well and all appropriate elevations associated with the top-well equipment shall be surveyed by a registered professional surveyor. The elevation shall be surveyed to the nearest 0.01 foot above mean sea level (with year of the sea-level datum shown). The point on the well casing for which the elevation was determined shall be permanently marked on the casing. The location shall be given in terms of the latitude and longitude at least to the nearest tenth of a second or shall be accurately located with respect to the landfill grid system described in Part IV, Site Operating Plan, §4.11, Landfill Markers and Benchmark.

2.2.3.9 Reporting

30 TAC §330.421(e)

Monitoring well installation and construction details must be submitted on forms available from the TCEQ and must be completed and submitted within 60 days of well completion. A copy of the detailed geologic log of the boring, a description of development procedures, any particle size or other sample data from the well, and a site map drawn to scale showing the location of all monitoring wells and the point of compliance must be submitted to the TCEQ at the same time. The licensed driller should be

familiar with the forms required by other agencies; a copy of those forms must also be submitted to the TCEQ.

2.3 Groundwater Sampling and Analysis Requirements

Groundwater sampling and analytical testing will be performed in accordance with the Appendix III5B, Groundwater Sampling and Analysis Plan (GWSAP). The GWSAP includes procedures for the sampling of groundwater at each monitoring well within the groundwater monitoring system and for laboratory analysis. The plan establishes a detection monitoring program and an assessment monitoring program as well as methods to be used to evaluate groundwater monitoring data.

2.4 Evaluation of Historical Groundwater Monitoring Data

The facility began detection monitoring with the first quarterly sampling event in 1999. Part III4F, Historic Groundwater Quality Testing Data is a tabulation of available groundwater analytical test results from quarterly background and semi-annual detection monitoring events since 2005.

2.4.1 Historical Statistically Significant Increases

To provide a relevant historical account of the statistically significant increases (SSIs) at the facility within the last 10 years, detections for inorganic metal constituents above current background concentrations for each individual groundwater monitoring well and detections for volatile organic compounds (VOCs) above the TCEQ recommended Municipal Solid Waste Practical Quantitation Limits (MSW-PQL) are presented in Appendix III5C, Historical Statistically Significant Increases (SSI).

Every detection for inorganic metal constituents above background was followed by either verification resampling and / or an alternate source demonstration (ASD). If the verification resampling demonstrated constituent levels lower than background value, then the measurements were excluded from Appendix III5C. Therefore, all historical SSIs for inorganic metal constituents have a demonstration of an alternative source other than the landfill that has been accepted by the TCEQ.

Every detection for VOCs was followed by verification resampling, have been recorded and accepted by the TCEQ as anomalous measurements, or the approved assessment monitoring program was initiated for the groundwater monitoring well of concern. If VOCs detections were determined to be anomalous, then the measurements were excluded from Appendix III5C. Therefore, all historical SSIs for VOCs have been evaluated under the assessment monitoring program.

2.4.2 Assessment Monitoring

30 TAC §330.63(f)(6)(B)

The assessment monitoring program has been initiated for groundwater monitoring wells MW-4A and MW-22 because VOCs above the MSW-PQL were detected and verified. As shown in Appendix III5C, monitoring well MW-4A contained VOC detections above the MSW-PQL for benzene, 1,4-Dichlorobenzene, 1,1-Dichloroethane, cis-1,2-Dichloroethene, Tetrachloroethene, Trichloroethylene, and Vinyl Chloride. MW-4A and two adjacent monitoring wells, MW-7R and MW-11, were sampled and tested for 40 CFR Part 258, Appendix II Constituents in March 2014 and resulted in no detections in the additional constituents. MW-22 had VOC detections above the MSW-PQL for cis-1,2-Dichloroethene. MW-22 and two adjacent monitoring wells MW-3A and MW-23 were sampled and tested for 40 CFR Part 258, Appendix II Constituents in December 2015 and resulted in no detections in the additional constituents.

2.4.3 Source of Contamination

30 TAC §§330.63(f)(2), 330.63(f)(2)(A), & 330.63(f)(2)(B)

A contamination plume is body of ground water containing contaminants, emanating and migrating from a point source within a hydrogeologic unit. Although VOCs have been detected in MW-4A and MW-22, the point source of VOC contamination has not been conclusively identified nor determined to be from the facility's waste management unit. In addition, adjacent monitoring wells to those of concern have been sampled and tested with analytical results showing no detections of VOCs. Because the point source, extent, migration direction, and maximum concentration of VOCs cannot be adequately assessed from the available data, a contamination plume cannot be delineated other than to the extent of the adjacent wells that show no detections.

In a proactive effort to address the potential source of the VOCs detected in MW-4A and MW-22, the City installed passive gas vent trenches between both monitoring wells and the existing waste footprint in March 2016. These passive gas vent trenches extended both 50 feet east and west, on either side of the monitoring well, to collect and passively vent any migrating landfill gas that could be contributing to the detection of VOCs. Since their installation, MW-4A analytical results have demonstrated no VOC detections for two consecutive semi-annual monitoring events and therefore the well is no longer in assessment monitoring.

Conversely, the analytical results for MW-22 show an increase in concentration for cis-1,2-Dichloroethene. The effectiveness of the passive gas vent trench installed for the monitoring well was evaluated. A review of its as-built construction revealed the trench was not installed at an adequate

depth to intercept migrating landfill gas that may exist directly above the groundwater surface. Consequently, the City reinstalled the passive gas vent trench to a depth below the existing groundwater surface in March 2017. MW-22 to date is in assessment monitoring and analytical results of further groundwater monitoring will determine if the reinstallation of the passive gas vent trench adequately mitigates the VOCs detected.

3.0 REFERENCES

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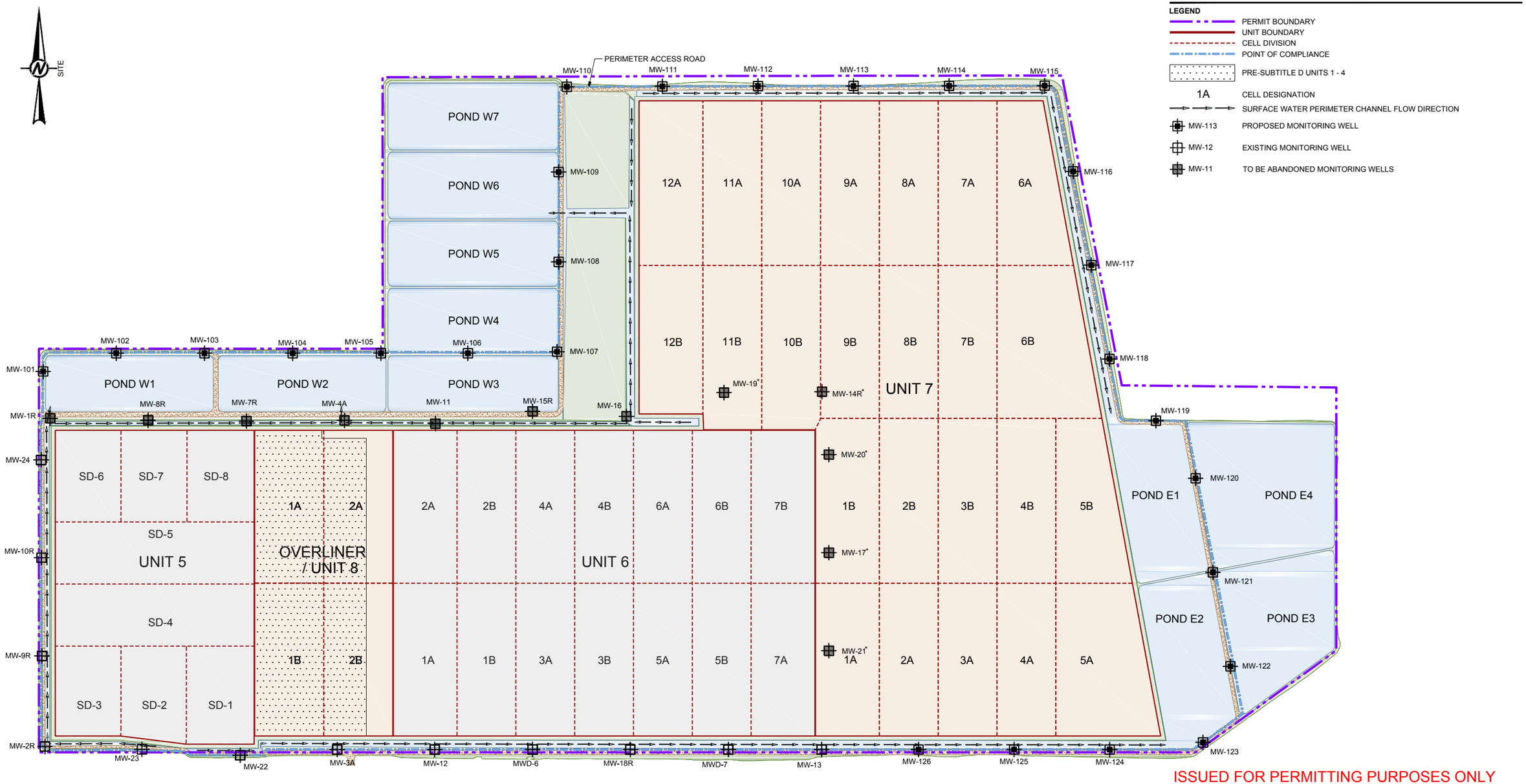

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
1	2017-11-07	RESPONSE TO TCEQ FIRST NOTICE OF DEFICIENCY	CEI	TNB	JAW	CEI
0	2017-07-21	PERMIT AMENDMENT APPLICATION SUBMITTAL	CEI	AA	JAW	CEI

SEAL

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PROJECT
EDINBURG REGIONAL DISPOSAL FACILITY
PERMIT AMENDMENT APPLICATION TCEQ PERMIT MSW-956C
EDINBURG, HIDALGO COUNTY, TEXAS

TITLE
GROUNDWATER MONITORING SYSTEM PLAN

PROJECT NO.	APPLICATION SECTION	REV.		FIGURE
1401491	III5	1	1 of 2	III5-1

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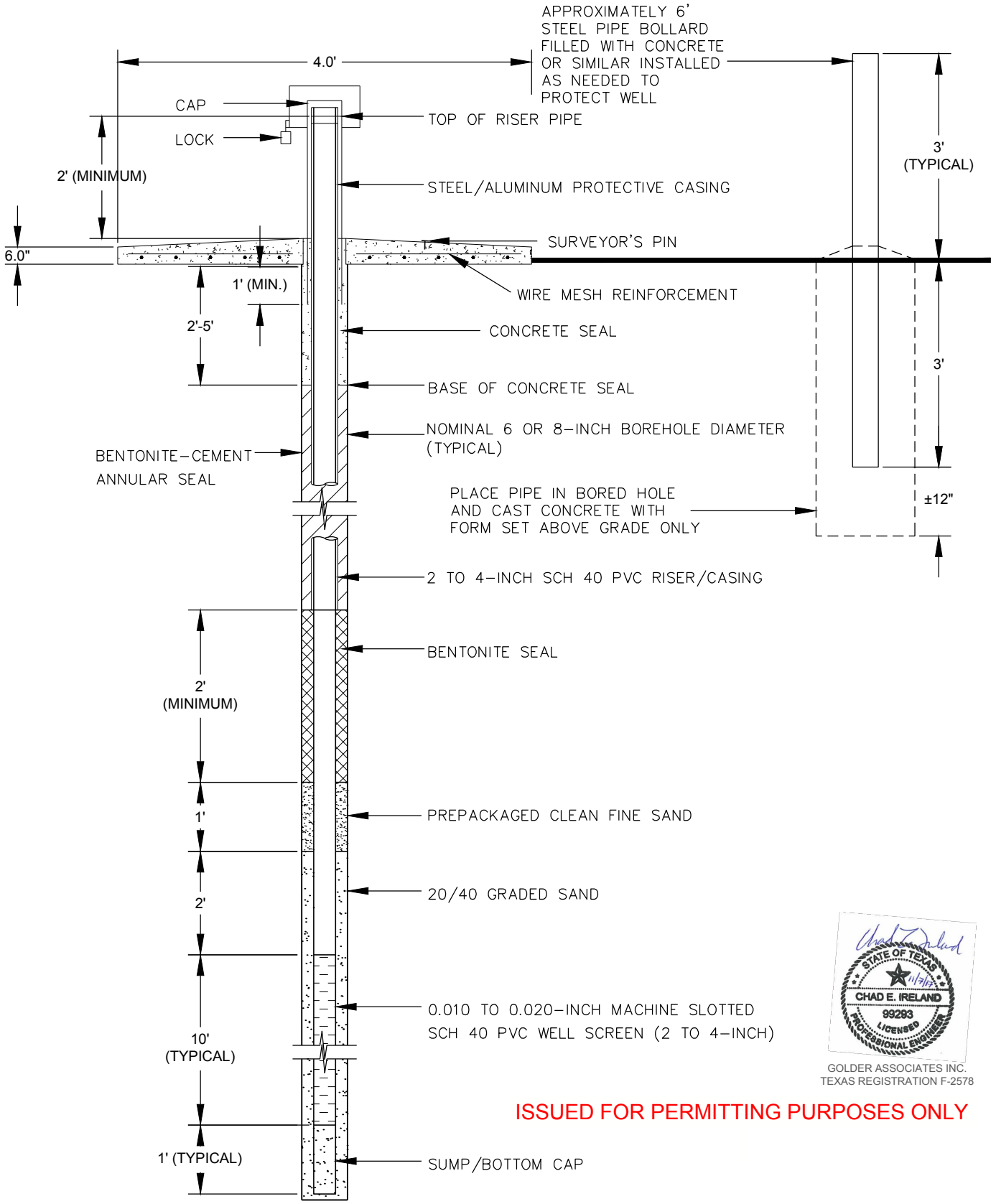

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CLIENT
CITY OF EDINBURG SOLID WASTE MANAGEMENT

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-11-07
DESIGNED	CEI
PREPARED	AA
REVIEWED	JAW
APPROVED	CEI

PROJECT
EDINBURG REGIONAL DISPOSAL FACILITY
PERMIT AMENDMENT APPLICATION TCEQ PERMIT MSW-956C
EDINBURG, HIDALGO COUNTY, TEXAS

TITLE
PROPOSED MONITORING WELL COSTRUCTION DETAILS

PROJECT NO.	APPLICATION SECTION	REV.		FIGURE
1401491	III5	1	2 of 2	III5-2

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CITY OF EDINBURG SOLID WASTE MANAGEMENT

PERMIT AMENDMENT APPLICATION

Part III, Attachment 5, Appendix B

GROUNDWATER SAMPLING AND ANALYSIS PLAN (GWSAP)

Edinburg Regional Disposal Facility

Edinburg, Hidalgo County, Texas

TCEQ Permit MSW-956C

Submitted To: City of Edinburg
Department of Solid Waste Management
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Edinburg, Texas 78542 USA

Submitted By: Golder Associates Inc.
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July 2017
Revised: November 2017

Project No. 1401491

Golder Associates

Table of Contents

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List of Tables

List of Figures

List of Appendices

GOLDER ASSOCIATES INC.
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EXECUTIVE SUMMARY

30 TAC §§330.63(f), 330.405(a), and 330.405(b)

This Groundwater Sampling and Analysis Plan (GWSAP) is prepared in accordance with 30 TAC §330 Subchapter J relating to Groundwater Monitoring and Corrective Action and includes consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and groundwater monitoring wells installed in compliance with 30 TAC §330.403(a) – (c). The City of Edinburg (City) shall submit this plan to the TCEQ for review and approval prior to commencement of sampling and shall maintain a current copy in the Site Operation Record (SOR).

1.0 GROUNDWATER SAMPLING AND ANALYSIS PROCEDURES

30 TAC §§330.63(f)(6)(E), 330.405(a), 330.405(b)(1), 330.405(b)(3), and 330.405(b)(3)(A)

Consistent analysis procedures are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the groundwater monitor wells. These sampling and analytical methods are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. Provided within this section of the GWSAP are procedures and techniques for sample collection, sample preservation and shipment, analytical procedures, chain of custody controls, and quality assurance and quality control. The City shall collect an appropriate number of samples necessary to establish groundwater quality data consistent with the appropriate statistical procedures for detection, assessment, and corrective measures.

1.1 Groundwater Sampling Procedures

1.1.1 Well Inspection

Prior to performing any purging or sampling, each monitoring well will be inspected to assess its integrity. The visual inspection will include the well lock, static water level measuring mark, protective steel casing, concrete pad, and monitor well casing for signs of damage by vandalism, animals, heavy equipment, or other causes. The objective of the visual inspection is to confirm that no outside constituents or other conditions exist that may affect the quality of the sampling. All necessary repairs or maintenance that can be accomplished without a TCEQ modification request will be conducted immediately by the City and documented on the Field Sampling Data Sheet for that well. If it is determined that the integrity of the well has been, or may have been, compromised the necessary information will be documented and the Executive Director of the TCEQ notified. No additional actions will be taken without the approval of the TCEQ.

1.1.2 Sample Collection

1.1.2.1 Equipment Decontamination

All equipment used for water-level measurement, purging, and/or the collection of groundwater samples will be decontaminated prior to use at each well location, unless the equipment is dedicated to a specific well. Appropriate decontamination procedures consists of scrubbing all equipment with a solution of Alconox® or equivalent laboratory grade detergent and deionized, tap, or distilled water, then triple rinsing with deionized or distilled water. Separate containers for each rinsate will be individually set up at each monitor well. At the conclusion of the sampling, all the rinsate will be properly disposed with the water generated during purging.

1.1.2.2 Calibration of Field Measurement Devices

Prior to use, all portable field measurement instrumentation, including the turbidimeter and the temperature, conductivity, and pH probes will be accurately calibrated on-site according to manufacturer's specifications. The probes will first be decontaminated to remove foreign material that may have accumulated on their components since their previous use. As recommended by the manufacturer, the probe's accuracy should first be verified and adjusted accordingly. Typically, conductivity probes are factory calibrated, but the accuracy should be confirmed in the field with a solution of known conductance, preferably in the range anticipated in the samples. The pH meter will first be standardized in the field by placing its probe in a neutral reference buffer solution (pH=7), adjusting as necessary, and then rinsed with deionized water. The probe will then be placed in a pH reference buffer solution of either 4 or 10, depending on the pH range anticipated in the samples to be collected, and adjusted accordingly.

Prior to each sampling event, the water depth indicator probe shall be inspected for any damage and for proper operation. In addition, it should be periodically verified for accuracy by a comparison to a calibrated tape.

1.1.2.3 Water Level Measurements

30 TAC §330.405(b)(2)

Groundwater elevations shall be measured at each sampling point prior to bailing or purging; measurement at an event shall be accomplished within a 48 hour period to avoid temporal variations in water levels; sampling at each event shall proceed from the point with the highest water-level elevation to those with successively lower elevations unless contamination is known to be present, in which case wells not likely to be contaminated shall be sampled prior to those that are known to be contaminated.

The static water level below the top of well casing and the total depth of the well will be measured and recorded in the field logbook. Depth measurements will be to the nearest 0.01 foot (ft). Depth measurements will be taken from the north side, top of the well casing at the "permanent measurement mark" each time a measurement is taken. The depth measurement probe will be decontaminated prior to use in each well. A functionality check will consist of dipping the probe into deionized water to see if the alarm sounds at the appropriate time. A visual check of the probe's condition and the condition of the tape and handle will be made when the measurements are being taken. Notation will be made of any minor damage or irregularities on the water level measurement device. If the tape appears to be elongated, kinked, or twisted, then the tape will be checked against a functional tape to determine if there are any discrepancies in the measurements. If the tape is determined to be non-functional due to elongation and/or damage, it will be replaced.

Using the surveyed elevation of the Top of Casing (referenced to mean sea level (msl)), depth to water measurements can be converted to water-level elevations (hydraulic head) by subtracting the depth to static water from Top of Casing (TOC) elevation.

Water-Level Elevation (ft msl) = TOC (ft msl) - Depth to Static Water (ft)

1.1.2.4 Field Sampling Data Sheets and Groundwater Sampling Field Report

A summary of all field activities including date, project name, weather conditions, sampling personnel, purpose of sampling, and site observations will be recorded on the Appendix III5B-1, Groundwater Field Sampling Data Sheet.

1.1.2.5 Purging or Bailing

Personnel performing water level measurements, well purging, or sampling will wear latex or nitrile gloves. The gloves will be changed when they become damaged and when activities begin at a different well location.

The following procedures will be followed for purging or bailing each monitor well prior to sampling:

- Prior to purging the wells, the volume of water in the well casing will be calculated based on the static water level, well casing diameter, and total depth measurements.
- The area around the well will be set-up to minimize potential contamination from the surroundings. If sampling equipment is to be set down, it should be placed on polyethylene sheeting to prevent contamination.
- The monitor well will be purged until a minimum of three well casing volumes of water has been purged, the well has been pumped dry, or until an appropriate amount of water has been purged to achieve the collection of a representative sample.
- A representative sample is considered when the field parameters of temperature, pH, and specific conductivity of the water have stabilized. The field parameters will be considered stable when three consecutive field measurements, taken at least 3- 5 minutes apart, are within 10% of each reading.
- When using a non-dedicated pump to purge the well, the pump intake should be located below, but near the static groundwater depth to allow for the collection of all potential types of contaminates that may exist in the groundwater. Non-dedicated pumps (if used) will be completely decontaminated before using in another well.
- A low flow purging method will be used and the water drawn from the well will be pumped at a rate no more than 500 mL/min.
- Purged effluent will be stored, transported, and disposed of appropriately. The purged water removed from each well will be containerized until the results of the analysis are known. If analytical results indicate contaminants are below the Maximum Contaminant Level (MCL) for constituents that have an MCL and below detection limits for constituents without MCL's, then the water may be discharged into the site's storm water management system. If levels of contamination are above the MCL's or detection limits, the water will be managed as leachate and handled in accordance with the facility's leachate management plan. If required, due to a hazardous classification, the water will be transported and disposed of at a hazardous waste permitted facility.

- Extremely slow recharging wells will be purged dry. The total amount of purged water will be measured and recorded.

The following purging information for each well will be noted and recorded on the sampling field sheet:

- Well number
- Well casing diameter
- Current outside temperature and weather conditions
- Well inspection information
- Date and time
- Static water level and total depth of well
- Height of water column and well casing volume
- Purging discharge rate, well purging time, volume of water purged
- In situ water quality measurements (temperature, pH, specific conductivity and turbidity)

1.1.2.6 Well Sampling

30 TAC §330.405(c)

Sampling personnel will wear nitrile, latex, or other equivalent non-powdered gloves during sampling to avoid contamination to the samples. Generally wells should be sampled within 24 hours of purging the well to obtain a representative groundwater sample. Sampling procedures will follow the low-flow sampling method demonstrated in the Low-Flow Purging and Sampling Demonstration Report dated July 1, 2009. The pump flow rate for the dedicated bladder pump is to be no more than 500 ml per minute. For the collection of the VOCs, the pump flow rate will be adjusted to less than 100 ml per minute. For wells with non-dedicated pumps, the wells will be sampled using a single-use, disposable bailer. Groundwater samples shall not be field-filtered prior to laboratory analysis.

- **Metals** are to be collected in a high density polyethylene (HDPE) or glass container that is preserved with nitric acid ($HN0_3$) to a pH < 2, and immediately chilled to four degrees Celsius (4°C).
- **Other Parameters** are to be collected in polyethylene or glass containers, and immediately chilled to four degrees Celsius (4°C).
- **Volatile Organic Compounds (VOCs)** are to be collected in 40-mL VOA vials that are preserved with hydrochloric acid (HCl) and immediately chilled to four degrees Celsius (4°C). There is to be no headspace or air bubbles when the sample is collected.

As each sample container is filled, the sampling time will be recorded on the sampling field sheet and the container will be labeled with the following information:

- Facility name and/or owner (i.e. City of Edinburg Landfill)
- Monitoring well number (i.e., MW-1)
- Sample date and time
- Preservatives utilized

- Sampler's signature or initials

1.1.3 Sample Preservation

The proper container, preservation technique, and maximum holding times shall be in accordance with the requirements identified in the U.S. EPA Publication No., SW-846 (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods). Preservation of samples may be conducted in the field immediately after the container is filled or the sample container can be pre-preserved by the laboratory in advance of the sampling event based on the specific testing required. The only exception will be for the analyses of volatile organic compounds, in which case the sample containers will always be pre-preserved by the laboratory.

1.1.4 Quality Assurance / Quality Control Samples

To document that sample collection and handling procedures have not affected the quality of the groundwater samples, QA/QC samples shall be prepared and analyzed as detailed below:

- **Equipment Blank:** Following decontamination of all non-dedicated or disposable sampling equipment, and prior to sample collection, reagent-grade water will be run over the sampling equipment and the rinsate will be collected in a clean container labeled as an Equipment Blank. A minimum of one equipment blank will be collected each day. This sample will be analyzed for all detection monitoring constituents, to measure the effectiveness of the decontamination procedure in removing contaminants from one sample collection point to another.
- **Field Blank**: A field blank will be prepared in the field by pouring reagent-grade water into empty sample containers. This procedure shall be conducted on the downwind side of the facility or in another appropriate location that is the most representative of site sampling conditions. A minimum of one field blank will be collected per day. The sample will be analyzed for VOCs only and will verify field sampling procedures and check for the presence of airborne contaminants that may be present at the well site.
- **Trip Blank:** A minimum of one Trip Blank per sampling event and/or number of coolers containing VOC samples (whichever is greater) will be prepared by the laboratory with reagent-grade water, and shall accompany the VOC sample container coolers during site activities, but never opened. This blank will be analyzed for VOCs only to determine if any of the samples and/or containers have become contaminated before, during, or subsequent to the sampling event prior to laboratory analysis.
- **Field Duplicates:** One (1) Field Duplicate will be collected per day. The duplicate samples are prepared by collecting two samples from the same monitor well during the same sample collection period. One of the samples will be labeled as duplicate (i.e. DUP-01) so the laboratory is unaware of the relationship between the two samples. The field personnel will note which well was duplicated on their field forms. The duplicate will be analyzed for all detection monitoring constituents. The purpose of this sample is to check the reliability (precision and accuracy) of the laboratory's techniques.

1.1.5 Sample Shipment

Subsequent to field activities, all samples collected shall be preserved as appropriate, and immediately transported to the laboratory within the required holding times, dictated by the specific analytical methods. To maintain sample integrity, the samples shall be kept in appropriate portable coolers that have a constant interior temperature of 4°C, protect samples from sunlight, and minimize the risk of sample container

breakage. Under no circumstances shall dry ice be used as the chilling agent for sample preservation; dry ice has the potential to freeze samples, which can result in container breakage (i.e., glass containers may shatter). Custody seals will be placed on the coolers and will not be broken until the samples arrive in the analytical laboratory and are checked in by the laboratory personnel.

If samples are shipped by common carrier, the COC form will be completed with the signature of the relinquisher and the date and time relinquished. The COC is then placed in a sealable plastic storage bag and placed in the sample cooler. At the time and place of receipt of the samples, the receiving party will attach a copy of the bill of lading to the COC document.

1.1.5.1 Chain of Custody

The primary objective of the chain-of-custody is to create an accurately written and verified record that can be used to trace the possession and handling of the samples from the moment of collection until receipt by the laboratory. Adequate sample custody will be achieved by proper completion of an approved Chain-of-Custody (COC) Form. Each party handling the samples will sign the COC and provide the date and time when the samples were relinquished or received.

The COC Form includes:

- The unique sample number as obtained from the sample label
- Date and time of sample collection
- Number of total containers per unique sample number
- Number of containers per preservative used
- Source of the sample
- Analysis name and analytical method requested (i.e., OM Metals)
- Name of person taking samples
- Signature of persons involved in the chain-of-custody
- Inclusive dates of possession

1.2 Groundwater Analysis Procedures

1.2.1 Laboratory Procedures

Paramount to the receipt of representative data is that the analytical laboratory closely follows an established QA/QC program. To eliminate the laboratory's interpretation of the items required in a QA/QC program, a detailed QA/QC Plan needs to be requested from the laboratory and submitted to the TCEQ Municipal Solid Waste Permits for review and approval prior to the receipt and analysis of the samples. The QA/QC Plan should include as a minimum, the following criteria:

- Technical expertise, and instrumentation capable of performing the desired analyses.

- Method Detection Limits (MDLs) and practical quantitation limits (PQLs), as appropriate.
- Possession of the required current state and/or health department certifications of competence.
- Frequency of third party chemist validation of analytical data.
- Detailed listing of typical sample holding times, sequence of sample analyses, container certifications of quality and cleanliness, frequency of laboratory and blanks, duplicates, spikes, and instrumentation calibrations.

If at any time the site changes analytical laboratories, the Laboratory Standard Operating Procedures (LSOP) should be submitted to the TCEQ for review and approval of the laboratory's QA/QC procedures. In the event that the laboratory changes over time, updated LSOPs will be submitted by the laboratory to the City. The City will then submit the LSOP to TCEQ for review and approval. All laboratory testing, laboratory QA/QC, and laboratory reporting will be conducted in accordance with 30 TAC §330, Subchapter F.

1.2.2 Practical Quantitation Limit

The practical quantitation limit (PQL) is defined as the lowest concentration reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions and is analogous to the limit of quantitation (LOQ) definition in the most recent available National Environmental Laboratory Accreditation Conference (NELAC) Standard. The PQL is method, instruments, and analyte specific and may be updated as more data becomes available. The PQL must be below the groundwater protection standard established for that analyte as defined by 30 TAC §330.409(h) unless approved otherwise by the TCEQ. The precision and accuracy of the PQL shall be initially determined from the PQLs reported over the course of a minimum of eight groundwater monitoring events. The results obtained from these events shall be used to demonstrate that the PQLs meet the specified precision and accuracy as shown in the table below. The PQL will be supported by analysis of a PQL check sample, which is a laboratory reagent grade sample matrix spiked with chemicals of concern at concentrations equal to or less than the PQL. At minimum, a PQL continues to meet the specified limits for precision and accuracy as defined in the table below.

Table III5B-1: PQL Performance Objectives

Chemical Compound	Precision (%RSD)	Accuracy (% Recovery)	EPA SW-846 Analytical Method
Metals	10	70-130	6010 (6020)
Volatiles	20	50-150	8260
Semi-Volatiles	30	50-150	8270

% RSD – is a measure of precision, calculated as the standard deviation of the set of values divided by the average and multiplied by 100.
% Recovery – is defined as a measure of agreement between analytical measurements and accepted reference values (recover % of a true value)

1.2.3 TCEQ Established PQLs

The MSW Permits Section of the TCEQ has performed an Inter-Laboratory MSW Practical Quantitation Limit (PQL) Study and revised the groundwater monitoring performance objectives to better meet both 40 CFR §258.53(h)(5) and 30 TAC §330.405(f)(5) for the requirements to specify limits for precision and accuracy at the PQL. As a result of the study, MSW-PQL "benchmark" concentrations for the 40 CFR Part 258 Appendix I constituents have been established. If the City does not wish to use the MSW-PQL benchmarks, then the City will be required to demonstrate how the preferred reporting limits chosen are representative of the lower limit of quantitation that can meet the PQL performance objectives.

Appendix III5B-2A, Detection Monitoring Constituents contains the 40 CFR Part 258 Appendix I constituents, EPA SW-846 Analytical Method, and associated MSW-PQL benchmark concentrations. EPA Method 6020 may be used for metals analysis because instrumentation is capable of attaining reporting limits for all metal constituents, which are low enough to capture concentrations at or below regulatory groundwater protections standards.

The most current MSW-PQL benchmark concentrations must be used in lieu of Method Detection Limits (MDLs) as reporting limits. Only concentrations at or above the MSW-PQL shall be reported and those less than the MSW-PQL will be reported as non-detected.

2.0 DETECTION MONITORING PROGRAM

30 TAC §§330.63(f)(5), 330.407(a), & 330.407(d)

The detection monitoring program provides for the sampling and analysis of groundwater at each of the groundwater monitor wells in the groundwater monitoring system to determine if there is a Statistical Significant Increase (SSI) in any hazardous constituents listed in the table located in 40 Code of Federal Regulations Part 258, Appendix I. After establishment of the background groundwater quality, the detection monitoring frequency shall be at least semiannual during the active life of the facility and the closure and post-closure care period. If the City determines that the detection monitoring program no longer satisfies the requirements of 30 TAC §330.407, the City must, within 90 days of this determination, submit an application for a permit amendment or modification to make any appropriate changes to the program.

2.1 Detection Monitoring Constituents

30 TAC §330.419

The City shall sample and analyze groundwater at each of the groundwater monitor wells in the groundwater monitoring system for any hazardous constituents listed in the table located in 40 Code of Federal Regulations Part 258, Appendix I. Appendix III5B-2A, Detection Monitoring Constituents lists the 40 CFR

Part 258 Appendix I constituents. In addition, the monitoring wells may also be sampled for water quality parameters listed in Appendix III5B-2B, Water Quality Parameters.

2.2 Background Quality Establishment

30 TAC §§330.63(f)(5)(B), 330.405(d), & 330.407(a)(1)

Background sampling for a groundwater monitoring well within the groundwater monitoring system shall be completed on a quarterly basis until eight non-filtered statistically independent samples is collected and analyzed. Testing results will be analyzed and using a statistical method described in Section 4.0, Groundwater Monitoring Data Evaluation to establish background values, or upper prediction limits (UPLs), for each Detection Monitoring Constituent for each groundwater monitoring well within the groundwater monitoring system. Background data sets may be updated once every two years with semiannual detection monitoring results that are demonstrated to be representative of background groundwater quality. At least one sample from each groundwater monitor well shall be collected and analyzed during each subsequent semiannual sampling event.

Upon completion of background monitoring and during background updates, the background data to will be evaluated ensure that the data are representative of background groundwater constituent concentrations unaffected by waste management activities, leakage from a solid waste management unit, or other sources of contamination. The evaluation shall be documented in a report and submitted to the TCEQ before the next subsequent groundwater monitoring event following the updated background period.

2.3 Detections Above Established Background Quality

30 TAC §330.407(b)

Not later than 60 days after each sampling event, the City shall determine whether there has been an exceedance over background of any tested Detection Monitoring Constituents at any groundwater monitor well. An exceedance is determined to be a detection above the upper prediction limit (UPL) of the established background value for inorganic constituents; for volatile organic constituents an exceedance is determined to be a detection above the TCEQ established MSW-PQL benchmark concentrations listed in Appendix III5B-2A, Detection Monitoring Constituents.

If an exceedance is determined, the City shall notify the TCEQ of the initial exceedance, and any local pollution agency with jurisdiction that has requested to be notified, in writing within 14 days. The Notice of Initial Exceedance will include a statement explain how the City intends to proceed regarding any initial exceedances. Possible actions include:

- treating the initial exceedance as an statistically significant increase (SSI) and establishing an assessment monitoring program,

- conducting verification resampling, or
- preparing and submitting an alternate source demonstration (ASD)

2.3.1 Statistically Significant Increase

30 TAC §330.407(b)(1)

If the City determines a statistically significant increase (SSI) over background of any tested constituent at any monitoring well, the City shall immediately place a notice in the site operating record (SOR) describing the increase and shall establish an assessment monitoring program meeting the requirements of 30 TAC §330.409 within 90 days of the date of the required notice to the TCEQ.

2.3.2 Verification Resampling

30 TAC §330.407(b)(2)

If an exceedance is determined over background of any tested Detection Monitoring Constituents at any monitoring wells, the City may submit the results of verification resampling as appropriate for the statistical method being used within 60 days of determining the initial exceedance. The resample data may be used to statistically confirm or disprove an SSI.

2.3.3 Alternative Source Demonstration

30 TAC §§330.407(b)(3), & 330.407(b)(4)

If a SSI increase over background of any tested Detection Monitoring Constituents at any groundwater monitoring well has occurred and the City has reasonable cause to believe that a source other than a landfill unit caused the contamination or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality, then the City may submit a report providing documentation to this effect. In making an alternative source demonstration, the City must:

- notify the TCEQ, and any local pollution agency with jurisdiction that has requested to be notified, in writing within 14 days of determining a SSI over background at the compliance point that the City intends to make a demonstration;
- within 90 days of determining a SSI, submit a report to the TCEQ, and any local pollution agency with jurisdiction that has requested to be notified, that demonstrates that a source other than a monitored landfill unit caused the contamination or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The report must be prepared and certified by a qualified groundwater scientist;
- not filter the groundwater sample for constituents addressed by the demonstration prior to laboratory analysis. The TCEQ may also require City to provide analyses of the landfill leachate to support the demonstration; and
- continue to monitor in accordance with the Detection Monitoring Program.

If the City does not make a demonstration satisfactory to the TCEQ within 90 days after the date of the required notice to the TCEQ, the City shall initiate an assessment monitoring program that meets the requirements of 30 TAC §330.409. The TCEQ may require the City to install additional wells at the point of compliance to further characterize the release.

2.4 Annual Detection Monitoring Report

30 TAC §330.407(c)

The City shall submit an annual detection monitoring report within 90 days after the facility's last groundwater monitoring event in a calendar year that must include the following information determined since the previously submitted annual report:

- a statement regarding whether a statistically significant increase has occurred over background values in any well during the previous calendar year period and the status of any statistically significant increase events;
- the results of all groundwater monitoring, testing, and analytical work obtained or prepared under the requirements of this GWSAP, including a summary of background groundwater quality values, groundwater monitoring analyses, statistical calculations, graphs, and drawings;
- the groundwater flow rate and direction in the uppermost aquifer. The groundwater flow rate and direction of groundwater flow shall be established using the data collected during the preceding calendar year's sampling events from the monitoring wells of the detection monitoring program. The City shall also include in the report all documentation used to determine the groundwater flow rate and direction of groundwater flow;
- a contour map of piezometric water levels in the uppermost aquifer based at a minimum upon concurrent measurement in all monitoring wells. All data or documentation used to establish the contour map should be included in the report;
- recommendation for any changes; and
- any other items requested by the TCEQ.

In addition, the City will submit the entire laboratory report which includes laboratory QA/QC data and laboratory analytical data, a laboratory case narrative, and a laboratory checklist. The facility may explain any problems encountered in the laboratory analysis, either by adding additional explanations to the checklist or by extending the laboratory case narrative. Any information required in the laboratory case narrative that cannot be completed by the laboratory will be completed by the City.

3.0 ASSESSMENT MONITORING PROGRAM

30 TAC §§330.63(f)(6), 330.409(a), & 330.409 (g)(4)

An assessment monitoring program will be initiated within 90 days whenever the City determines there has been a SSI over background for one or more of the Detection Monitoring Constituents or the TCEQ does not accept an alternate source demonstration (ASD) for the SSI. The assessment monitoring program

provides for the sampling and analysis of groundwater at each of the groundwater monitor wells in the groundwater monitoring system to determine if there is a Statistical Significant Level (SSL) above the groundwater protection standard (GWPS) of any hazardous constituents listed in the table located in 40 Code of Federal Regulations Part 258, Appendix II.

If the presence of hazardous constituents listed in 30 TAC §330.419 has been detected in the groundwater at the time of the permit application, the City shall submit sufficient information, supporting data, and analyses to establish an assessment monitoring program that meets the requirements of 30 TAC §330.409. If the City determines that the assessment monitoring program no longer satisfies the requirements of 30 TAC §330.409 relating to Assessment Monitoring Program, the City must, within 90 days, submit an application for a permit amendment or modification to make any appropriate changes to the program.

3.1 Assessment Monitoring Constituents

30 TAC §§330.63(f)(6)(C) & 330.409(b)

At the initiation of the assessment monitoring program, the City shall sample and analyze the groundwater monitoring system for the full set of constituents listed in in the table located in 40 Code of Federal Regulations Part 258, Appendix II. The Appendix II constituents are inclusive of the Detection Monitoring Constituents. Appendix III5B-2C, Assessment Monitoring Constituents lists the 40 CFR Part 258 Appendix II constituents.

3.2 Assessment Sampling

30 TAC §§330.409(b), 330.409 (c)(1)-(5), 330.409 (d), & 330.409 (d)(1)

A minimum of one sample shall be collected from each groundwater monitor well and analyzed for the Assessment Monitoring Constituents. Not later than 60 days after the initial assessment sampling event, the City shall submit to the TCEQ the Assessment Monitoring Constituents results from the initial sampling event and place them in the site operating record.

After sampling all groundwater monitor wells for Assessment Monitoring Constituents, the TCEQ may specify an appropriate subset of wells to be sampled and analyzed for the Assessment Monitoring Constituents during assessment monitoring and may delete any of the Assessment Monitoring Constituents for a municipal solid waste management unit if the City can document that the removed constituents are not reasonably expected to be in or derived from the waste contained in the unit.

The TCEQ may specify an alternative monitoring frequency for repeated sampling and analysis during the active life and the closure and post-closure care period for the Assessment Monitoring Constituents. The alternative frequency during the active life and the closure and post-closure care period shall be not less than annual. The alternative frequency shall be based on consideration of the following factors:

- lithology and hydraulic conductivity of the aquifer and unsaturated zone;
- groundwater flow rates;
- minimum distance of travel from the waste nearest to any groundwater monitoring well;
- resource value of the uppermost aquifer; and
- nature (fate and transport) of any constituents detected.

Within 90 days of submittal of the results from the initial assessment sampling event and on at least a semiannual basis thereafter, resample all groundwater monitor wells in the groundwater monitoring system or TCEQ approved subset of wells and conduct analyses for all Detection Monitoring Constituents and for those additional Assessment Monitoring Constituents that are detected. Not later than 60 days after each sampling event, the City shall submit to the TCEQ the Assessment Monitoring Constituents results from the initial and subsequent sampling events and place them in the site operating record.

3.3 Background Quality Establishment

30 TAC §§330.409(b) & 330.409(d)(2)

For any new constituent(s) detected in the groundwater monitor wells as a result of the complete Assessment Monitoring Constituents analysis, a minimum of four statistically independent samples from each groundwater monitor well shall be collected and analyzed to establish background levels for the additional constituent(s).

3.4 Duration of Assessment Monitoring

30 TAC §§330.409(e) & 330.409(f)

If the concentrations of the Assessment Monitoring Constituents are shown to be at or below background values, using the statistical procedures in 30 TAC §330.405(f) for two consecutive sampling events, the City must notify the TCEQ in writing and return to detection monitoring if approved. If the concentrations of the Assessment Monitoring Constituents are above background values, but below the established groundwater protection standard City shall continue assessment monitoring.

3.5 Groundwater Protection Standards

30 TAC §§330.409(d)(3), 330.409(h), & 330.409(i)

The City shall establish a GWPS for Assessment Monitoring Constituents detected in the groundwater monitor wells. The groundwater protection standard must be:

- for constituents for which a maximum contaminant level (MCL) has been promulgated under 40 CFR Part 141, Safe Drinking Water Act (codified), §1412, the MCL for that constituent;

- for constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells; or
- for constituents for which the background level is higher than the MCL, the background concentration.

The TCEQ may establish an alternative GWPS for Assessment Monitoring Constituents for which MCLs have not been established. These GWPS shall be appropriate health-based levels that satisfy either the criteria of the following:

- the level is derived in a manner consistent with United States Environmental Protection Agency guidelines for assessing the health risks of environmental pollutants (51 FR 33992, 34006, 34014, 34028, September 24, 1986);
- the level is based on scientifically valid studies conducted in accordance with the Toxic Substances Control Act Good Laboratory Practice Standards (40 CFR Part 792) or equivalent;
- for carcinogens, the level represents a concentration associated with an excess lifetime cancer risk level (due to continuous lifetime exposure) with the 1 x 10-4 to 1 x 10 -6 range; and
- for systemic toxicants, the level represents a concentration to which the human population (including sensitive subgroups) could be exposed to on a daily basis that is likely to be without appreciable risk of deleterious effects during a lifetime. For purposes of this subchapter, systemic toxicants include toxic chemicals that cause effects other than cancer or mutation; or

inclusive or comply with the level is developed in accordance with 30 TAC §350, Texas Risk Reduction Program.

3.6 Detections above Groundwater Protection Standards

30 TAC §330.409(g)

Not later than 60 days after each sampling event, the City shall determine whether any Assessment Monitoring Constituents were detected at statistically significant levels (SSLs) above the established groundwater protection standard (GWPS) in any sampling event. A SSL is when the calculated 95% lower confidence limit (LCL) from the eight previous sampling events exceeds the GWPS. If a SSL has been determined, the City shall notify the TCEQ and appropriate local government officials in writing within seven days.

3.6.1 Requirements

30 TAC §330.409(g)(1)

If the groundwater protection standard has been exceeded, the City shall also:

- characterize the nature and extent of the release by installing additional monitoring wells as necessary;

- install at least one additional monitoring well between the monitoring well with the statistically significant level and the next adjacent wells along the point of compliance before the next sampling event and sample these wells;
- notify in writing all persons that own or occupy the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site as indicated by sampling of wells; and
- initiate Assessment of Corrective Measures Program all within 90 days of the notice to the TCEQ.

3.6.2 Alternate Source Demonstration

30 TAC §330.409(g)(2)-(3)

The City may demonstrate that a source other than the monitored solid waste management unit caused the contamination or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. In making an alternative source demonstration (ASD), the City must:

- notify the TCEQ in writing within 14 days of determining a SSL above the GWPS at the point of compliance that the City intends to make an ASD;
- within 90 days of determining a SSL above the GWPS, submit a report to the TCEQ that demonstrates that a source other than the monitored solid waste management unit caused the contamination or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The report shall be prepared and certified by a qualified groundwater scientist;
- not filter the groundwater samples for constituents addressed by the demonstration prior to laboratory analysis. The TCEQ may also require the City to provide analysis of landfill leachate to support the demonstration; and
- continue to monitor in accordance with the Assessment Monitoring Program.

If a successful ASD is made, the City shall continue monitoring in accordance with the Assessment Monitoring Program and may return to detection monitoring after two consecutive sampling events if the Assessment Monitoring Constituents are at or below established background concentrations. Until a successful demonstration is made, the City shall comply with the requirements of this section including initiating an assessment of corrective measures.

3.7 Assessment of Corrective Measures

30 TAC §330.63(f)(7)

If hazardous constituents have been measured in the groundwater that exceed the concentration limits of the established GWPS, the City shall submit sufficient information, supporting data, and analyses to establish a corrective action program that meets the requirements of 30 TAC §330.411 and §330.413 relating to Assessment of Corrective Measures and Selection of Remedy, respectively. To demonstrate compliance with of 30 TAC §330.411, the City shall address, at a minimum, the following:

- a characterization of the contaminated groundwater, including concentrations of assessment constituents as defined in §330.409 of this title;
- the concentration limit for each constituent found in the groundwater;
- detailed plans and an engineering report describing the corrective action to be taken;
- a description of how the groundwater monitoring program will demonstrate the adequacy of the corrective action; and
- a schedule for submittal of the aforementioned information required provided the City obtains written authorization from the TCEQ prior to submittal of the complete permit application.

Implementation of the Corrective Action Program will be conducted in accordance with 30 TAC § 330.415.

3.8 Annual Assessment Monitoring Report

30 TAC §§330.63(f)(6)(A), 330.409(k), & 330.409(k)(1)-(6)

The City shall submit an annual assessment monitoring report within 60 days after the facility's second semiannual groundwater monitoring event that includes the following information determined since the previously submitted report:

- a statement whether an statistically significant level above the established groundwater protection standard has occurred in any groundwater monitor well during the previous calendar year period and the status of any statistically significant level events;
- the results of all groundwater monitoring, testing, and analytical work obtained or prepared in accordance with the requirements of this GWSAP, including a summary of background groundwater quality values, groundwater monitoring analyses, statistical calculations, graphs, and drawings;
- the groundwater flow rate and direction in the uppermost aquifer. The groundwater flow rate and direction of groundwater flow shall be established using the data collected during the preceding calendar year's sampling events from the monitoring wells of the Assessment Monitoring Program. The City shall also include in the report all documentation used to determine the groundwater flow rate and direction of groundwater flow;
- a contour map of piezometric water levels in the uppermost aquifer based, at a minimum, upon concurrent measurement in all groundwater monitor wells. All data or documentation used to establish the contour map should be included in the report;
- recommendation for any changes; and
- any other items requested by the TCEQ such as a description of any special wastes previously handled at the facility.

In addition, the City will submit a laboratory case narrative and a laboratory checklist with all analysis submitted to the TCEQ. An example laboratory review checklist and exception report is included in Appendix D. In place of the laboratory checklist, the facility may submit a copy of the laboratory QA/QC and analytical data. The facility may explain any problems encountered in the laboratory analysis, either by adding additional explanations to the checklist or by extending the laboratory case narrative. Any

information required in the laboratory case narrative that cannot be completed by the laboratory will be completed by the City.

4.0 GROUNDWATER MONITORING DATA EVALUATION

30 TAC §§330.63(f)(5)(C) & 330.63(f)(6)(E)

Provided in the following sections are a description of statistical comparison procedures that may be utilized in evaluating groundwater monitoring data in accordance with 30 TAC §330.405 (e) – (f).

4.1 Statistical Methods

30 TAC §330.405(e)

One or more of the following statistical methods may be used in evaluating groundwater monitoring data for each parameter or constituent analyzed as required for the Detection Monitoring Program and Assessment Monitoring Program under 30 TAC §330.407 and §330.409 respectively. These statistical analysis methods are necessary to determine whether a statistically significant increase (SSI) over background has occurred. The statistical analysis of monitoring data occurs after receiving validated results from each sampling and analysis event. The statistical test(s) chosen shall be conducted separately for each tested constituent in each groundwater monitoring well or sampling point.

Different methods may be selected for each groundwater quality constituent. The appropriateness of a method must be substantiated by demonstrating that the distribution of the data for that constituent is appropriate for the method. Selection of a specific method is described in the USEPA "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Interim Final Guidance" (USEPA, 1989) and is also discussed in "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Addendum to Interim Final Guidance" (USEPA, 1992). The methods include the following:

- a parametric analysis of variance followed by multiple-comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each point of compliance well's mean and the background mean levels for each constituent;
- an analysis of variance based on ranks followed by multiple-comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each point of compliance well's median and the background median levels for each constituent;
- a tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each point of compliance well is compared to the upper tolerance or prediction limit;
- a control-chart approach that gives control limits for each constituent; and
- another statistical test method that meets the performance standards. The City shall submit to the TCEQ satisfactory justification for this alternative test. Sanitas™ statistical software may be used to determine intrawell statistical "upper prediction limits".

4.2 Performance Standards

30 TAC §330.405(f)

The statistical performance standards provide a means to limit the possibility of making false conclusions from the monitoring data. Any statistical method chosen shall comply with the following performance standards, as appropriate. The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of tested constituents. If the distribution of a tested constituent is shown by the City to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed. Any statistical method chosen shall comply with the following performance standards, as appropriate:

- The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of tested constituents. If the distribution of a tested constituent is shown by the owner or operator to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.
- If an individual well (or sampling point) comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple-comparisons procedure is used, each testing period shall be no less than 0.05, but the Type I error of no less than 0.01 for individual well comparisons shall be maintained. This performance standard does not apply to tolerance intervals, prediction interval, or control charts.
- If a control-chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern.
- If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence, and for tolerance intervals the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.
- The statistical method shall account for data below the limit of detection with one or more statistical procedures that are protective of human health and the environment. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.
- If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

4.3 Data Presentation

Upon receiving the groundwater sampling data from the laboratory, it shall be organized in a format that it can be clearly understood and analyzed. For each sampling event, the City will make a selection of at least one or more of the following data presentation formats:

- **Tables:** provide an overall summary of the data in a neat, clearly understood format that allows straightforward analysis and comparison to other data points and standards;
- **Contour Maps:** placement of contaminant concentrations in contours on a map assist in conveying a clearer picture of contamination distribution. Contaminant distribution and associated concentrations will dictate whether this format can be easily utilized;
- **Time Series Displays (X and Y Line Graphs)**: assist in the display of single or multiple contaminant concentration variations over time for a single data point or for multiple point comparison; and/or
- **Histograms (X and Y Bar Graphs)**: allows comparisons of the magnitudes of single or multiple data point contaminant concentrations.

The groundwater sampling and laboratory analytical results will be submitted to the TCEQ on forms and electronic formats specified by the TCEQ.

TX83-SF

LEGEND

- PERMIT BOUNDARY
- POINT OF COMPLIANCE
- UNIT BOUNDARY / LIMITS OF WASTE PLACEMENT
- MW-113 PROPOSED MONITORING WELL
- MW-12 EXISTING MONITORING WELL

MW-110 MW-111 MW-112 MW-113 MW-114 MW-115 MW-116 MW-117 MW-118 MW-119 MW-120 MW-121 MW-122 MW-123 MW-124 MW-125 MW-126 MW-13 MWD-7 MW-18R MWD-6 MW-12 MW-3A MW-22 MW-23 MW-2R MW-9R MW-10R MW-24 MW-101 MW-102 MW-103 MW-104 MW-105 MW-106 MW-107 MW-108 MW-109

UNIT 5

OVERLINER / UNIT 8

UNIT 6

UNIT 7

100 125 75

ISSUED FOR PERMITTING PURPOSES ONLY

0 300 600
1" = 600' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
1	2017-11-07	RESPONSE TO TCEQ FIRST NOTICE OF DEFICIENCY	CEI	TNB	CEI	CEI

SEAL

STATE OF TEXAS
CHAD E. IRELAND
99293
LICENSED
PROFESSIONAL ENGINEER
11/7/17

GOLDER ASSOCIATES INC.
TEXAS REGISTRATION F-2578

CLIENT

CITY OF EDINBURG SOLID WASTE MANAGEMENT

CONSULTANT

Golder Associates

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PROJECT
EDINBURG REGIONAL DISPOSAL FACILITY
PERMIT AMENDMENT APPLICATION TCEQ PERMIT MSW-956C
EDINBURG, HIDALGO COUNTY, TEXAS

TITLE
GROUNDWATER MONITORING SYSTEM PLAN

PROJECT NO.	APPLICATION SECTION	REV.		FIGURE
1401491	III5B	1	1 of 1	III5B-1

Path: \\houston\drafting_2014\1401491 - city of edinburg\PRODUCTION\A - Permit Amendment Application\ | File Name: 1401491A198.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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